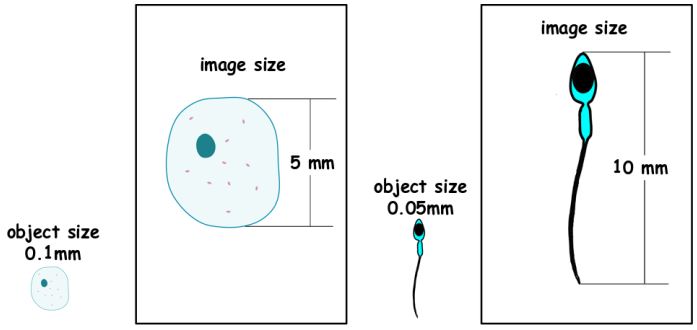
Questions on The Light Microscope: Answers

Comprehension

1. What humans can see, used to be limited by the naked eye.
2. You can see objects about 0.1mmm across with the naked eye.
3. Living organisms are made from small units called cells.
4. The average size of a cell is about 0.01mm.
5. A magnifying lens is the simplest microscope.
6. A compound microscope uses two magnifying lenses to make objects look bigger.
7. The lens that you look through is called the eyepiece lens.
8. Magnification is found by dividing the image size by the object size.
9. Eyepiece lens magnifications are often X10.
10. You multiply the eyepiece lens magnification by the objective lens magnification to get total magnification.
11. The stage clips hold the slide in place.
12. When using a microscope select the lowest power lens first
13. To begin with, the objective lens should be positioned as close to the object as possible.
14. To begin, move the objective lens away from the slide.
15. Adjust the fine focus for the clearest possible image.

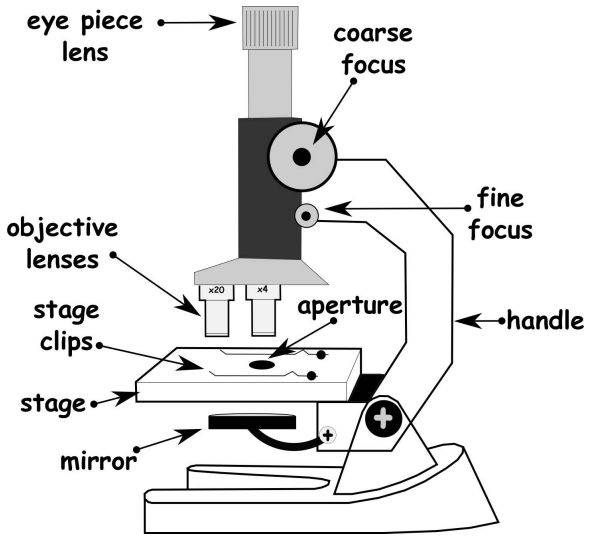
Additional tasks

2. Calculate the magnification of the cell images below.



$\frac{5 \div 0.1 = 50}{\text{magnification}}$ $\frac{10 \div 0.05 = 200}{\text{magnification}}$

1. As per diagram.

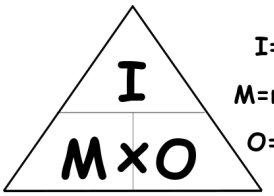


3. Calculate the **total magnification** when using a compound microscope with the following eyepiece and objective lenses.

a.	Eyepiece lens X10, objective lens X10	**100**
b.	Eyepiece lens X10, objective lens X20	**200**
c.	Eyepiece lens X10, objective lens X40	**400**
d.	Eyepiece lens X5, objective lens X100	**500**
e.	Eyepiece lens X5, objective lens X50	**250**

4. Calculate the 'real' object size (O) using the magnification and image size in the table below;

Magnification	Image size on paper (mm)	Object size (mm)
40	40	1. 1.0
100	20	2. 0.2
250	5	3. 0.02
50	1	4. 0.02



I=image size
M=magnification
O=object size

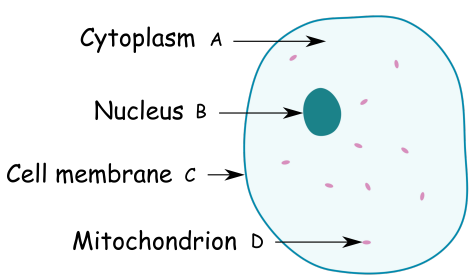
Questions on Cells: Answers

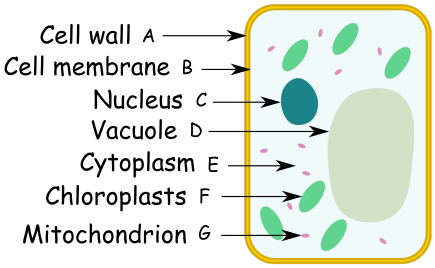
Comprehension

1. Living things are made from cells.
2. Cells are tiny individual units of life
3. The specialised structures that make up a cell are called organelles.
4. Plant and animal cells both have a membrane, cytoplasm, nucleus and mitochondria.
5. The cell membrane controls what goes into and out of a cell.
6. Chemical reactions happen in the cytoplasm.
7. The DNA is in the nucleus, it contains the instructions for making new cells.
8. The cell wall stops plant cells from being flaccid (floppy).
9. Cell sap is contained in the vacuole.
10. The chloroplasts contain chlorophyll for photosynthesis.
11. Sperm cells are specially adapted by having a long tail for swimming to the egg.
12. Root hair cells have a large surface area for absorbing water and nutrients.
13. Tissue is formed by cells grouping together to carry out a similar function.
14. Different types of tissue can work together to form an organ.
15. An organ system is different organs working together.
16. If different organ systems combine they can form an organism.

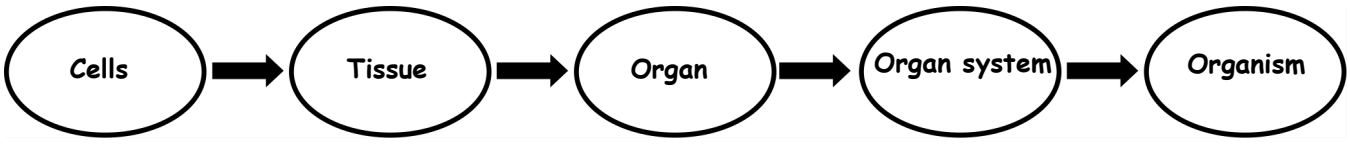
Additional tasks

1.





2. Complete the flow diagram showing how **cells** can group together, finally forming an **organism**.



3. Match the organ (s) below to their organ systems.

1.	*Ear canal, ear drum, ossicles*	**Digestive system**
2.	*Mouth, gullet, small intestines*	**Female reproductive system**
3.	*Pupil, lens, retina*	**Nervous system**
4.	*Lungs and wind pipe*	**Respiratory system (breathing)**
5.	*Blood vessels*	**Male reproductive system**
6.	*Penis and testes*	**Visual system**
7.	*Spinal cord*	**Hearing (auditory) system**
8.	*Ovaries, oviduct, womb*	**Circulatory system**

4. Rearrange the jumbled up letters to reveal the names of the cell organelles and write next to the organelle, **plant only** or **both**.

LECL BRNEAMEM	**Cell membrane**	**LSUECNU**	**Nucleus**
PSTLSAOLROHC	**Chloroplasts**	**ALCOVUE**	**Vacuole**
CPOTSMALY	**Cytoplasm**	**ELCL LLWA**	**Cell wall**
CHOTIMRIODNON	**Mitochondrion**		

Questions on Diffusion: Answers

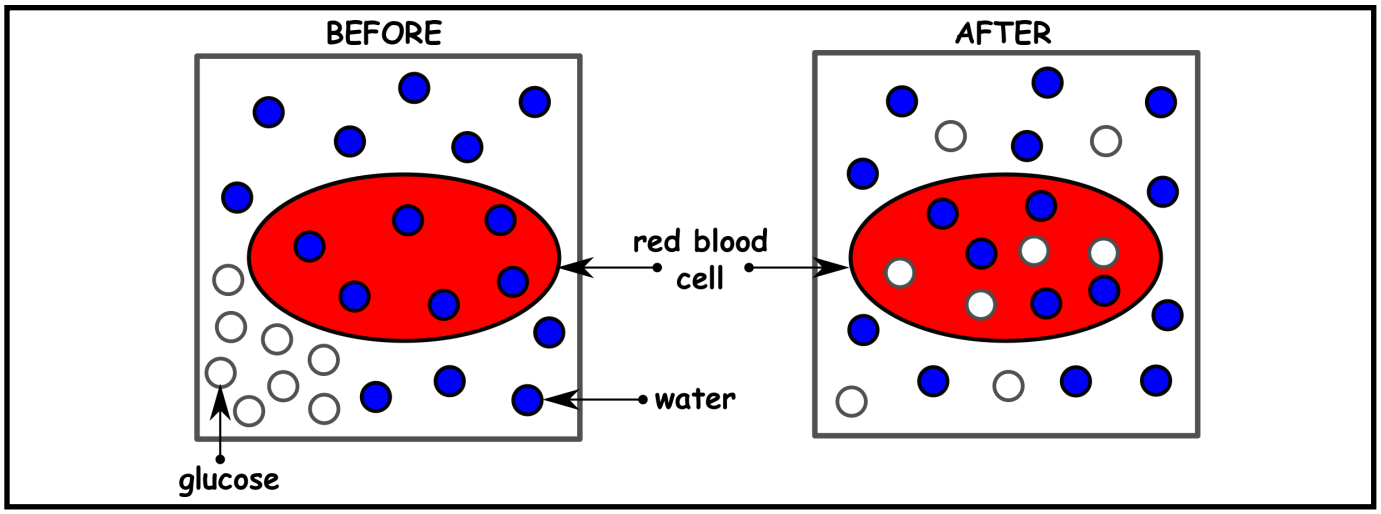
Comprehension

1. The process of smells spreading out is called diffusion.
2. We can think of diffusion as mixing without stirring.
3. Particles diffuse from where there are more (high concentration) to where there are less (low concentration).
4. Orange squash particles stop diffusing when they are evenly spread.
5. Diffusion happens in gases and liquids.
6. Particles move in a random motion.
7. Digestion is the breaking down of food for absorption.
8. The high concentration of food particles diffuse into our blood.
9. The large surface area of root hair cells allows water and nutrients to be absorbed through diffusion.
10. There is a higher concentration of water and nutrients in the soil than the root hair cell.
11. The oxygen in the air we breathe ends up in our blood.
12. Carbon dioxide builds up in our blood due to respiration.
13. Respiration is the release of energy from our food.
14. Carbon dioxide diffuses from the blood to our lungs to be breathed out.

Additional tasks

Glucose with a higher concentration in the blood can diffuse into a red blood cell with a lower concentration.

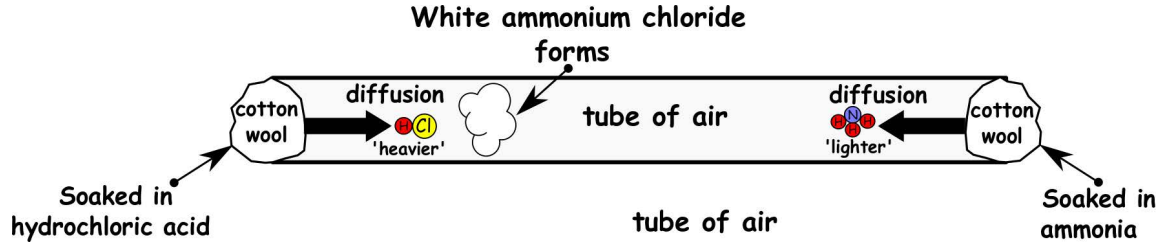
1. Complete the diagram below to show what things look like after diffusion (it looks just like the squash and chips opposite). Any colour is fine.



2. Where have some of the glucose molecules ended up?!

   On the red blood cell.

3. Hydrochloric acid particles and ammonia particles diffuse through the tube of air. When they meet they react to form ammonium chloride, a **white solid**. This happens nearer to where the hydrochloric acid particles came from. They diffuse slower because they are heavier and move more slowly than ammonia particles. Complete the gapped exercise below to explain what is happening. Choose from the words in bold.



Hydrochloric acid (HCl) and ammonia (NH_3) **particles** both **diffuse** through the tube. When they **meet** they form **ammonium chloride**, this **white solid**, forms nearer to where the hydrochloric acid particles came from. Hydrochloric acid particles are **heavier**, and move **more slowly** than ammonia particles. **Heavier** and slower particles diffuse more **slowly**. Lighter **faster** moving particles diffuse more **quickly**.

Questions on the Skeleton and Muscles: Answers

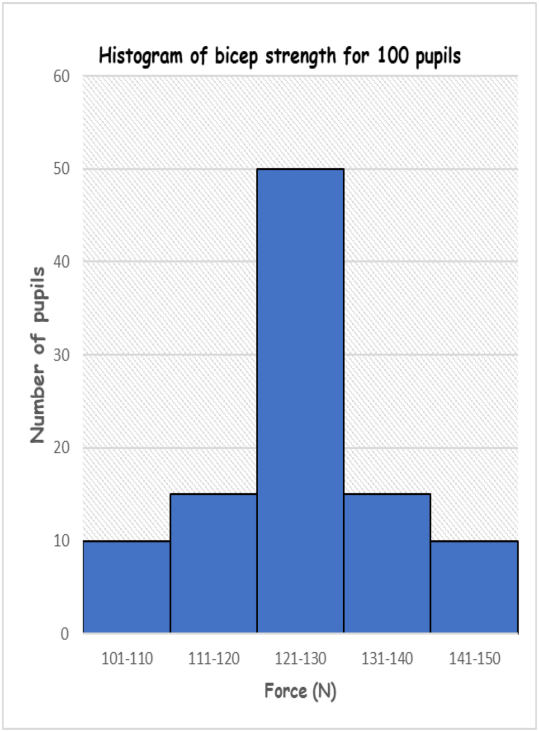
Comprehension

1. A human skeleton has 206 bones.
2. Bones are made from calcium because they need to be hard.
3. An endoskeleton is where animals have their bones on the inside of their body.
4. Insects have an exoskeleton.
5. Chitin is what insect bones are made from.
6. The four main jobs of the human skeleton are: support, protect organs, enable movement and make blood.
7. The skull protects the brain from injury.
8. Bone joints enable you to move.
9. The shoulder has a ball and socket joint.
10. Ball and socket joints are really useful because they allow limbs to rotate in a circle.
11. Blood cells are made inside of bones.
12. Red blood cells carry oxygen.
13. Tendons hold the muscles to the bones.
14. Ligaments hold the bones together.
15. Your triceps relax when your biceps contract.
16. Muscles working in pairs contracting and relaxing are called antagonistic.

Additional tasks

4. 100 children test their bicep strength by **pushing up** on a **force meter** fixed under a desk. The results are shown below. Plot a histogram of the results (see pg50).

Force (N)	101-110	111-120	121-130	131-140	141-150
Number of pupils	10	15	50	15	10



2. Below are examples of where we find **pivot joints** (for rotation), **hinge joints** (for bending and straightening only) or **ball and socket joints** for movement in most directions. For each one write down which type of joint you think they are.

   a. the hip joint &**ball and socket**'
   b. the knee joint &**hinge joint**'
   c. the finger joints (**hinge joint**)
   d. the ankle joint (**hinge joint**)
   e. the joint connecting the head to the neck (**pivot joint**)

3. Write down next to the animal's name below, whether you think they have an exoskeleton or endoskeleton.

WASPS	**(EXO)**	**FISH**	**(ENDO)**
BEARS	**(ENDO)**	**HORSES**	**(ENDO)**
CRABS	**(EXO)**	**CENTIPEDES**	**(EXO)**
BIRDS	**(ENDO)**	**BEETLES**	**(EXO)**
LIZARDS	**(ENDO)**	**GRASSHOPPERS**	**(EXO)**

5. Explain what you think the job of the rib cage and the spine is.

   Can you explain the job of any other bones?

   The rib cage protects the heart, the lungs, and abdominal organs such as the liver. It is also involved in helping us to breathe (respire).

   The spine provides support for the body and protects the spinal cord that carries messages to and from the brain.

Questions on the Healthy Human Diet: Answers

Comprehension

1. A healthy diet is all about consuming the right amount of the seven food groups.
2. There isn't a single food group that contains everything we need.
3. Carbohydrates provide energy.
4. The main role of lipids (fats) is as an energy store.
5. Proteins help grow and repair tissue.
6. Calcium and iron are minerals needed by the body.
7. Vitamins are needed in small amounts.
8. Fibre is undigested food, it gives your waste bulk to help it pass through the large intestine better.
9. Starchy foods come mainly from grain based food such as bread, pasta, cereals and potatoes.
10. Pulses are edible seeds and are a good source of protein.
11. Leafy or green vegetables are a good source of iron.
12. Scurvy is caused by lack of vitamin C.
13. Symptoms of scurvy are bleeding gums and pain in the joints.
14. Night blindness is not being able to see well at night.
15. Lack of calcium and vitamin D can cause rickets.

Additional tasks

2. a. Use the Eat Well Plate to write down in order the types of foods we should eat most of, to the types of food we should eat least of.

MOST Fruit, veg
↑ Bread, rice, potatoes, pasta
Dairy
Meat, fish eggs, beans
LEAST Fatty and sugary foods

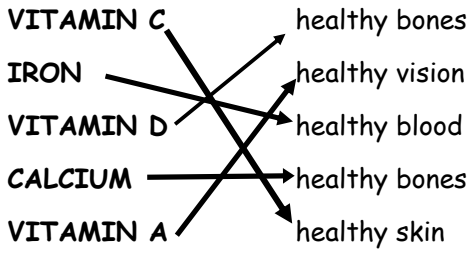
b. Write down which food groups you would get too much of and which too little of if you ate the following:

i. Only fruit and vegetables
Too many carbohydrates, vitamins, minerals and fibre.
Not enough, proteins and fats.

ii. Only dairy foods
Too many fats mainly
Not enough, proteins, carbohydrates, vitamins, minerals and fibre.

iii. Only meat, fish, eggs and beans
Too much protein and fats mainly.
Not enough carbohydrates, vitamins, minerals and fibre.

3. Match the vitamins and minerals below to what they help keep healthy.



Questions on Food Fuel:Answers

Comprehension

1. A fuel is something we burn to provide heat.
2. Humans slowly 'burn' their food through respiration.
3. If humans consume more energy than they use, they gain weight.
4. Energy is measured in joules.
5. Kilo means thousand.
6. 5000j in 5kJ.
7. 8400kJ is how much energy an average adult requires per day.
8. A child needs more energy in their teenage years when they are growing quickly.
9. Nutritional labels usually tell us how much energy, protein, fat, carbohydrate and salt is in the food.
10. The information is often given per item, per 100g or as %RI.
11. %RI tells us the percentage of the maximum amount an adult should eat for that food group per day.
12. Eating just biscuits would mean eating too much fat.
13, Eating just biscuits means you wouldn't get enough protein, carbohydrate, fibre or salt.
14. A balanced diet means eating a bit of all types of food.

Additional tasks

1. Use a calculator to complete the %RI columns for **100g** of the **Multigrain cereal** and the **Cheese and onion sandwich** below. The reference intakes are;

energy 8400kJ, protein 50g, fat 70g, carbohydrate 260g, fibre 30g, Sodium (salt) 6g.

Nutritional information;	*Multigrain cereal*	% RI
	Per 100g	Per 100g
Energy	1500 kJ	*17.9*
Protein	**9.3 g**	*18.6*
Fat	**2.9 g**	*4.1*
of which are saturated fats	*0.6g*	
Carbohydrates	**69 g**	*26.5*
of which are sugars	*17g*	
Dietary fibre	**12 g**	*40*
Sodium (salt)	**0.5 g**	*8.3*

Nutritional information;	*Cheese and onion sandwich brown bread*	% RI
	Per 100g	Per 100g
Energy	1200 kJ	*14.3*
Protein	**10 g**	*20*
Fat	**16.5 g**	*23.6*
of which are saturated fats	*0.6g*	
Carbohydrates	**42g**	*16.2*
of which are sugars	*2 g*	
Dietary fibre	**6 g**	*20*
Sodium (salt)	**1.7 g**	*28.3*

2. One of the ways to measure the amount of energy in foods is to burn the food and use the flame to heat up water. To calculate the energy value (in joules) of the food you've burned, just multiply the **mass of the water (in grams)** by the **temperature change of the water (in °C)** and then **multiply by 4.2**.

a. Explain how you could measure the mass of water in the test tube (what mass will you measure first?).

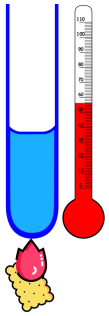
Measure the mass of the test tube first, then measure the mass of the test tube and the water together.

Mass of water = mass of water and test tube - mass of test tube.

b. Explain how you could measure the temperature change of the water.

Measure the temperature before heating and the temperature after heating.
Temperature change = temperature after heating - temperature before heating.

c. **Dividing** the **energy value found from burning the food**, by the **mass of food burned** tells us the *energy value per gram* of that food, the **energy density**. Calculate the energy densities of some common foods in the table below.



	Potatoes	*Biscuits*	*Crisps*	*Peanuts*	*Cereal*	*Banana*
Energy found by burning food (J)	**17,000**	**40,000**	**70,000**	**100,000**	**15,000**	**14,000**
Mass of food burned (g)	5	2	3	4	1	4
Energy density (J/g)	**3400**	**20,000**	**23,333**	**25,000**	**15,000**	**3500**

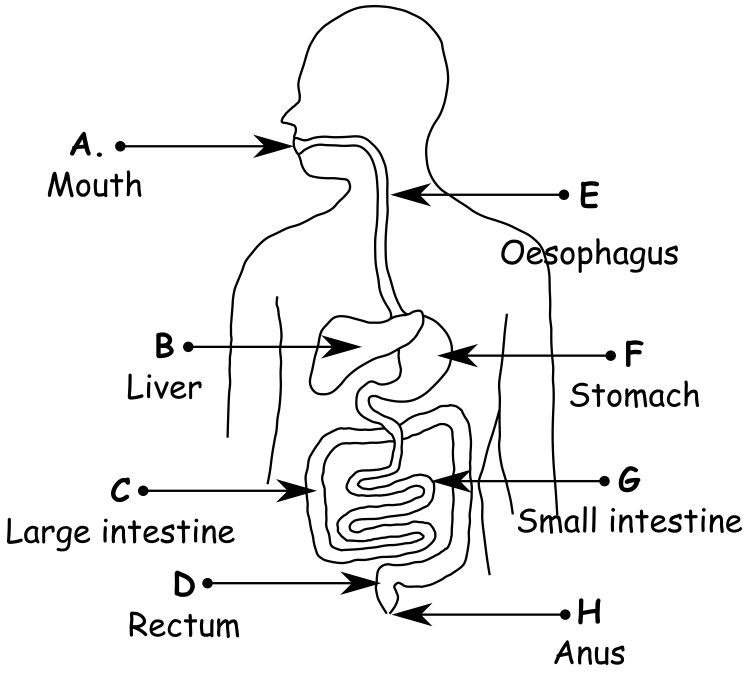
Questions on the Human Digestive System: Answers

Comprehension

1. We can 'think' of digestion as starting on the plate because food is cut into smaller pieces.
2. The purpose of digestion is to turn large insoluble pieces of food into smaller soluble molecules that it is made from.
3. Digestion really starts in our mouths.
4. Digestion ends with our faeces in the rectum.
5. Excretion is the process of expelling waste.
6. Saliva is an example of a digestive juice.
7. The food passes down the gullet before reaching the stomach.
8. Peristalsis helps the food on its way similar to squashing toothpaste from a tube.
9. Churned means squashed and mixed.
10. The acidic conditions kill bacteria and help the digestive juices work well.
11. Bile helps break down fats, it comes from the liver.
12. In the small intestines the broken down food is absorbed into the blood.
13. In the large intestine, the food is mostly undigestible waste.
14. Only water is left to absorb in the large intestine.
15. Another word for waste faeces is poo.
16. Waste faeces is more solid after the water is absorbed.
17. Faeces is stored in the rectum.
18. Faeces are excreted through the anus.

Additional tasks

1.



2. Write **1** to **11** next to the mixed up order of events for digestion to put them in their correct order. 1 first, 11 last.

_9__ water is absorbed from the faeces
_3__ food moves down the gullet
_1__ food chewed
_4__ food enters stomach
_2__ saliva is added
_5__ food is churned
_10__ faeces is stored in rectum
_6__ food moves to small intestine
_11__ faeces excreted from anus
_7__ bile is added
_8__ undigestible food moves to large intestine

3. Write about why 'bacteria are important too', include the words; **micro-organism, faeces, vitamins, nutrients, gut bacteria, probiotics.**

Bacteria are important too

The digestive system contains trillions of <u>microorganisms</u>.

The waste they produce make up about half of our <u>faeces</u>.

They help us make important <u>vitamins</u> and absorb <u>nutrients</u>.

A healthy digestive system needs <u>gut bacteria</u>, foods that boost the are called <u>probiotics</u>.

Questions on Enzymes: Answers

Comprehension

1. Enzymes act as catalysts.
2. Catalysts speed up chemical reactions without being used up.
3. Enzymes are called biological catalysts because they speed up chemical reactions in living organisms.
4. The enzymes are produced by the organism itself.
5. There are three main types of enzymes in the human digestive system.
6. Protease breaks down proteins.
7. Lipase breaks down fats.
8. Enzymes act like scissors in breaking down undigestible food molecules into smaller digestible ones.
9. Starch is a long carbohydrate molecule made from connected sugar molecules.
10. Amylase breaks down starch into simple sugars.
11. Protease in washing powder can help break down stains that contain protein such as blood stains.
12. Protease in baby foods breaks down the proteins so it is easier for the baby to digest.
13. Invertase can be used to give chocolates a soft centre by breaking down sugars.
14. Enzymes in yeast can convert sugar to alcohol and carbon dioxide.
15. The enzyme rennet is used in cheese making.

Additional tasks

1.

Catalysts	substances that speed up chemical reactions without being used up
Enzymes	biological catalysts
Carbohydrase	enzymes that break down carbohydrates
Protease	enzymes that break down proteins
Lipase	enzymes that break down fats (lipids)
Invertase	enzyme for breaking down sugar (sucrose)

2. Complete the gap filling exercise below on enzymes. Choose from the words in bold.

carbohydrase, soluble, chemical, used, digest, insoluble, protease, sugars, catalysts, fats, amino, lipase, oils, proteins

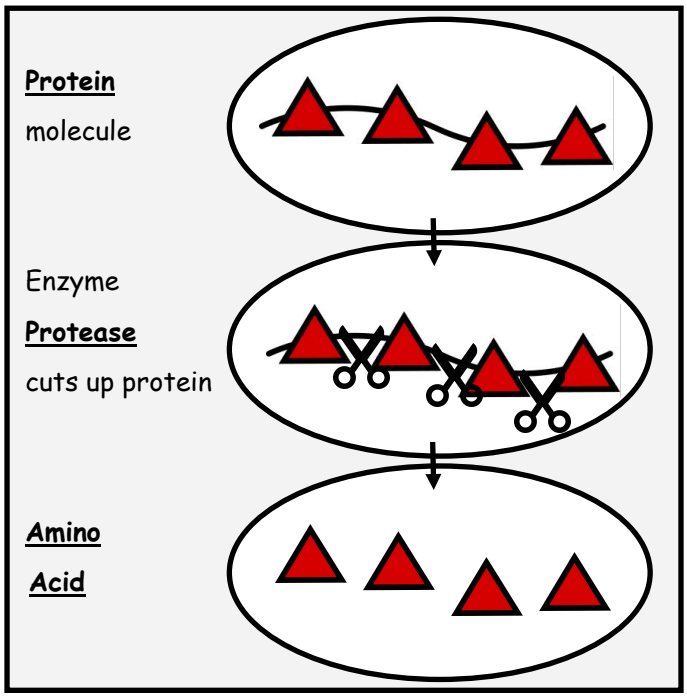
Enzymes are biological **catalysts**. This means they speed up **chemical** reactions without being **used** up. Enzymes help us **digest** our food. They breakdown larger **insoluble** molecules into smaller **soluble** ones. **Protease** enzymes break down **proteins** into **amino** acids, **carbohydrase** enzymes break down carbohydrates into **sugars** and **lipase** enzymes break down **fats** and **oils**.

3. Write a few sentences about how our lives are made better because of enzymes (NB: the petrol that we put in our cars is 5% alcohol).

Mention of benefits can include:

- help to clean our clothes
- makes alcohol for us to drink
- nice chocolates for us to eat
- used to make cheese from milk
- used in petrol which enables us to travel in cars and buses and is less harmful to the environment

4.



Questions on Plants and Energy Flow: Answers

Comprehension

1. With no plants there would be no animal life.
2. Plants are called producers because they can make their own food using energy from sunlight.
3. Herbivores eat plants only.
4. Omnivores eat other animals and plants.
5. A Carnivore is the name of an animal that only eats other animals.
6. Plants use light to make glucose and grow.
7. The energy in a food chain is passed from producer to consumer.
8. Primary consumers eat plants only.
9. Food webs show how many food chains can connect to each other (link).
10. The plants and animals found in a certain location are called an ecosystem.
11. If a hawk entered the ecosystem the number of rabbits could decrease.
12. The foxes and wolves would eat more sheep (because there are less rabbits).
13. By conflict we mean competition for the available food.
14. One of the animals may leave the ecosystem to look for food elsewhere.
15. Predators at the top of a food chain are called apex predators.
16. Energy is lost as heat, faeces and for movement as it moves between levels in a food chain.

Additional tasks

1.

Producer	the plants
Consumers	the animals
Glucose	a sugar
Biomass	amount of living material
Herbivores	animals that eat plants only
Carnivores	animals that eat meat (other animals) only
Omnivores	animals that eat plants and meat (other animals)

2. Draw food chains for the following *jumbled up* producers and consumers.

a. ***grass → rabbit → snake***

b. ***seeds → mouse → hawk***

c. leaf → aphids → ladybirds

d. cabbage → caterpillar → robin → hawk

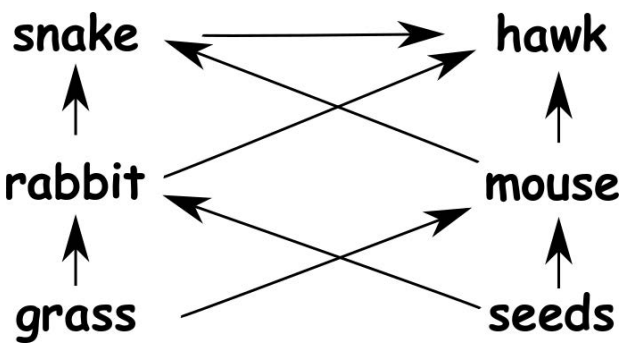
e. zooplankton → herring → tuna → shark

f. grass → cow → humans

g. leaf → greenfly → ladybird → spider

h. grass → vole → snake → hawk

3. Write the food chains **a** and **b** above side by side and show how they can connect to form a **food web** like the one opposite (pg20).



4. Write down **four** food chains from the food web opposite (pg20).

i. **grass, sheep, fox**

ii. **grass, rabbit, fox**

iii. **grass, rabbit, wolf**

iv. **grass, sheep, wolf**

5. Out of the two food chains shown below, which is best for the planet and wastes least energy? Explain why. (The WHAT? box opposite helps)

Wheat → Humans

Wheat → Cows → Humans

The best food chain for the planet is wheat consumed by humans. This is because energy is 'lost' by the cows as heat, faeces and for movement. This means less of the energy from the wheat ends up benefiting humans when we eat a cow after it has eaten wheat.

<u>Numbers example</u>

If 100J of wheat energy is eaten by humans, 10% (10J) ends up as a human's biomass (living matter). A cow would need to eat 1000J of wheat energy to supply a human with 100J because 10% of the wheat energy the cow eats is lost as heat, faeces and movement by the cow. It is better for the human to eat the wheat directly.

Questions on The Respiratory System; Breathing

Comprehension

1. Respire means to breathe.
2. We respire so that our cells get oxygen needed for respiration.
3. Respiration is a chemical reaction that releases energy
4. The waste gas from respiration is carbon dioxide.
5. The air we breathe in contains about 21% oxygen, the air we breathe out contains about 16.5% oxygen.
6. This tells us that oxygen is taken in by the lungs and carbon dioxide is removed.
7. The diaphragm is a thin muscle at the bottom of the chest.
8. Contract means to shorten.
9. The space inside the lungs increases when breathing in.
10. This makes the air pressure inside the lungs less than outside of the lungs.
11. This difference in pressure pushes air into the lungs.
12. The increase in pressure pushes the air out of the lungs.
13. Gas exchange means getting oxygen into the blood and carbon dioxide out.
14. The tiny air sacs in the lungs are called alveoli.
15. There are about 600 million alveoli in the lungs.
16. Alveoli are in contact with a thin blood vessel called a capillary.
17. Oxygen is absorbed into the capillaries through diffusion.
18. Carbon dioxide moves the other way because there is more carbon dioxide in the blood than the lungs.

Additional tasks

1. Put the descriptions below in the correct order to describe **breathing in** and **breathing out**.

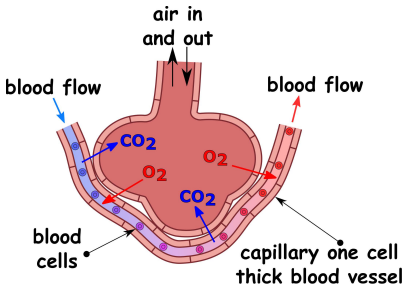
Breathing in

Diaphragm contracts → intercostal muscles contract → lung space increases → air pressure inside lungs decreases → air pushed into lungs

Breathing out

Diaphragm relaxes → intercostal muscles relax → lung space decreases → air pressure inside lungs increases → air pushed out of lungs

2. As per diagram.



3. Below is a model of the lungs, when the rubber balloon (diaphragm) is pulled down the lungs inflate. When it is released they deflate. Explain why.

Pulling the balloon down is the same as the diaphragm moving down. The space (volume) increases meaning the pressure inside the glass jar is reduced so the pressure 'outside' is greater than 'inside' and air is pushed into the balloons (pretend lungs).

When the balloon is released the opposite happens. The space inside decreases, increasing the pressure inside the jar (now greater than the pressure outside) and the air is pushed out and the balloons deflate.

Questions on Aerobic and Anaerobic Respiration: Answers

Comprehension

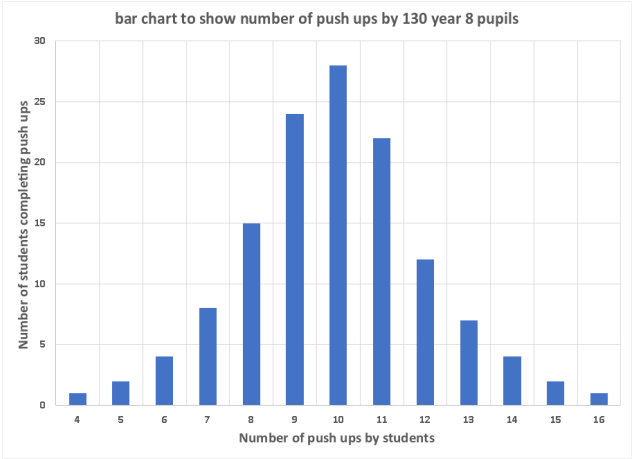
1. Aerobic means involving oxygen.
2. Cells release energy through a process called respiration.
3. Respiration without oxygen is called anaerobic respiration.
4. Most of our energy comes from glucose.
5. Examples of three life processes are: growth, reproduction and movement.
6. The products of aerobic respiration are carbon dioxide and water.
7. Expelled means forced out.
8. Respiration is the same chemical equation as combustion (burning).
9. Our body might require anaerobic respiration when we ask it to do a lot of work.
10. The downside to anaerobic respiration is the production of lactic acid.
11. Lactic acid leads to muscle burn (pain) and fatigue (tiredness).
12. Louis Pasteur discovered yeast can undergo aerobic and anaerobic respiration.
13. Yeast is a single celled organism part of the fungus family.
14. Aerobic respiration is used in bread making because a lot of carbon dioxide gas is given off, making the bread rise.
15. Another word for ethanol is alcohol.
16. The products of fermentation are carbon dioxide and ethanol (alcohol).

Additional tasks

1.

Respiration the release of energy in a cell
Yeast single celled organism used in brewing and baking
Aerobic involving oxygen
Fermentation anaerobic respiration by yeast producing alcohol and carbon dioxide
Anaerobic not involving oxygen
Lactic acid an acid produced during anaerobic respiration that causes muscle burn

2.



3. a. **Aerobic Respiration**

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O + \text{Energy}$$

Anaerobic Respiration

$$C_6H_{12}O_6 \longrightarrow C_3H_6O_3 + \text{Energy}$$

Proofing (baking)

$$C_6H_{12}O_6 + O_2 \xrightarrow{\text{yeast}} CO_2 + H_2O + \text{Energy}$$

Fermentation

$$C_6H_{12}O_6 \xrightarrow{\text{yeast}} CO_2 + C_2H_5OH \text{ (alcohol)}$$

b. The equations are **not** balanced. Use the anaerobic respiration equation to explain what we mean by this.
There are 6 C (carbon atoms), 12 H (hydrogen atoms) and 6 O (oxygen atoms) on the left and only 3 C, 6 H and 3 O on the right. Not the same / balanced, we need another lactic acid molecule to balance the equation.

Questions on Exercise, Asthma and Smoking: Answers

Comprehension

1. Exercises are activities that require physical effort.
2. Humans exercise to improve their health and fitness.
3. Exercise reduces the risk of heart disease, strokes, diabetes and cancer.
4. Exercise improves our energy levels.
5. Five to eighteen year olds are recommended to have one hour of exercise per day.
6. During exercise more blood is pumped to the muscles than other parts of the body.
7. Long term effects of exercise is that the muscles grow in size and strength.
8. Tendons hold the muscles to the bones.
9. Ligaments hold your bones together.
10. Increased bone density means your bones are less likely to break.
11. Asthma affects the function of the airways.
12. Chronic means long term.
13. Symptoms of asthma are breathlessness and wheezing.
14. A person's airways can narrow and mucus can build up for someone with asthma.
15. When someone has an asthma attack they should use their reliever inhaler or call an ambulance.
16. Smoking is addictive because of the drug nicotine.
17. Tar exposure is strongly linked to cancer.
18. Cilia are tiny hairs in out lungs that sweep out unwanted dust.
19. Carbon monoxide is poisonous and reduces the ability of our blood to transport oxygen.

Additional tasks

1.

Nicotine the addictive drug from smoking

Asthma a disease of the airways leading to breathlessness and wheezing

Exercise an activity that requires physical effort

Stress a state caused by demanding activities

Carbon monoxide a toxic gas from smoking that reduces the ability of the blood to carry oxygen

Tar a sticky brown substance from smoking and the main cause of throat and lung cancer

Adult	*1*	*2*	*3*	*4*	*5*	*6*
Recovery time (mins)	1.5	8	2	10	7.5	9

3. One of the way ways to measure fitness is your **recovery heart rate**. This is the amount of time that it takes your heart rate (**beats per minute**) to return to its resting value after exercise. The table below gives data for the recovery rate of **six 40 year olds** asked to **run** at the **same speed** for **10 minutes**.

   a. Which adults do you think are 'fit'?

   Adults 1 and 3 are fit.

   b. Why do you think they were asked to run at the same speed for the same time?

   So that it is a fair test and the recovery times can be compared against the same amount of exercise. A fair test is where only one variable is changed. In this test it is the adult that changes and the amount of exercise is kept constant (controlled).

   c. What would you advise the 'unfit' 40 year olds to do?

   Steadily increase the amount of exercise they do over time and then re-run the test to see if their recovery rate is improving. If not seek professional advice.

   d. What things doesn't the data tell you that may affect the results?

   If an adult is over weight. If an adult smokes or drinks too much alcohol. If they have any medical conditions.

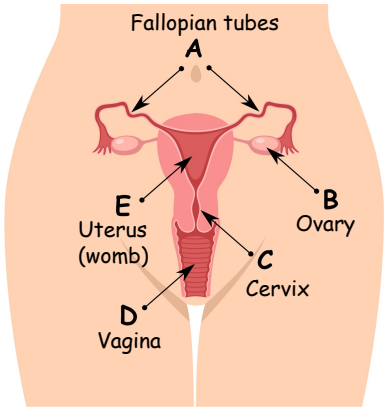
Questions on Reproduction in Humans; Women: Answers

Comprehension

1. Gametes are sex cells.
2. A woman's gametes are made in the ovaries.
3. Sperm is made in the testes.
4. Reproduction where sperm and egg meet is called sexual reproduction.
5. Hormones are chemical messengers.
6. A woman's egg is released on day 14.
7. The menstrual cycle describes how a woman's fertility changes over approximately one month.
8. When a woman's uterus lining breaks down she bleeds.
9. We call this bleeding having a period.
10. A period lasts between 3 to 5 days.
11. The release of a mature egg is called ovulation.
12. After release the egg travels down the fallopian tube.
13. The eggs stays alive for about 12-24 hours.
14. If an egg is not fertilised by a sperm it dies.
15. The main hormones involved in a woman's menstrual cycle are estrogen and progesterone.
16. Fertilisation means the fusion of sperm and egg.
17. The fertilised egg grows by cell division.
18. The placenta allows nutrients and oxygen to pass from the mother to the baby and waste products to pass to the mother.
19. After the embryo develops human features we call it a foetus.

Additional tasks

1.



2. Solve the jumbled up letters to reveal words relating to the female reproductive system.

ESTRMUALN	MENSTURAL
IOAREVS	OVARIES
RUTESU	UTERUS
FALTULOPANIBES	FALLOPIAN TUBES
GVAAIN	VAGINA
TESOERNG	ESTROGEN
EPORGTRONEES	PROGESTERONE
GAETESM	GAMETES
ONUAVTILO	OVULATION
OMWB	WOMB
ZOTEYG	ZYGOTE

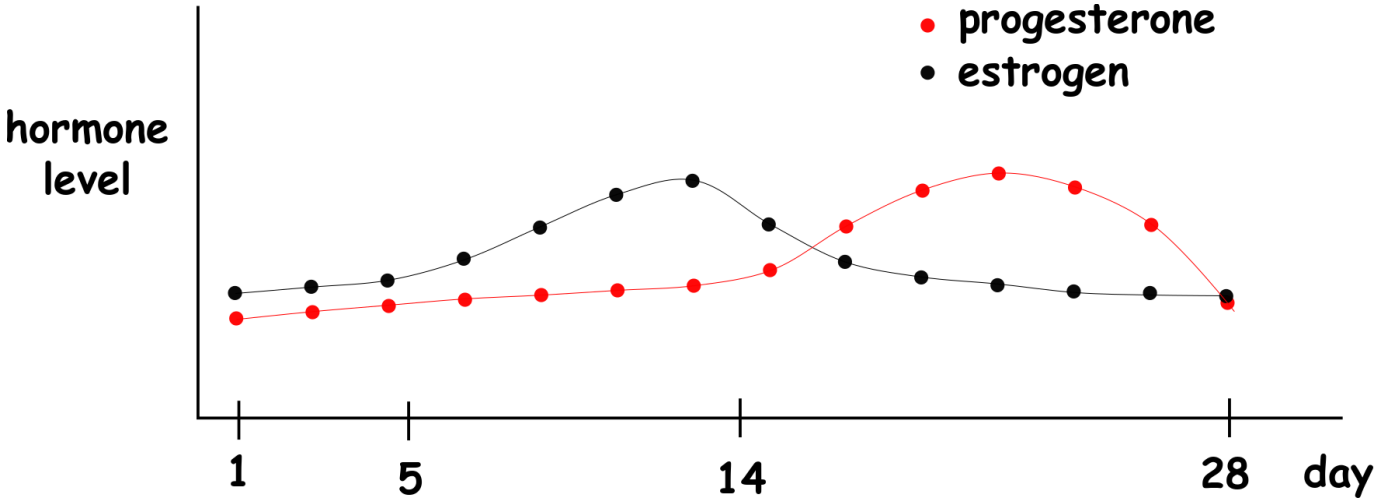
3. 'Join the dots' to show how the levels of progesterone and estrogen change during the menstrual cycle.

a. What do you think the rise in estrogen causes?

Part of the stimulation for egg release/ ovulation.

a. What do you think the drop in progesterone? causes?

The wall of the uterus to begin to break down and a period begin.



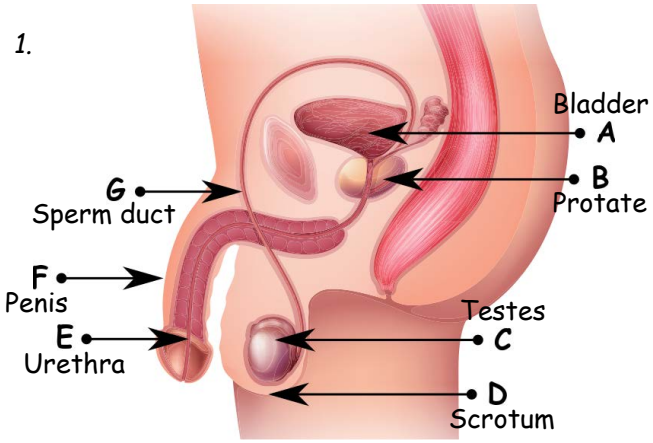
Questions on Reproduction in Humans; Men: Answers

Comprehension

1. The hormone testosterone controls the reproductive system in men.
2. Testosterone is made in the testes.
3. The main job of the testes is to produce sperm and testosterone.
4. A man's testes are kept in the scrotum.
5. It is important that testes are outside of the body because they produce sperm better at a temperature lower than our body's of 37°C.
6. To have a baby a man and a woman must have sexual intercourse.
7. Before wanting sex a woman's vagina becomes moist.
8. To get an erection a man's penis fills with blood.
9. The back and forth motion causes a man to ejaculate.
10. Semen is made in the prostate gland.
11. The liquid part of semen contains energy and enzymes.
12. If an egg and sperm fuse the woman becomes pregnant.
13. The gestation period is the time between becoming pregnant and giving birth.
14. The gestation period for women is about 9 months or around 40 weeks.
15. The woman provides the baby with oxygen and food during this time.
16. During pregnancy a women needs more protein, iron, calcium and folic acid.
17. Folic acid is important because it reduces the risk of the baby developing defects.
18. Chemicals from cigarette smoke and alcohol can pass across the placenta and into the baby's blood.
19. Some babies are born addicted to drugs because the mother was using them during pregnancy.

Additional tasks

1.



2.

To make a baby both a man and a women must be **sexually mature.** This means that a man must be able to **ejaculate** and a woman must have started her **periods**.

If a man can **ejaculate** he can release **sperm.**

(CONTINUED)

If a woman has started her periods she is able to release an **egg**. If a man and woman are aroused, a man's **penis** becomes hard and a woman's vagina **moist**. This allows for the penis to enter the vagina. On inserting his penis the man's back and forth motion **stimulates** him to **ejaculate**.
On ejaculation sperm is released and swims up through the **cervix** and uterus into the **fallopian tube** where an egg may be waiting. If the sperm meets an egg and **fuses** the woman becomes **pregnant**.

3. Write down some ideas about why it is important for a woman to stay healthy during pregnancy.

Whatever the mother eats, drinks or takes into her body can be passed onto the baby. Having a balanced diet means the baby will get everything it needs. If the mother ate a poor diet the baby wouldn't get all the nutrients and energy they need to grow properly and may be born with problems.

If the mother uses drugs, smokes or drinks too much alcohol during pregnancy the harmful effects can be passed onto the baby and may affect the baby's start in life.

Mums want to give their babies the best start, staying healthy during pregnancy is the best way they can do this.

Questions on Drugs and their Impact: Answers

Comprehension

1. A drug is a chemical substance that affects the way your body works.
2. People use recreational drugs for pleasure.
3. All drugs can have side effects.
4. Pain relief is an obvious example of a good medicine.
5. An anaesthetic is a drug that causes loss of sensation.
6. A good use for an anaesthetic is making operations painless.
7. Antibiotics kill bacterial infections.
8. Before antibiotics people often died from infections after the operation.
9. Many infections are becoming resistant to antibiotics due to overuse.
10. Alcohol is an example of a depressant.
11. After drinking alcohol your nerve activity is slowed down.
12. A side effect of long term overuse of alcohol is liver damage.
13. One danger of getting drunk is that people can choke on their own vomit.
14. Heroin is an example of an illegal depressant.
15. People that get hooked on heroin only care about taking the drug.
16. Stimulants increase nerve activity.
17. Caffeine and nicotine are two legal stimulants.
18. Nose damage and bowel problems are some of the long term side effects of cocaine use.

Additional tasks

1.

Recreational drugs taken for enjoyment

Depressant slows down nerve activity

Medicines drugs that help us get better from illness

Stimulant speeds up nerve activity

Anaesthetic drugs that cause loss of sensation

Antibiotics drugs taken to treat bacterial infections

3. Some common 'general' medicines students might name, include:

Aspirin - pain relief
Antacids - relieve indigestion
Antihistamine - relieve allergy symptoms
Antibiotics - kill bacterial infections
Chemotherapy medicines - help treat cancers
Cough Medicines - relieve coughs
High blood pressure medicines - lower blood pressure
High cholesterol medicines - lower cholesterol
Indigestion medicines - relieve indigestion
Inhalers - relive asthma symptoms or breathlessness
Steroids - reduce inflammation

4. Put the following results of drinking alcohol in order of severity (getting worse). You may debate these!

Suggested order;

1. **MORE RELAXED THAN NORMAL**
2. **VERY RELAXED**
3. **SOME SLURRED SPEECH**
4. **DRUNK**
5. **DIFFICULT TO WALK IN A STRAIGHT LINE**
6. **PASS OUT**
7. **DEATH**

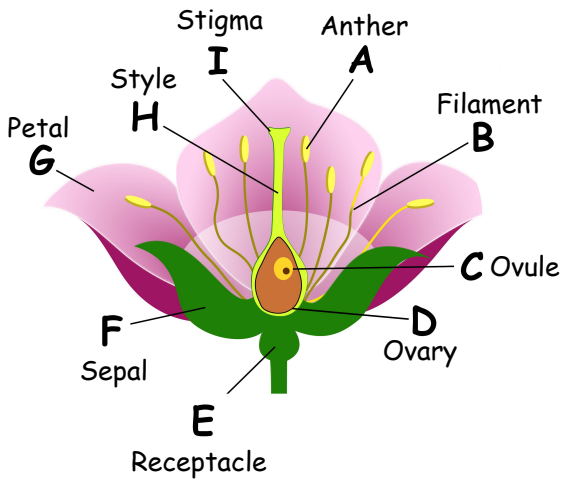
Questions on Reproduction in Plants: Answers

Comprehension

1. Flowering plants reproduce sexually.
2. The male sex cell is called pollen
3. The ovule is the female sex cell.
4. Pollination is when a pollen grain lands on the stigma of a flower.
5. Pollination in the same plant is called self pollination.
6. The pollen grows a tube down to the ovule to transfer its nucleus.
7. Pollination produces a seed.
8. The ovule (ovary) becomes a fruit.
9. Pollination usually happens by wind or being carried by insects.
10. Plants produce a sugary liquid (nectar) to attract insects for pollination.
11. They also produce scents to attract insects.
12. The four main methods of dispersal are: wind, carried by animals, transported by water or thrown as seed pods explode.
13. It is important seeds are dispersed so the seeds aren't too close competing for light, water and nutrients.
14. Germination is when a seed begins to grow.
15. The embryo is the beginnings of a new plant.
16. About 85% of plant life is actually in the oceans.

Additional tasks

1.



2. On a calm day 100 seeds fall from a tree and land close together near to the trunk. On a windy day 100 seeds fall from the tree and are scattered far apart and away from the tree's trunk.

Write down which seeds are more likely to grow and reasons why.

Seeds most likely to grow and why

Seeds that land near to the tree's trunk might not get much light. Being closer together means there will be **more competition** for growth. The soil may be less nutrient rich because of the tree and there may be less water available.

Seeds scattered further from the tree are more likely to grow well. They will likely have more light, **less competition** and perhaps better soil conditions such as nutrients and water.

3. Put the following statements in the correct order for a plant that undergoes **cross pollination** with another plant of the same species.

_5_ bee flies to another plant
_1_ pollen is made in the anther
_9_ plant is fertilised to produce a seed
_4_ pollen accidentally sticks to bee
_6_ pollen grains move from bee to stigma
_2_ pollen collects on top of the anther
_7_ pollen grows tube down to ovule
_8_ nucleus of pollen and ovule fuse
_3_ bee visits flower to collect nectar

Questions on Photosynthesis: Answers

Comprehension

1. Photo in photosynthesis refers to light.
2. Photosynthesis means using light to make food.
3. The two reactants in photosynthesis are water and carbon dioxide.
4. The chemical formula for water is H_2O and for carbon dioxide CO_2.
5. Glucose is an example of a sugar.
6. Glucose is stored as starch.
7. Oxygen allows respiration (release of energy), to happen in our cells.
8. Without plants, life as we know it would not exist.
9. Carbon dioxide contributes to global warming.
10. Plants respire at night.
11. Leaves are green because they contain chlorophyll, a green pigment.
12. Chlorophyll can absorb light energy for photosynthesis.
13. Palisade cells contain most of the chlorophyll.
14. Stomata are pores or air holes on the underside of a leaf.
15. During the day stomata open to **let in** CO_2 and **let out** O_2.
16. Guard cells control the opening and closing of stomata.
17. Stomata close at night to prevent water loss.
18. The waxy cuticle also helps reduce water loss.

Additional tasks

1.

Oxygen a gas produced by photosynthesis, chemical formula O_2

Water a liquid absorbed through photosynthesis, chemical formula H_2O

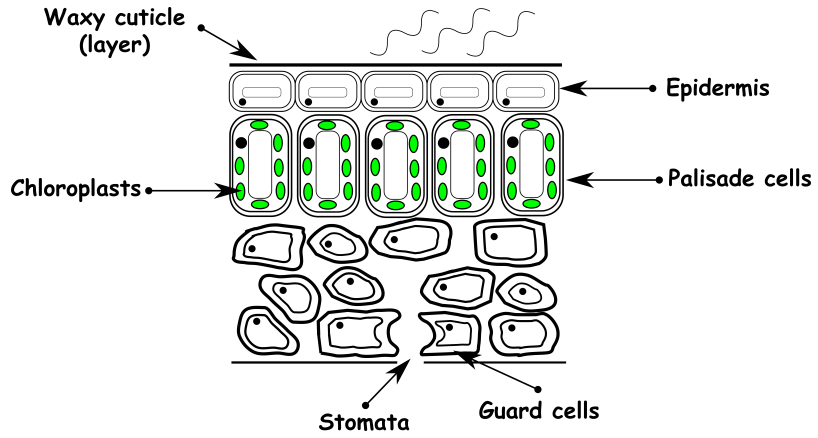
Carbon dioxide a gas absorbed through photosynthesis, chemical formula CO_2

Chlorophyll a green pigment found in leaves for photosynthesis

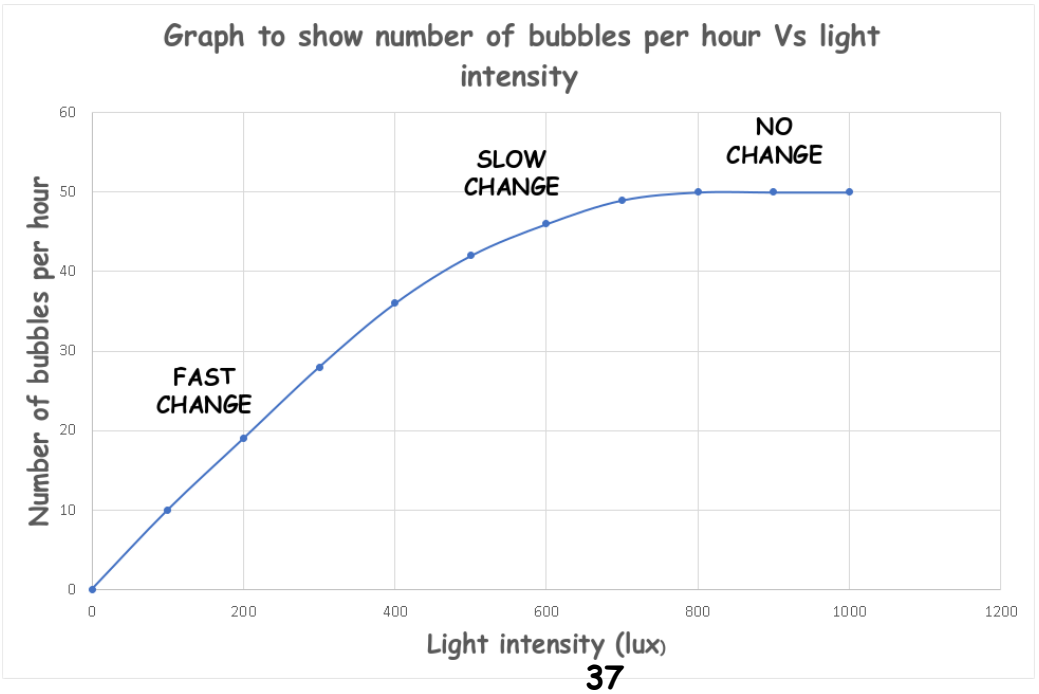
Glucose a sugar produced through photosynthesis, chemical formula $C_6H_{12}O_6$

Stomata pores on the underside of a leaf to control gas exchange

2.



3.



Questions on Genetics and Inheritance: Answers

Comprehension

1. Inheritance is the passing of genetic characteristics from parent to offspring.
2. Our characteristics are influenced by the genes we get from our parents.
3. There are two genes for each characteristic.
4. Chromosomes look like two long balloons tied in the middle.
5. X and Y chromosomes determine your sex.
6. Womens' eggs only carry X chromosomes.
7. A punnett square shows a boy or girl are equally likely.
8. The gene that determines offspring is male is found on the Y chromosome.
9. We share 99% of the same genes as a chimpanzee.
10. Evolved means developed gradually.
11. The same species can breed and produce fertile offspring.
12. Horses and donkeys are not the same species.
13. If they breed they produce a mule that is infertile.
14. Franklin and Wilkins fired X-rays at DNA.
15. The scattering of the X-rays produced patterns.
16. Watson and Crick came up with the double helix structure that we now know is correct.

Additional tasks

1.

Genes sections of the chromosome that carry information for how we grow

Recessive a weaker gene that only produces the characteristic if combined with another recessive gene

Inheritance the passing of genetic characteristics from parent to offspring

Dominant a stronger gene that produces a characteristic

DNA a molecule that makes up chromosomes, has a double helix shape

Chromosome carry the genetic information

2. **offspring, dominant, characteristic, looks, recessive, recessive, inherit, blue eye, punnett, freckles**

Our characteristics are the **looks** and attributes that we **inherit** from our parents. Things like eye colour, hair colour and **freckles.** If the stronger gene called the **dominant** gene combines with another gene of that characteristic then we see that **characteristic** in the **offspring**. The weaker gene is called the **recessive** gene. We only see that characteristic if it combines with another **recessive** gene. For example, the recessive blue eye gene only produces blue eyes if it combines with another recessive **blue eye** gene, one from each parent. A **punnett** square shows the possible combinations.

3 a. Complete the **punnett squares 1 to 4** below to show the possible outcomes for the offspring from moms and dads with the recessive and dominant gene combinations below (like opposite).

b. Write down how many offspring 'out of four' have blue eyes for each punnett square 1 to 4. below.

B = dominant brown eyes gene **b = recessive blue eyes gene**

1.

Mom \ Dad	B	B
B	BB	BB
b	Bb	Bb

0 out of 4

2.

Mom \ Dad	B	b
b	Bb	bb
b	Bb	bb

2 out of 4

3.

Mom \ Dad	B	B
b	Bb	Bb
b	Bb	Bb

0 out of 4

4.

Mom \ Dad	b	b
b	bb	bb
b	bb	bb

4 out of 4

4. Correct order of size below;

MOLECULE

DNA

CHROMOSOME

NUCLEUS

CELL

TISSUE

ORGAN

Questions on Adaptation: Answers

Comprehension

1. Adaptations help a species to survive in its habitat.
2. If an organism is not well adapted to its environment it may not survive.
3. Adaptations usually take thousands or millions of years.
4. The water proof outer layer of a cactus reduces water loss.
5. The leaves of a cactus have become spines.
6. The sweet liquid that plants (flowers) produce is called nectar.
7. Hairs in a Venus fly trap detect movement to tell it to snap shut.
8. The trapped insects are digested for nutrients.
9. The Caudal fin propels the shark at great speed.
10. A shark's streamlined shape means it can move through the water with little resistance.
11. A sharks 'skeleton' is made from cartilage.
12. A polar bears skin is black and it helps absorb heat from the sun's rays.
13. A polar bears big feet spreads their weight which stops them sinking into the snow.
14. Their white coat is useful for camouflage.
15. Camels can drink 80 litres of water in one go.
16. Sweating very little below 50°C means they reduce water loss.

Additional tasks

2. Complete the adaptations crossword answers below.

    1. Adaptations
    2. Habitat
    3. Shark
    4. Big feet
    5. Super bugs
    6. Kangaroo rats
    7. Camels
    8. Okapi
    9. Pollen
    10. Cactus

3.

- Dogs have developed an excellent sense of smell

  Dogs can find and track prey efficiently. Smell can also warn them of predators.
- Springbok (small deer like animals) jump in the air to make themselves look bigger

  Predators are less likely to attack because they look bigger.
- Some non-venomous snakes have very bright colours

  Deters predators because bright coloured snakes are often venomous.
- The bee orchid flower looks like a female bee

  Attracts more male bees and means the plant is more likely to be pollinated.
- Cheetahs have a long spine, long legs, light skeleton and large nostrils

  The long spine allows for more flexibility for running at high speed. The light skeleton makes speed easier to achieve and acceleration faster. Large nostrils allow the cheetah to breathe in a lot of oxygen which is needed for the running at high speeds.
- Mountain goats have rough pads on their hooves, their hooves spread widely and have very strong hind (back) legs for jumping

  Strong back legs enable the mountain goat to jump a long way. The hooves spread widely and have rough pads for good grip on the rocks.

Questions on Evolution and Natural Selection: Answers

Comprehension

1. Evolve means to change gradually over time.
2. Two ways mutations can occur are by accident or due to environmental conditions such as radiation.
3. Mutations lead to new traits.
4. Traits better adapted to the environment or for finding food increases an animals chance of survival.
5. Over time, these traits become more common in the population.
6. We describe this as becoming naturally selected.
7. We call those better adapted to survive, 'survival of the fittest'.
8. Less well adapted species eventually die out.
9. Charles Darwin is credited with first presenting the ideas behind evolution.
10. Charles Darwin famously studied species on the Galapagos islands.
11. An insecticide is a chemical that kills insects.
12. Some insects are able to breakdown insecticide so they cause them no harm.
13. The population of these insects grows.
14. MRSA is also called a superbug.
15. MRSA are resistant to antibiotics.
16. This has been made worse due to overuse of antibiotics.

Additional tasks

1.

Bacteria single celled organisms

Traits the characteristic of an animal, for example thick fur

Insecticides chemicals that kill insects

Mutate to change from what you were

Survival of the fittest animals with the best adaptations for survival

Evolve to change over time

2. Complete the sentences choosing from the words in bold describing what trait each animal has evolved over time to help them survive.

smell, speeds, upright, sharp, brains, hearing, sensitive, long, teeth, nectar, wolf, bipedalism, 'fly', detect, streamlined

- **Sharks** have evolved to constantly replace their **teeth** over a lifetime. This ensures they are able to maintain many rows of **sharp** teeth.
- **Humans** have evolved big **brains** enabling them to solve problems and also evolved to walk **upright** on two legs called **bipedalism**.
- **Dogs** have evolved excellent **hearing**, sharp teeth and an exceptional sense of **smell** to help them hunt. All from their ancestor, the **wolf**.
- **Tarantulas** have evolved to be **sensitive** to small vibrations in the ground to **detect** prey.
- **Humming birds** have evolved **long** beaks so that they can reach **nectar** inside flowers.
- **Penguins** have evolved wings that allow them to ' **fly** ' underwater at high **speeds** to catch fish and are beautifully **streamlined** to reduce water resistance.

3. Write true or false next to the statements about evolution below.

Every one now believes the theory of evolution (_**False**_) Evolving is a slow process 'normally' (_**True**_)
Darwin was the only one to come up with the theory (_**False**_) Evolution has stopped now (_**False**_)
The Goblin shark has barely evolved over millions of years (_**True**_) Mutations drive evolution (_**True**_)
Some humans that live at high altitude have evolved to have higher blood oxygen content (_**True**_)
We are still learning about evolution (_**True**_) If species don't evolve they risk extinction (_**True**_)

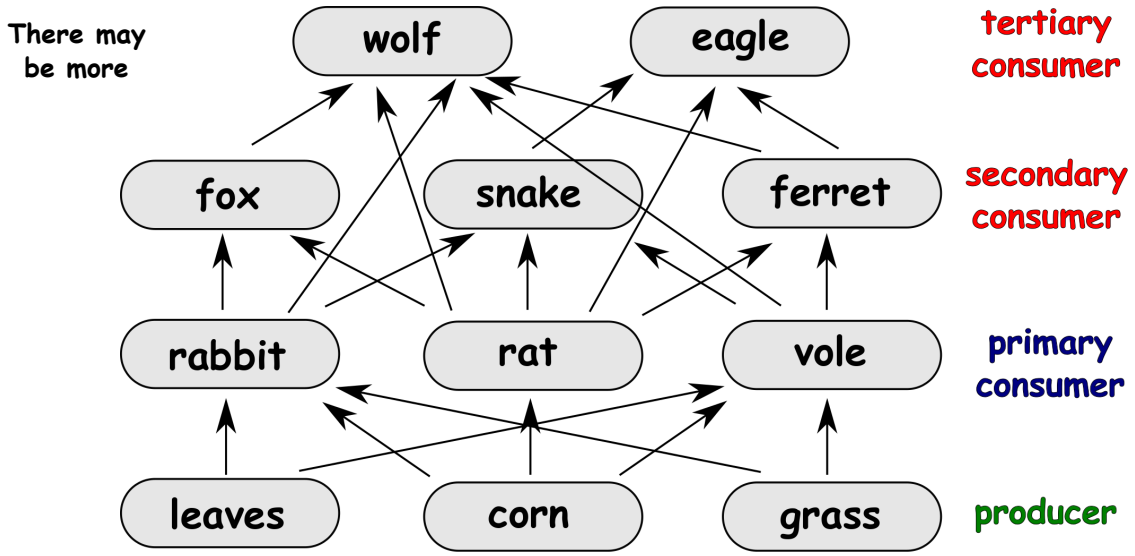
Questions on Biodiversity and Gene Banks: Answers

Comprehension

1. The desert food web shows the food chains of a diverse range of plants and animals.
2. Diverse means many different types.
3. If insecticide kills the grasshopper there will be no food for the lizard who might die out.
4. Biodiversity is essential for maintaining healthy populations.
5. Less biodiversity means ecosystems are less able to cope with change and species are more likely to die out.
6. In a diverse ecosystem species can survive on other sources of food if there is a bad year.
7. Human food supply could be put in danger if we allowed honey bee numbers to decrease.
8. Honey bees pollinate much of the fruit plants, vegetables and crops that we eat.
9. Introduction of non-native species can disrupt biodiversity.
10. Cane toads were introduced to control the cane beetle pest.
11. Some native (erratum non-native) predators are not adapted to the poisonous glands of the cane toad.
12. Reduction in prey has put pressure on other native animals that depend on the same diet.
13. Species still become extinct.
14. Gene banks are a way of storing genetic material for the future.
15. Genetic material can be used for research or to reproduce lost species.

Additional tasks

1. Use these three food chains; **leaves, rabbit, fox**; **corn, rat, snake**; **grass, vole, ferret** and a **wolf** and **eagle** as the tertiary consumers, to fill the boxes below and draw arrows between who eats what.



2. Here are some statements about captive breeding programs, put them under the title ***Pros*** (advantages) or ***Cons*** (disadvantages).

- Captive breeding programs are not cheap. **Con**
- We learn a lot about the animals in captive breeding programs. **Pro**
- Many people have jobs in breeding programs. **Pro**
- Animals are often not introduced back into the wild and this should be the aim. **Con**
- Reintroduced species often don't survive. **Con**
- It means we can still see endangered animals without having to enter their habitat. **Pro**
- Captive breeding programs have limited success. **Con**
- Some endangered animals may still have benefits to humankind that we still don't know about. **Pro**
- Some habitats are reopening to wild animals, if we don't have captive breeding programs we may not be able to reintroduce. **Pro**
- It's important for maintaining biodiversity. **Pro**

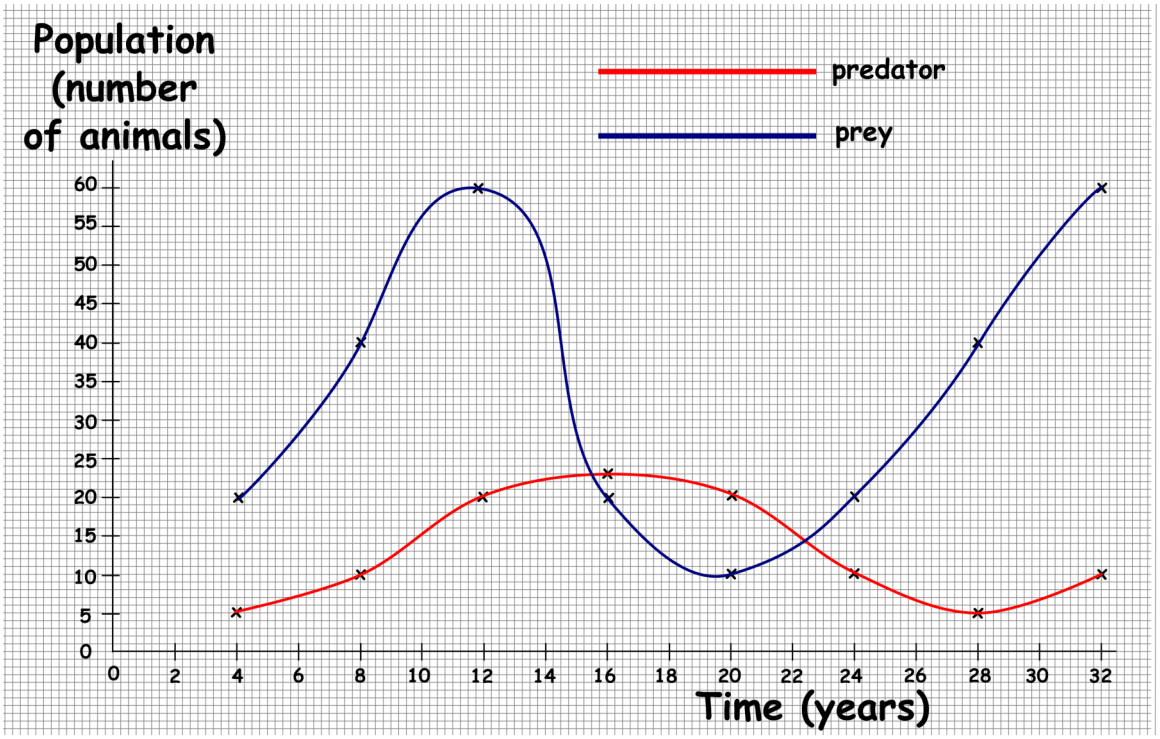
Questions on Predator Prey and Populations: Answers

Comprehension

1. A predator is an animal that kills another animal for food.
2. A cat (predator) and mouse (prey) are good examples.
3. As the cats eat the mice, mice population decreases.
4. As the population of mice decreases, there is less food for the cats so they don't breed as much and their population decreases.
5. The mice population starts to rise again because there are less cats eating them.
6. The population of the cats rises again as there is more food for them.
7. Predator prey graphs show the change in population over time.
8. They are simple to follow when only considering one predator and one prey.
9. Environmental conditions such as weather can also affect prey numbers.
10. The lions might steal the hyena's food and space.
11. Animals of the same species will compete for territory for breeding rights as well as food.
12. Water can also be competed for.
13. 'Darwin's finches' are a group of 14 species of small birds.
14. Birds with medium sized beaks compete for the same food.
15. Birds with shorter and longer beaks have more food available.

Additional tasks

1.



2. How long does it take the predator numbers to go from a **maximum** to a **minimum** value (or vice versa)?

12 years

3. Below is one answer for each factor. In most cases the counter argument is also true, e.g. plenty of food means good growth, healthy population, increased fertility and rising numbers.

NUTRIENTS IN SOIL
Not enough can mean leaves are unhealthy (yellow) and growth is stunted.

FOOD
Lack of food means malnutrition, poor growth and fertility, population can drecrease.

PREY
Not enough prey can cause predator population to decrease (not enough food).

DISEASE
Disease can kill predators or kill prey. The reduction in prey also reduces predator numbers.

WAR
Deaths from a wars can reduce populations.

PREDATORS
Too many predators eating the prey can reduce population.

LIGHT TO GROW
Not enough light can reduce how many plants are able to grow in a habitat.

SPACE
Limited space means a population can only grow to a certain size.

OXYGEN
Limited oxygen, for example, in a fish tank can cause fish to die.

WEATHER OR CLIMATE
Natural disasters such as floods or droughts can cause the deaths of animals and plant life in the area.

Questions on Pyramids of Numbers and Toxin Accumulation: Answers

Comprehension

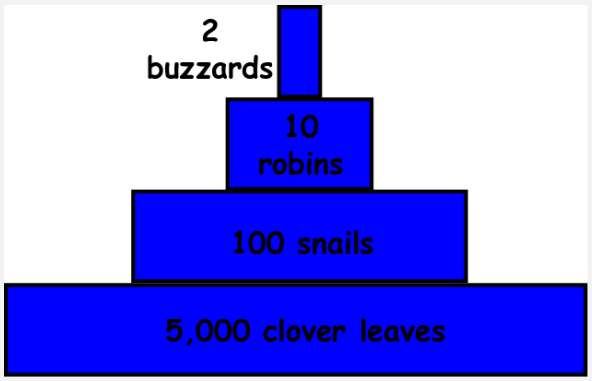
1. Toxins are poisonous chemicals.
2. Toxins have four routes into an organism.
3. Ingested means eaten.
4. Pesticides are used for killing pests.
5. Mercury and lead are toxic metals that can be passed up the food chain.
6. Pyramids of numbers show us the size of the population at each level in a food chain.
7. Each level in the food chain is drawn in proportion to the size of the population.
8. They often look like pyramids because the numbers often start off big and get smaller.
9. One bush can feed thousands of greenfly.
10. Pyramids of numbers don't tell us the size of the organism.
11. Chemical fertiliser can wash off fields and into rivers and reservoirs.
12. Toxins can get into soil through air pollution.
13. Toxin concentration increases (builds up) higher up in a food chain.
14. Mercury levels can become high enough to become harmful to humans.

Additional tasks

1. Draw a pyramid of numbers in the boxes below for the following two food chains;

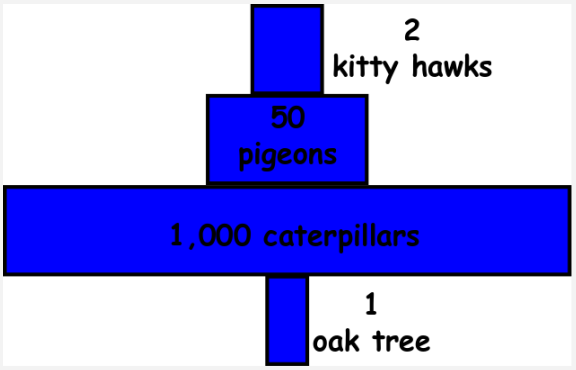
5,000 Clover leaves, **100** Snails, **10** Robins, **2** Buzzards (birds of prey)

Pyramid of numbers



1 Oak tree, **1000** Caterpillars, **50** Pigeons, **2** Kitty hawks (birds of prey)

Pyramid of numbers



2. Another way of drawing pyramids for food chains is to draw **pyramids of biomass**. This is where each trophic level is drawn to represent the **mass** of living material (biomass) rather than the number of each species.

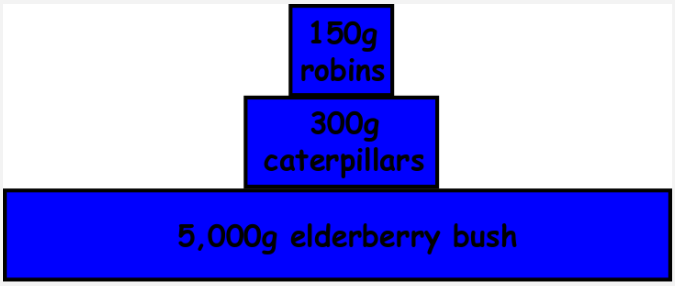
a. Complete the table below to calculate the **total biomass** for each organism by multiplying the number of organisms by their mass.

	Caterpillar	Robin	Elderberry bush
Mass of organism (g)	3	75	5000
Number of organisms	100	2	1
Total biomass (g)	**300**	**150**	**5000**

3. Use the total mass to draw a **pyramid of biomass** for the food chain.

Elderberry bush → Caterpillar → Robin

Pyramid of biomass

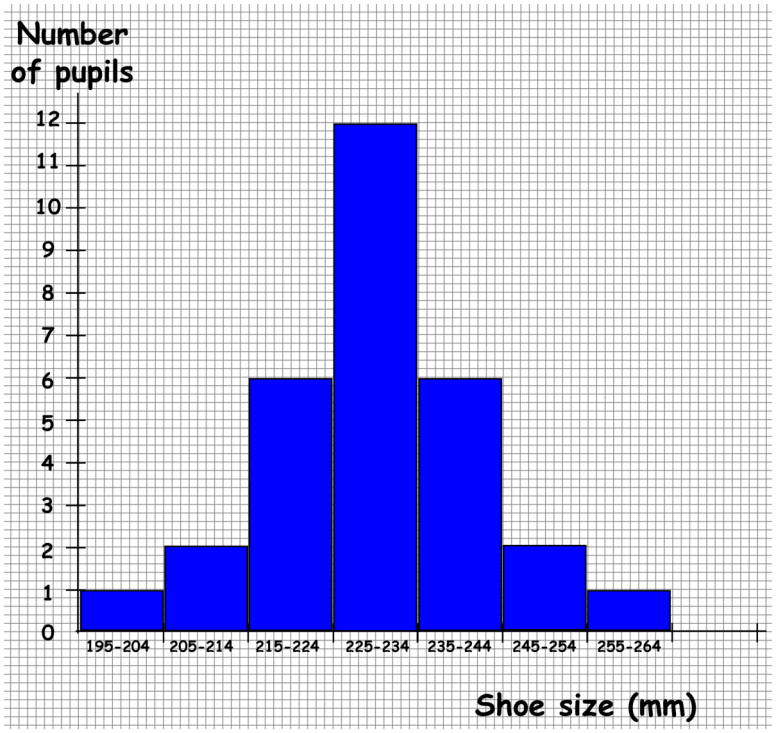


Questions on Variation: Answers

Comprehension

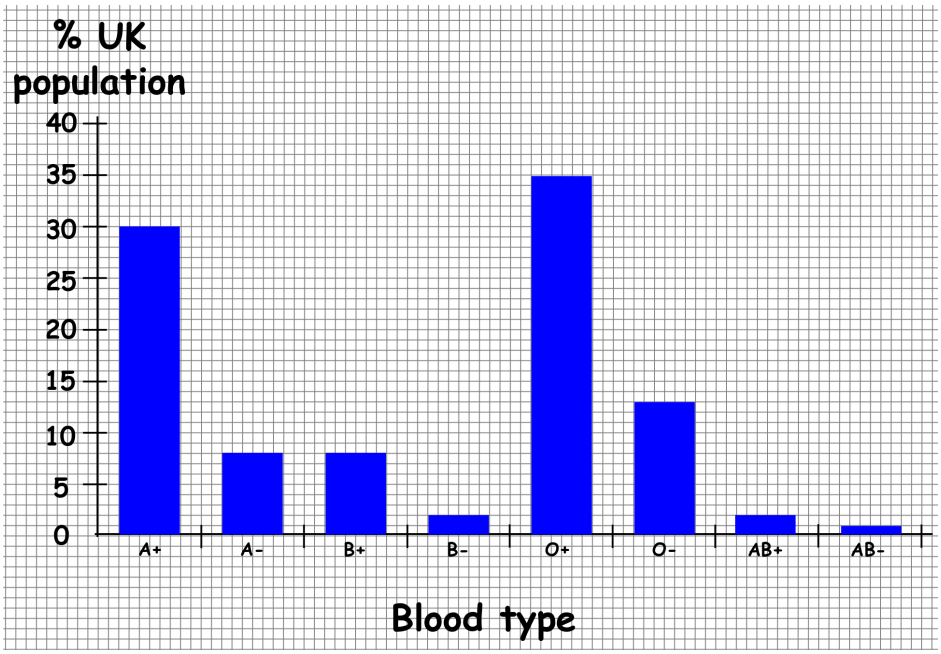
1. Variation clearly exists between species.
2. All dogs can breed with each other because they are the same species.
3. Discontinuous means falls into a specific category or there is nothing in between.
4. Blood group, hair colour, eye colour and gender are all discontinuous.
5. Continuous characteristics have any value within a certain range.
6. Height, weight, skin colour and foot size are continuous.
7. A histogram plots the number of people that fall within a certain range for the characteristic.
8. Discontinuous data is plotted on a bar chart.
9. Half of our genes come from mom and half from dad.
10. Our genes and the environment affect our characteristics.
11. We can sunbathe to change our skin colour.
12. Malnutrition could cause the child of tall parents to be small.
13. Genes and the environment are thought to influence asthma.
14. The nature Vs nurture debate has been around for a long time.
15. We can all read to improve knowledge and practise maths to get better.
16. Genes can influence how easy certain tasks are for certain individuals.

Additional tasks



1. Draw a histogram for the data below showing shoe size for a class of 30 year seven pupils.

Number of pupils with that shoe size	Shoe size range (mm)
1	195-204
2	205-214
6	215-224
12	225-234
6	235-244
2	245-254
1	255-264



2. Draw a bar chart of the percentage of people with each blood type in the UK.

Percentage of people in UK	Blood type
30	A+
8	A-
8	B+
2	B-
35	O+
13	O-
2	AB+
1	AB-

Questions on the Particulate Nature of Matter: Answers

Comprehension

1. We call minute pieces of matter particles.
2. Leucippus and Democritus are first thought to have presented the idea that substances are made from particles.
3. The particles that make up substances are too small to be seen.
4. We now call these particles atoms.
5. Indivisible means can't be split.
6. Existing as a solid liquid or gas depends on the temperature of a substance.
7. Density tells us how closely packed particles are.
8. In solids the forces of attraction are strong.
9. This gives solids a fixed shape and volume.
10. They vibrate about the same position.
11. In the liquids the force of attraction is medium strength (weak bonds).
12. In a liquid the particles can move over and under each other (flow).
13. Liquids take the shape of the container they are in.
14. Liquids can't be compressed because there is little space between the particles.
15. In a gas the particles are far apart so the forces of attraction are weak.
16. Gases are easily compressed because there is a lot of space between the particles.

Additional tasks

1.

Water vapour the gaseous (gas) form of water

Randomly means with no particular pattern, the way particles in a gas move

Indivisible means can't be divided or split

Bond a force of attraction between particles

Density tells us how tightly packed particles are

Volume is the amount of space a substance occupies

2. Write next to the statements as to whether they are correct for a solid, liquid or a gas.

Particles are the closest together **solid**

Are easily compressed **gas**

Medium strength bonds **liquid**

Fixed volume but not fixed shape **liquid**

No fixed shape or volume **gases**

Least dense **gases**

Most dense **solids**

Usually less dense than solids **liquids**

Particles vibrate around one position **solids**

Strong bonds **solids**

Weak or no bonds **gases**

Can flow **liquids**

Atoms arranged regularly **solids**

3. The density of carbon dioxide as a solid, liquid and gas is given below.

Solid CO_2 (density **1560** kg/m^3)

Liquid CO_2 (density **1100** kg/m^3)

Gaseous CO_2 (density **2.0** kg/m^3)

Explain the difference in density using how the particles are arranged and the spacing between them. Draw diagrams if you wish.

As per diagrams and particle spacing explained opposite.

4 a. Helium has a density of 0.18 kg/m^3 and air has a density of 1.3 kg/m^3. What does this mean that a helium balloon will do?

A Helium balloon will float in air.

b. What do you think this tells you about why objects float?

Objects float when they are less dense than the fluid (liquid or gas) they in. Any object less dense than water will float.

Questions on Atoms, Elements, Compounds and Molecules: Answers

Comprehension

1. John Dalton developed the idea that matter is made from atoms.
2. Atoms are like tiny spheres (balls).
3. He did experiments and observed to check his rules.
4. Chemical reactions are due to the rearrangement of atoms of a substance.
5. A pure element is made from only one type of atom.
6. A pure diamond is made from only carbon atoms.
7. Compounds are formed when two or more different atoms are bonded together.
8. A chemical bond is when atoms are held together by an electrostatic attraction.
9. The chemical formula for water is H_2O.
10. Another name for alcohol is ethanol.
11. Molecules are two or more atoms bonded together. They are also the smallest complete unit of a substance.
12. Oxygen atoms prefer to bond to make oxygen molecules.
13. We draw circles to represent the atoms.
14. The number of each circle tells us how many of each atom are in the molecule.
15. Hydrogen is the most common element in the universe.
16. Helium doesn't form molecules.
17. Helium is normally found as an atom on its own.

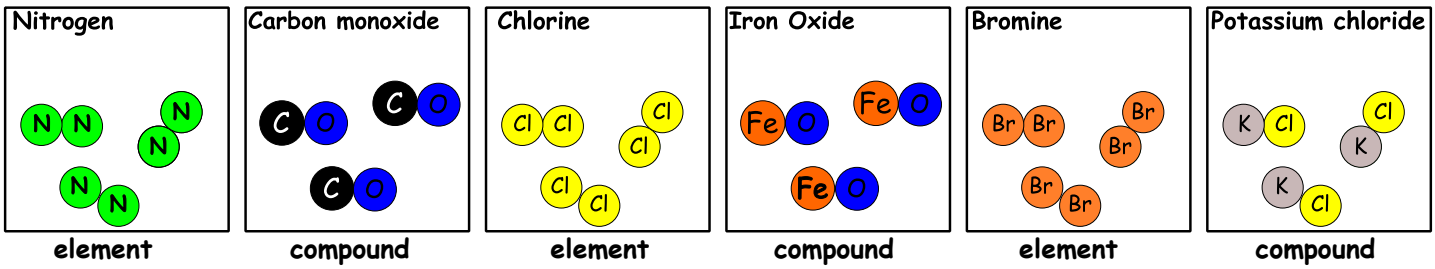
Additional tasks

2. Complete the gap filling exercise, choose from the words in bold below;

molecules, one, water, Oxygen, unit, different, same, different, carbon dioxide, compound, Helium

A pure element will only be made from **one** type of atom. **Helium** is an element often used in party balloons. **Oxygen** is the element that we breathe. Oxygen and hydrogen are both elements that form **molecules**. Molecules are the smallest complete **unit** of a substance. They are made from two or more atoms that can be **different** or the **same**. A molecule like **water**, H_2O is an example of a **compound**. Compounds are formed from two or more **different** atoms bonded together. The gas that we breathe out called **carbon dioxide** is a compound.

3. The images below show either ***an element made from molecules*** or ***a compound made from molecules.*** Write underneath each image whether you think they are an element or compound.



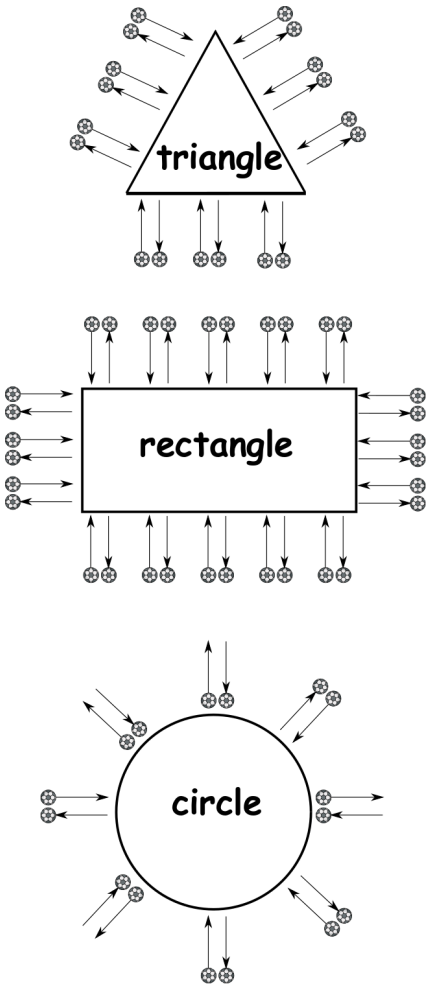
Questions on Evidence for Particles: Answers

Comprehension

1. Scientists thought the difference in elements was caused by being made from different atoms.
2. You don't normally see specks of dust because they are too small.
3. You can sometimes see dust particles in a bright beam of sunlight.
4. The particles seem to move in random directions.
5. Robert Brown was studying pollen grains suspended in water.
6. He was unable to explain the random motion of the pollen grains.
7. We know air exists because we can breathe it, feel it and weigh it.
8. Collisions with air particles causes the dust to move erratically.
9. The erratic motion from start to end is called the random walk.
10. Albert Einstein explained the random motion using mathematics.
11. Most importantly Einstein's predictions matched observations.
12. A simple way of knowing the rough size of a molecule is to let an oil drop spread on water.
13. We assume the oil spreads to a one molecule thick layer.
14. Other experiments shoot small particles at matter and see how they bounce off.

Additional tasks

2. Draw in what you think the invisible shapes are by how the balls are bouncing off.



3. An atom is about **0.0000001mm** across (diameter).

Use a calculator to divide the thickness of these everyday items by the diameter of an atom to calculate how many 'atoms thick' they are. Write your answer as a number and in words.

Remember *1,000 = thousand*

1,000,000 = million

1,000,000,000 = billion

a. human hair = 0.1mm **1,000,000 = one million**

b. piece of paper = 0.08mm
800,000 = Eight hundred thousand

c. human skin = 2mm **20,000,000 = Twenty million**

d. the height of a door = 2000mm
20,000,000,000 = Twenty billion

e. house paint = 0.05mm **500,000 = Five hundred thousand**

f. wooden shelf = 15mm
150,000,000 = One hundred and fifty million

g. the length of a brick = 215mm
2,150,000,000 = Two billion and one hundred and fifty million

Questions on Chemical Symbols and Chemical Formula: Answers

Comprehension

1. 118 elements have been discovered so far.
2. Often the chemical symbol is a shortened version of the full name.
3. Other symbols come from Latin.
4. Some elements are named after scientists.
5. The chemical formula for water is H_2O.
6. A water molecule has two hydrogen atoms and one oxygen atom.
7. Carbon monoxide is dangerous because it is poisonous and doesn't smell.
8. In methane molecules there are four hydrogen atoms and one carbon atom.
9. Calcium carbonate is commonly found as limestone.
10. Baking soda has one sodium, one hydrogen, one carbon and three oxygen atoms.
11. Glucose is the main sugar molecule that provides us with energy.
12. Common compounds are known by their own names.
13. A compound ending in **-ide** is made from only two different elements.
14. If a compound ends in **-ate** one of the elements will be oxygen.

Additional tasks

1.

Water H_2O
Carbon dioxide CO_2
Methane CH_4
Calcium carbonate $CaCO_3$
Copper sulphate $CuSO_4$
Glucose $C_6H_{12}O_6$

2. Choose from the words below to name the elements or compounds in the text box on the left hand side. Use the periodic table on pg90 to help.

   Magnesium chloride, Nitrogen, Calcium oxide, Sodium carbonate, Hydrogen chloride, Iron dioxide, Magnesium carbonate, Calcium sulphate, Iron oxide, Magnesium oxide, Oxygen, Potassium sulphate, Sulphur, Silver nitrate

3. In the right hand box, write the number of each atom from the formula e.g. *Lithium sulphate,*

   Li_2SO_4, 2 X Li (lithium) atoms, 1 X S (sulphur) atom, 4 X O (oxygen) atoms.

$CaSO_4$ **Calcium sulphate**	$CaSO_4$ **Ca x1 S x1 O x4**
N_2 **Nitrogen**	N_2 **N x2**
Na_2CO_3 **Sodium carbonate**	Na_2CO_3 **Na x2 C x1 O x3**
HCl **Hydrogen chloride**	HCl **H x1 Cl x1**
$MgCl_2$ **Magnesium chloride**	$MgCl_2$ **Mg x1 Cl x2**
FeO **Iron oxide**	FeO **Fe x1 O x1**
FeO_2 **Iron dioxide**	FeO_2 **Fe x1 O x2**
S_8 **Sulphur**	S_8 **S x8**
$MgCO_3$ **Magnesium carbonate**	$MgCO_3$ **Mg x1 C x1 O x3**
CaO **Calcium oxide**	CaO **Ca x1 O x1**
MgO **Magnesium oxide**	MgO **Mg x1 O x1**
O_2 **Oxygen**	O_2 **O x2**
K_2SO_4 **Potassium sulphate**	K_2SO_4 **K x2 S x1 O x4**
$AgNO_3$ **Silver nitrate**	$AgNO_3$ **Ag x1 N x1 O x3**

Questions on Chemical Reactions: Answers

Comprehension

1. The two chemicals that react together are called the reactants.
2. A new substance is formed.
3. Often more than one product is formed.
4. There are six ways we can tell if a chemical reaction has happened.
5. A solid forming in a liquid is called a precipitate.
6. A simple example of products being a different colour is burning toast (white to black).
7. You don't feel anything when you put your hand above an unlit bunsen because there is no chemical reaction (heat).
8. Hand warmers have chemical inside that release heat when they react.
9. Milk that has gone off smells bad telling you a chemical reaction has happened.
10. Boiled eggs smell because they give off hydrogen sulphide (a smelly chemical).
11. Bubbles of gas given off in a liquid is called effervescence.
12. You can tell plants produce oxygen by the bubbles formed on the leaves.
13. This is due to the chemical reaction of photosynthesis.
14. Limewater goes cloudy because calcium carbonate is formed in the liquid, it is insoluble.
15. When water is added to Ouzo, a white cloudy solid is formed (a precipitate).

Additional tasks

1.

Effervescence the name given to bubbles formed in a liquid

Lime water a chemical used to test for the presence of carbon dioxide gas

Chalk a commonly used word for the chemical Calcium carbonate, $CaCO_3$

Precipitate a solid formed in a solution (liquid)

Hydrogen sulphide a smelly chemical given off from boiled eggs

Rusting a chemical reaction between iron (or steel), air and water producing orange – red - brown *rust* (chemical name iron oxide)

3. Underline what tells you a chemical reaction might have happened in the statements below. *One of them is '**wrong**', can you spot it and explain why?*

a. Magnesium **burns** very **brightly** in air and **gets very hot**

b. Add magnesium to acid it **fizzes** and **gets warm**

c. Colourless silver nitrate solution is added to sodium bromide solution and a **cream solid forms**

d. Acetic acid is added to alcohol and a noticeable **aroma is smelt**

e. Copper carbonate (green) is heated and **turns black**

f. An ice cube left in a beaker melts **X**

g. Barium hydroxide and ammonium chloride are mixed and the beaker gets **too cold** to hold

h. **Bubbles appear** on a pond plant underwater

i. Baking powder **releases carbon dioxide** when a cake is baked to make it rise

'f' is wrong because melting is a physical change not a chemical reaction

Questions on Chemical Reactions; Atoms Rearranged: Answers

Comprehension

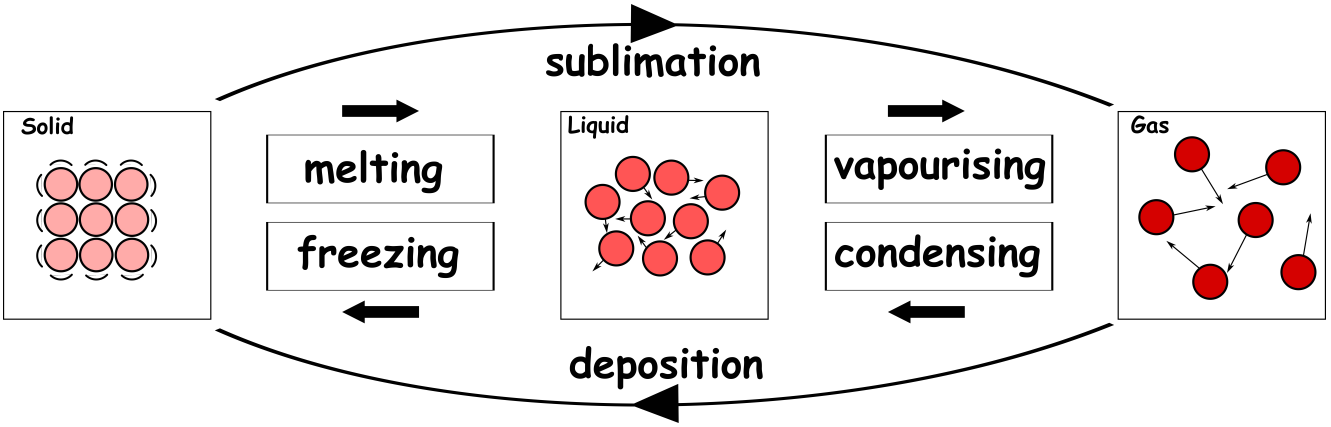
1. We know a chemical reaction has taken place when we see a colour change, temperature change, bubbles, a smell being given off or light emitted.
2. We always start with reactants and 'go to' products.
3. A chemical equations shows us what we start with and what we end up with.
4. When two substances react together bonds can be made or broken.
5. Bonds are forces that hold atoms together.
6. We know a chemical reaction has taken place because a new product is formed.
7. Chemical reactions can't usually be reversed.
8. If you put water in a freezer a physical change happens.
9. Sublimation means changing straight from a solid to a gas.
10. Boiling an egg is a chemical change.
11. When we add water to sand and cement a chemical reaction occurs making mortar.
12. Eggs, flour, butter and sugar are in a cake mixture.
13. You know a chemical reaction has taken place because you can't get back to the ingredients you started with (something new is made).
14. A hand warmer is an example of a reversible reaction.

Additional tasks

1. Write next to the examples below whether you think they are chemical or physical changes.

Frying an egg **chemical**	Milk going off **chemical**
Boiling water **physical**	Mixing sugar and salt **physical**
Dropping a metal in acid **chemical**	Burning toast **chemical**
Mixing sand with water **physical**	A lit sparkler **chemical**
Evaporating alcohol **physical**	Rotting wood **chemical**
Melting chocolate **physical**	Mixing oil and water **physical**
A cloud making rain **physical**	Making popcorn **chemical**
Filtering dirty water **physical**	Rusting **chemical**

2. Sketch the arrangement of the particles in a solid, liquid and gas then label the arrows with the following words (pg54 and pg130 help);



3. Write down some thoughts on whether dissolving sugar in water is a chemical or physical change. Think about whether something new is formed and if it is possible to get back to what you started with.

It is a physical change. No new product is formed and the water can be evaporated to get the sugar back from the water.

Questions on Conservation of Mass and Balancing Equations: Answers

Comprehension

1. Conservation of mass tells us that the total mass of chemicals we start with is equal to the total mass of chemicals we end with.
2. Conservation of mass is always true.
3. We can't write Mg + O because oxygen is found as a molecule O_2 not as an atom O.
4. When one carbon atom reacts with one oxygen molecule carbon dioxide, CO_2 is produced.
5. The number of atoms before and after the reaction is always the same.
6. Carbon dioxide plus water makes carbonic acid.
7. When hydrogen reacts with oxygen water is produced.
8. Putting numbers in front of the molecules shows us there is more than one.
9. There are four atoms in two molecules of hydrogen.
10. Putting the number 2 in front of H_2 and H_2O means there are four atoms of hydrogen on both sides of the equation.
11. The reaction between nitrogen and hydrogen produces ammonia.
12. The first equation is not balanced because there are three hydrogens on the right and only two on the left of the equation.
13. Once balanced both sides of the equation has six hydrogens.
14. When lead oxide reacts with carbon the products are carbon dioxide and lead.

Additional tasks

1. Balance the equations below, to help there is a space if a number is needed.

a. **2** K + F_2 → **2** KF

b. **2** Na + Cl_2 → **2** NaCl

c. **2** Ca + O_2 → **2** CaO

d. S_8 + **8** O_2 → **8** SO_2

e. **2** Al + **3** Br_2 → **2** $AlBr_3$

f. Mg + **2** HCl → $MgCl_2$ + H_2

g. CH_4 + **2** O_2 → **2** H_2O + CO_2

h. **2** Al + **3** FeO → Al_2O_3 + **3** Fe

2. Draw diagrams like the ones opposite to show the atoms and molecules for the reactions below, e.g.

A. 2 C O_2 ⟹ 2 CO

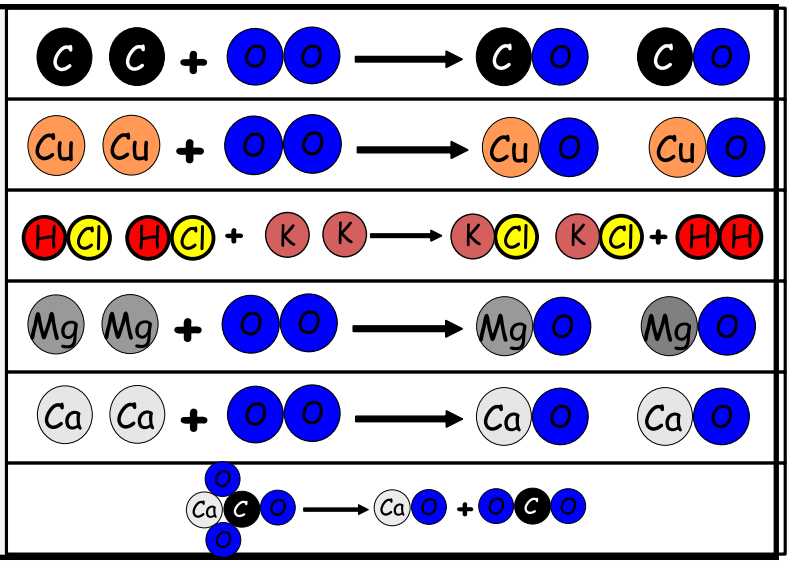
B. 2 Cu + O_2 → 2 CuO

C. 2 HCl + 2 K → 2 KCl + H_2

D. 2 Mg + O_2 → 2 MgO

E. 2 Ca + O_2 → 2 CaO

F. $CaCO_3$ (pg60) → CaO + CO_2



3. Acid in a flask is placed on a balance, the balance reads 100g. Magnesium weighing 10g is added to the beaker and the mass goes up to 110g. The magnesium starts *fizzing* and the mass goes down.

a. Why do you think the mass goes down when we know mass is conserved (same before and after)?

The hydrogen gas produced escapes into the air and isn't weighed.

b. What would happen to the mass if a bung was placed on top and why?

Mass would stay the say, hydrogen cannot escape and would still be weighed.

Questions on Changes of State: Answer

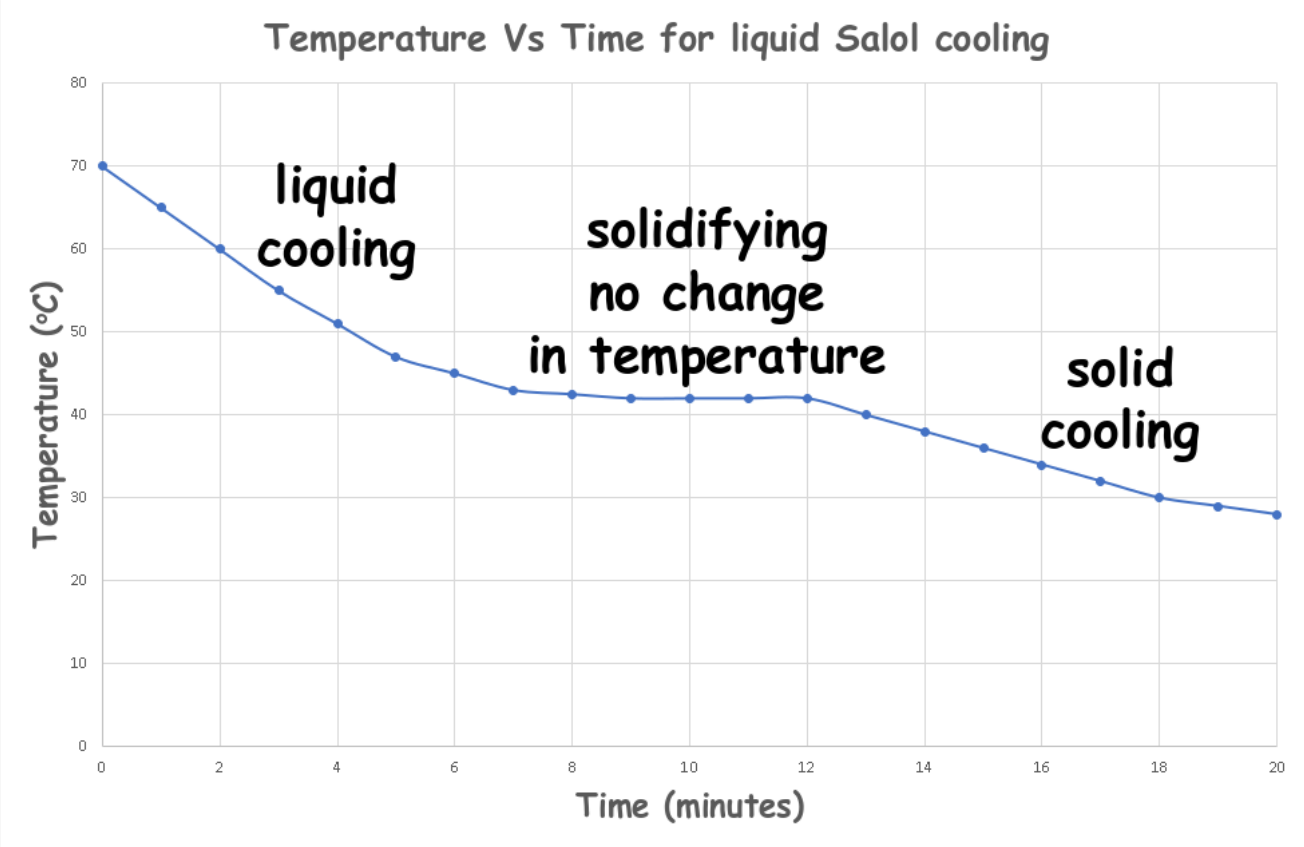
Comprehension

1. We mean changing from a solid to a liquid to a gas, or the other way round when talking about changing state.
2. To change state energy must be supplied to or released by the particles.
3. By gaseous state we mean as a gas.
4. We nearly always think of water as a liquid.
5. If we remove energy from the water molecules in the air, they don't move as quickly and get closer together.
6. When the water molecules are closer together the force of attraction between them is stronger.
7. The water molecules begin to change from being a gas to a liquid.
8. If we continue to remove energy from them the force of attraction becomes even larger. **OR**. They start to form solid ice.
9. Eventually the force of attraction is large enough to keep the molecules in fixed positions.
10. A solid (ice) is now formed.
11. Line 'a' shows ice heating up.
12. At line 'b' the energy in is breaking bonds.
13. When line 'b' meets 'c' all the ice has melted.
14. The water starts to 'boil off' or vapourise.
15. At 'e' all the water has turned to a gas.
16. Hot substances have more internal energy than cold.

Additional tasks

2. A chemical called salol has a melting point of 42°C. Salol is placed in a test tube with a thermometer and heated to 70°C. The temperature was then recorded every minute for 20 minutes as the **salol cooled.**

a. Plot a graph of the data with temperature (°C) on the y-axis against time (mins) on the x-axis. Connect the points to make a line.



3. Arrange the points below into two sentences to explain the ***flat section*** of the graph (spot the clues!).

this releases heat energy into the salol / bonds are formed /
This happens until all liquid has turned to solid / and stops the temperature falling. /
and the temperature begins to fall again. / During solidification

Answer

During solidification / bonds are formed / this releases heat energy into the salol / and stops the temperature falling. / This happens until all liquid has turned to solid / and the temperature begins to fall again.

Questions on Pure Substances, Mixtures and Separation: Answers

Comprehension

1. A pure substance is made from only one type of atom or molecule.
2. Air and salty water are mixtures.
3. In a mixture the substances aren't chemically combined or bonded together.
4. Allow the sand to sink and pour off the water to separate.
5. Immiscible means when liquids don't stay mixed.
6. Filtering simply allows the liquid to pass through and the solid not to.
7. The solid that doesn't pass through the filter is called the residue.
8. Magnetic separation simply means using a magnet to pull out magnetic substances from non-magnetic.
9. The three magnetic elements are, iron, nickel and cobalt.
10. Chromatography means colour writing.
11. Chromatography is a method of separating dissolved substances.
12. Some of the colours (chemicals) move faster and are carried further up the paper than others.
13. Other chemicals stick to the paper better and move slower so don't move up as much.
14. When the dissolved substances are separated, a chromatogram is produced.
15. We can compare chromatograms to see if inks contain the same colour.

Additional tasks

1.

Immiscible describes liquids that don't stay mixed, like oil and water

Mixture a combination of substances that are not chemically combined (bonded)

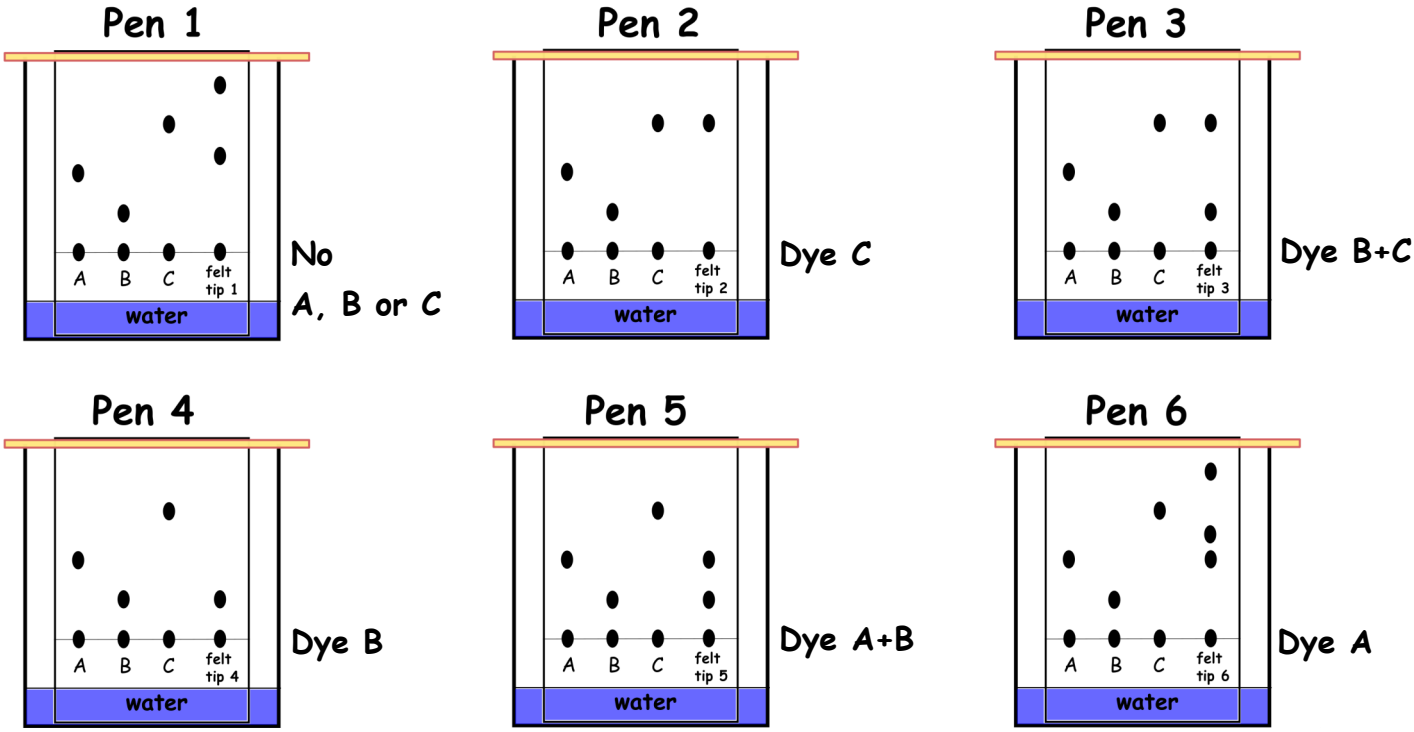
Iron, Nickel and Cobalt the three magnetic metals

Chromatogram a record of the separated substances by chromatography

Filtrate the liquid that passes through the filter

Residue the solid left behind after filtering

2.



3. **Four** boys share a desk. One of the boys feels a push in his side and notices some blue/black ink on his white shirt. **Two** of the other boys have **different black** pens and **one** has a **blue** pen. It is difficult to tell if the ink is blue or black. The teacher uses a cotton bud to absorb some of the ink and says to the three boys 'I'm going to find out who did this, give me your pens'. ***Explain how the teacher could use chromatography find to out which pen it was.***

Use the cotton bud to place some ink on chromatography paper. Put some ink from the boys' pens next to it. Place in water and the ink that produces the same chromatogram is the pen that was used.

Questions on Evaporation and Distillation: Answers

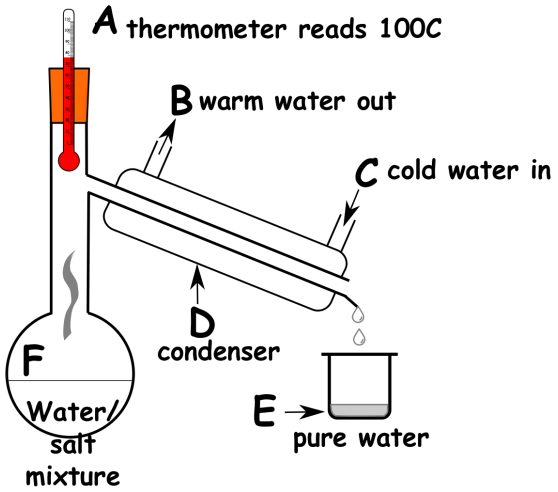
Comprehension

1. When evaporating water, molecules at the surface escape into the air.
2. Evaporation can take place at any temperature water is a liquid.
3. When water molecules break away at the surface they take away energy with them.
4. Taking away energy leaves the liquid cooler.
5. When you sweat salt is left behind.
6. Mud can be seen left behind when a puddle evaporates.
7. Let a sugary drink evaporate and you are left with sugar.
8. Higher temperatures can make the evaporation faster.
9. It is better to evaporate just below the boiling point to avoid burning the solid.
10. Simple distillation is a way of separating a mixture that has different boiling points.
11. Distillation involves boiling a liquid then condensing the vapour.
12. We can obtain drinking water by distilling sea water.
13. Obtaining drinking water from sea water is called desalination.
14. Distillation can separate a mixture of liquids because they have different boiling points.
15. A mixture of alcohol and water can be separated by boiling off the alcohol at 78°C.

Additional tasks

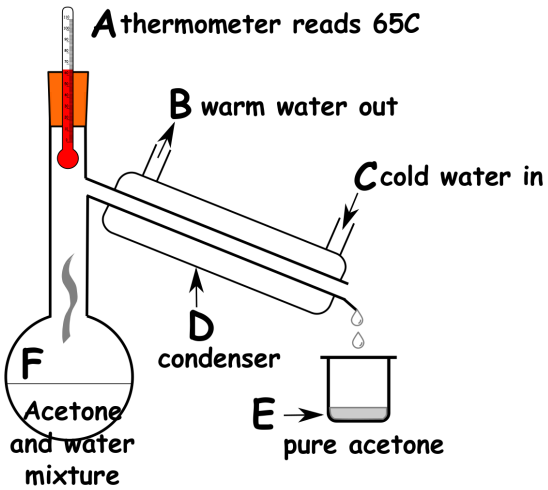
1. Label the apparatus below.

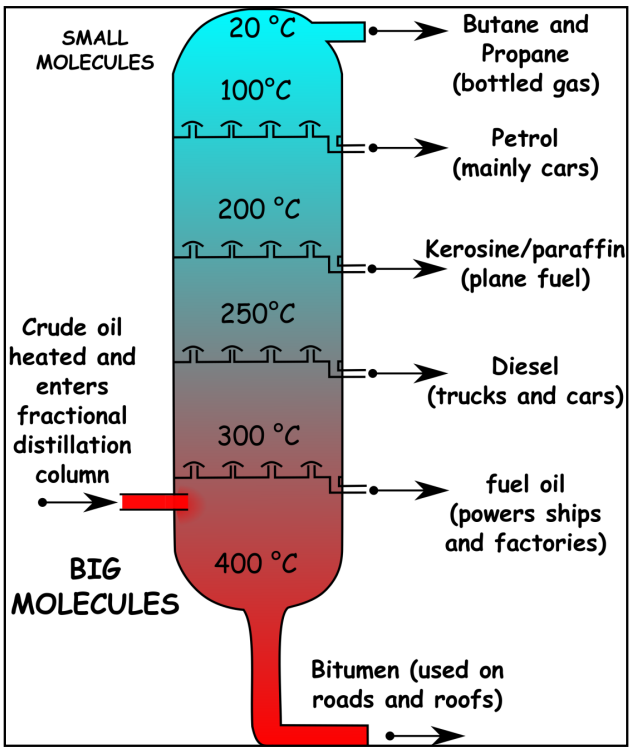
Label A-F below using the following.



2. Label the apparatus below.

Label A-F below using the following.





3. Crude oil is a **mixture** and can be separated into its useful parts using **fractional distillation**. Complete the gap filling exercise that begins to explain how fractional distillation works. *Most answers are in the diagram* ***look carefully***

The column is **hottest** at the bottom and **coolest** at the top. **Crude oil** is a mixture of different **sized** molecules that have different **boiling** points. This means they condense back to liquids at **different** temperatures. At different **points** up the column we can collect the liquid that **condenses** at that temperature. The **petrol** part of crude oil condenses at about **100°C**. The **diesel** part of crude oil condenses at about **250°C** . **Gases** collect at the top and are the smallest molecules.

Questions on Dissolving: Answers

Comprehension

1. Dissolving means when a solid becomes part of the liquid it is in.
2. When dissolving, the solid appears to disappear.
3. Once surrounded by water molecules the sugar molecules spread out.
4. The substance you are dissolving is called the solute.
5. Water is often called the universal solvent.
6. Another common solvent is alcohol.
7. Solubility tells us how well something dissolves.
8. Saturated due to the rain means you can't get any wetter.
9. Why some substances dissolve and others don't is down to forces.
10. If the forces of attraction between water and sugar molecules is greater than the attraction between sugar molecules, the sugar will dissolve.
11. Gases also dissolve in liquids.
12. Carbon dioxide is dissolve in fizzy drinks.
13. Temperature can affect how quickly something dissolves.
14. Fish sometimes come to the surface to gasp air when there is not enough oxygen dissolved in the water.
15. Water has no effect on nail polish.
16. Nail polish remover is acetone which can also dissolve fats.

Additional tasks

1.

Solution what is produced when a solute dissolves in a solvent e.g. salty water

Insoluble not able to be dissolved, e.g. chalk, sand, glass

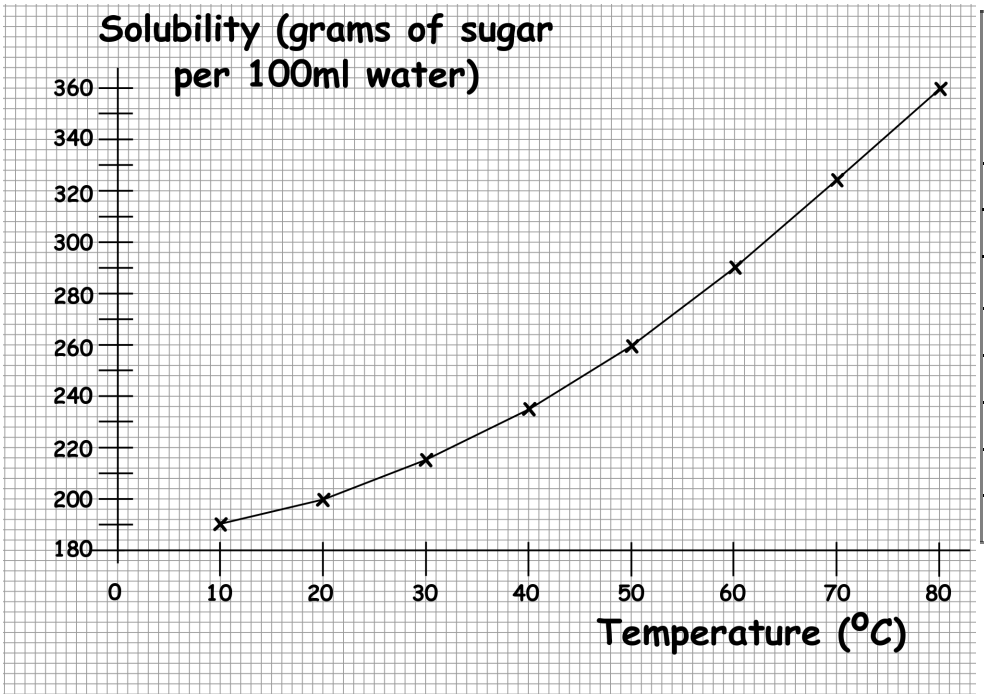
Solute the substance being dissolved

Saturated when no more solute can be dissolved by the solvent

Solvent the liquid you are dissolving into

Soluble able to be dissolved, e.g. sugar, salt, metal in acid

2.



Solubility (grams of sugar per 100ml of water)	Temperature (°C)
190	10
200	20
215	30
235	40
260	50
290	60
325	70
360	80

3. **360/1000 = 0.36 so anything above 0.36 will be saturated**

a. 190g of salt in 500ml of water	b. 36g of salt in 120ml of water	c. 7g of salt in 20ml of water
Saturated	**Unsaturated**	**Unsaturated**
d. 80g of salt in 250ml of water	e. 720g salt in 1500ml of water	f. 40g of salt in 100ml of water
Unsaturated	**Saturated**	**Saturated**

Questions on Combustion: Answers

Comprehension

1. Another name for combustion is burning.
2. The three requirements for combustion are: heat, fuel and oxygen.
3. The oxygen normally comes from the air.
4. Remove one of the requirements the flames go out (burning stops).
5. Hydrocarbons are commonly used as a fuel.
6. The products of burning methane are carbon dioxide and water.
7. Complete combustion happens when there is plenty of oxygen available.
8. Hydrocarbons are made from hydrogen and carbon only.
9. Propane and butane are also common fuels used for heating.
10. Windows 'steam up' because the water produced begins to condense on the windows.
11. The chemical turns blue (with water) and the limewater goes cloudy (indicating carbon dioxide gas).
12. Incomplete combustion is also called dirty burning.
13. Incomplete combustion happens when there isn't enough oxygen.
14. The products of incomplete combustion are carbon monoxide, water and soot (carbon).

Additional tasks

1. Write out the word equation for complete combustion and incomplete combustion below;

Complete combustion

Fuel + Oxygen ⟶ Carbon dioxide + Water

C x1 O x4 H x4 C x1 O x4 H x4

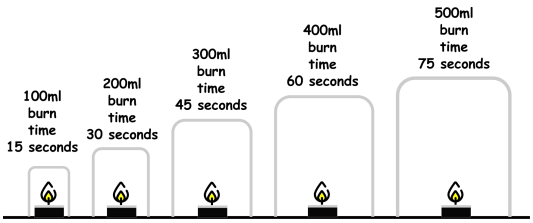
Incomplete combustion

Fuel + Oxygen ⟶ Carbon dioxide + Water + Carbon

C x4 O x10 H x16 C x4 O x10 H x16

2. Using the 'balanced' symbol equations opposite, write the number of carbon, hydrogen and oxygen atoms underneath the left hand side and right hand side of **both** equations.
Remember 4 CH_4 means 4 X C, 4 carbon atoms (4 C) and 4 X H_4, 16 hydrogen atoms (16 H). They should be the same on both sides!

3. **Identical candles** are lit and then different sized (volume) beakers are placed on top. A stop watch is then used to time how long it takes before the candles go out.



a. Why do the candles go out?

The oxygen is used up.

b. Why do they burn longer under bigger beakers?

More oxygen in a bigger volume.

c. What pattern can you see in the results? What is the name for this relationship (pg152)?

Doubling or trebling the volume doubles or trebles the burn time. It is called being directly proportional.

d. If you plotted burn time (y-axis) against volume (x-axis), what would a graph of the results look like (pg152)?

A straight line through (0,0) the origin.

e. Predict how long you think it would take for the candle to go out under a 1000ml volume beaker.

It would take (1000/500) 2 x 75 = 150 seconds.

Questions on Thermal Decomposition: Answers

Comprehension

1. In thermal decomposition, heat is used to break down a compound.
2. We usually use a Bunsen burner to heat the solid in a lab.
3. Another name for calcium carbonate is chalk or limestone.
4. If you add water to calcium carbonate before it is heated nothing happens.
5. Another name for calcium oxide is quicklime.
6. Huge amounts of calcium oxide are made in lime kilns every year.
7. Calcium oxide and carbon dioxide are formed after heating calcium carbonate.
8. Copper carbonate turns into a black powder (copper oxide) after heating.
9. We know a gas is given off because we can see bubbles appear at the end of the delivery tube in limewater.
10. We know the gas given off is carbon dioxide, because it turns the limewater cloudy.
11. Carbonates are dug up from the ground or mined.
12. Zinc carbonate decomposes to zinc oxide and carbon dioxide.
13. Zinc oxide has lots of uses in medicine.
14. Zinc oxide can be found in cosmetics (make up products).

Additional tasks

1. Complete the word equations for the thermal decomposition of the carbonates below.

Calcium Carbonate	*(heat)* →	*Calcium **oxide** + Carbon dioxide*
Copper Carbonate	*(heat)* →	***Copper** oxide + **Carbon** dioxide*
Zinc Carbonate	*(heat)* →	*Zinc **oxide** + **Carbon** **dioxide***
Magnesium Carbonate	*(heat)* →	***Magnesium oxide** + Carbon dioxide*
Sodium Carbonate	*(heat)* →	***Sodium oxide** + **Carbon** **dioxide***

2. Solve the following 12 clues.

i.	*Another name for calcium carbonate* **Limestone or chalk**	vii.	Decompose refers to? **Breaking down**
ii.	*Calcium carbonate will thermally decompose to?* **Calcium oxide and carbon dioxide**	viii.	Another name for calcium oxide? **Quicklime**
iii.	*Thermal refers to?* **Heat**	ix.	Used to heat things in a lab? **Bunsen burner**
iv.	*An element bonded to CO_3 is called a?* **Carbonate**	x.	Has many uses in medicine? **Zinc oxide**
v.	*A black powder from heating copper carbonate?* **Copper oxide**	xi.	Cement, water and sand make? **Mortar**
vi.	*This liquid turns cloudy when carbon dioxide is bubbled through?* **Limewater**	xii.	Huge amounts of calcium oxide are made in? **Lime kilns**

Questions on Oxidation Reactions: Answers

Comprehension

1. Without oxidation reactions we wouldn't be alive.
2. Steel is mainly made from iron.
3. An apple soon turns brown once bitten, because of oxidation.
4. Oxidation is the addition of oxygen during a chemical reaction.
5. The product of oxidation is called an oxide.
6. When copper is heated to high temperatures in air, copper oxide is produced.
7. Combustion is an oxidation reaction.
8. When hydrocarbons are burned, carbon dioxide and water are produced.
9. Coal is mostly made of carbon.
10. The product of burning caarbon is carbon dioxide.
11. During respiration glucose is oxidised to give carbon dioxide.
12. Respiration is the same as burning hydrocarbons.
13. Respiration is also called slow burning.
14. Respiration happens at lower temperatures than burning.

Additional tasks

1. Complete the word equations for oxidation below.

a.	Zinc	+	Oxygen	⟶	Zinc oxide
b.	Beryllium	+	**Oxygen**	⟶	Beryllium oxide
c.	**Calcium**	+	Oxygen	⟶	Calcium oxide
d.	**Iron**	+	Oxygen	⟶	Iron oxide
e.	Aluminium	+	**Oxygen**	⟶	Aluminium oxide
f.	Nickel	+	Oxygen	⟶	**Nickel oxide**
g.	**Sulphur**	+	Oxygen	⟶	Sulphur dioxide
h.	Silicon	+	Oxygen	⟶	**Silicon** dioxide
i.	**Carbon**	+	**Oxygen**	⟶	Carbon dioxide

2.

USNRGTI **RUSTING**

ITIDAONXO **OXIDATION**

RONBINGW **BROWNING**

XINOIIGDS **OXIDISING**

OYNXEG **OXYGEN**

RODIIOENX **IRON OXIDE**

OPICXREPDEO **COPPER OXIDE**

OBOCISNMTU **COMBUSTION**

EPIRTRNSOIA **RESPIRATION**

ABICXDEROONID **CARBON DIOXIDE**

URNBGNI **BURNING**

REHBEAT **BREATHE**

3. and 4.

Al_2O_3	V_2O_5	SO_3
Aluminium oxide	**Vanadium oxide**	**Sulphur trioxide**
2XAluminium and 3XOxygen atoms	**2XVanadium and 5XOxygen atoms**	**1XSulphur and 3XOxygen atoms**
CrO_3	Fe_2O_3	BaO_2
Chromium oxide	**Iron oxide**	**Barium oxide**
1XChromium and 3XOxygen atoms	**2XIron and 3XOxygen atoms**	**1XBarium and 2XOxygen atoms**
Li_2O	H_2O	K_2O
Lithium oxide	**Di hydrogen monoxide**	**Potassium oxide**
2XLithium and 1XOxygen atom	**2XHydrogen and 1XOxygen atom**	**2XPotassium and 1XOxygen atom**

Questions on Displacement Reactions and the Reactivity Series: Answers

Comprehension

1. The dictionary definition of displacement is the action of moving something from its place or position.
2. You are able to grab the toy back because you are stronger.
3. In chemistry we say the stronger chemical is more reactive.
4. 'Z' is able to steal 'X' from 'Y' because it attracts it more strongly.
5. We say 'Z' has displaced 'Y'.
6. The four salts in the classic displacement experiment are: magnesium sulphate, zinc sulphate, iron sulphate and copper sulphate.
7. They are reacted with their pure metals.
8. Putting elements in order of reactivity is called the reactivity series.
9. A metal higher in the reactivity series is able to steal the sulphate part of the salt.
10. Magnesium is the most reactive of the four metals in the experiment.
11. We can see a reaction has taken place because the metal displaced (left behind) becomes visible.
12. Magnesium can't be more or less reactive than itself.
13. The thermite reaction gets hot enough to weld metal together.
14. Some explosions are just very very fast displacement reactions.

Additional tasks

1. In the empty spaces of the jumbled table below, write either **no reaction** or **yes** followed by the **name** of the **metal displaced**. Keep looking at the reactivity series when completing the table.

Salt solution	Iron metal	Magnesium metal	Copper metal	Zinc metal
Magnesium sulphate	**No reaction**	**No reaction**	**No reaction**	**No reaction**
Zinc sulphate	**No reaction**	**Yes zinc displaced**	**No reaction**	**No reaction**
Iron sulphate	**No reaction**	**Yes iron displaced**	**No reaction**	**Yes iron displaced**
Copper sulphate	**Yes copper displaced**	**Yes copper displaced**	**No reaction**	**Yes copper displaced**
Number of Reactions	**1**	**3**	**0**	**2**

2. Use the reactivity series to write **WILL** or **WILL NOT** to the following.

Potassium ___**WILL**____ displace platinum Sodium ___**WILL**_____ displace calcium

Magnesium ___**WILL NOT**_ displace calcium Carbon __**WILL NOT**__ displace aluminium

Zinc ____**WILL**____ displace tin Lead ____**WILL**____ displace copper

Copper ___**WILL NOT**_ displace carbon Tin ___**WILL**_____ displace silver

Silver ___**WILL**____ displace gold Platinum __**WILL NOT**_ displace copper

Sodium ___**WILL**___ displace magnesium Aluminium ___**WILL**____ displace lead

Hydrogen __**WILL NOT**__ displace zinc Carbon ___**WILL**__ displace iron

Questions on Acids, Alkalis, Neutralisation and the pH Scale: Answers

Comprehension

1. Acids and alkalis can be thought of as chemical opposites.
2. If we mix the right amount of acid and alkali, their chemical properties cancel out.
3. We call this neutralisation.
4. The two most commonly used acids in schools are hydrochloric acid and sulphuric acid.
5. Acids are dangerous when they are concentrated or strong.
6. Acid in our stomach is essential for killing bacteria and to make our enzymes work properly.
7. The fact that a bee sting is acidic has something to do with the pain we feel.
8. The most commonly used alkali in schools is sodium hydroxide.
9. The sodium hydroxide used in making soap leaves it alkaline.
10. Indigestion tablets help by neutralising excess acid.
11. The fact that a wasp sting is alkaline has something to do with the pain we feel.
12. In chemistry we use indicators to tell us if a solution is acidic or alkaline.
13. The pH scale is a number scale that tells us how strong an acid or alkaline solution is.
14. We often use universal indicator to know the pH of a solution.
15. Green is neutral on the pH scale.
16. Litmus indicator has no in-between colours to tell us pH.

Additional tasks

1. Complete the jumbled pH table below using the examples given on the opposite page.

pH	Example	Acid or alkali?
4	Tomato juice	acid
8	Egg	alkali
10	Hand soap	alkali
6	Milk	acid
11	Ammonia	alkali
5	Coffee	acid
1	Stomach acid	acid
12	Bleach	alkali
2	Lemon juice	acid
9	Washing powder	alkali
3	Apple juice	acid
14	Caustic soda	alkali
7	Pure water	neutral
13	Drain cleaner	alkali

2. Complete the gap filling exercise below. Choose from the following words.

acid particles, corrosive, skin, test tubes, acidic, Sulphuric acid, soaps, concentrated, 12, Hydrochloric acid, acetic acid, sodium hydroxide, washing powders, volume, strong, neutralise, stomachs, alkaline, neutral, red, metals, blue, bleach

Acids are only dangerous if they are **strong** or **concentrated**. Concentration is how many **acid particles** are in a certain **volume**. Acids and alkalis can be **corrosive**. This means they can damage your **skin** or attack **metals**. The hazard symbol for corrosive has a picture of two **test tubes** in it. **Sulphuric acid**, H_2SO_4 is used in car batteries. **Hydrochloric acid** helps our digestive system to work properly. Another name for vinegar is **acetic acid**.

Alkalis like **sodium hydroxide** are commonly used in schools. **Bleach** is alkaline and has a pH of about **12**. So are **soaps** and **washing powders**. Alkalis **neutralise** acids so can be used to treat upset **stomachs**. pH stands for potential of hydrogen. On the pH scale, pH-1 is strongly **acidic**, pH-14 is strongly **alkaline** and pH-7 is **neutral**. pH-7 is green, becoming more acidic the colour changes to yellow then **red**, becoming more alkaline the colour changes to more **blue** then purple.

Questions on Reacting Acids and Alkalis and Acids and Metals: Answers

Comprehension

1. Reacting an acid with an alkali we can get neutralisation.
2. An acid plus an alkali produces a salt and water.
3. When an acid reacts with a metal, a salt and hydrogen gas is produced.
4. When hydrochloric acid reacts with sodium hydroxide, sodium chloride is produced, its formula is NaCl.
5. When sulphuric acid reacts with sodium hydroxide, sodium sulphate is produced, its formula is Na_2SO_4.
6. When using hydrochloric acid, the salt produced is a chloride.
7. When using sulphuric acid, the name of the salt produced is called a sulphate.
8. Ammonium sulphate fertiliser is made by reacting sulphuric acid with ammonium hydroxide.
9. If magnesium metal is added to hydrochloric acid you will quickly see bubbles.
10. The test for hydrogen is a lit splint produces a squeaky pop sound when brought close.
11. How quickly the reaction takes place depends on the reactivity of the metal and the strength of the acid.
12. Sulphuric acid plus zinc metal produces zinc sulphate, $ZnSO_4$.
13. Hydrochloric acid plus potassium metal produces potassium chloride, KCl.

Additional tasks

1. Write the name of the salt produced underneath the chemical symbol.

$H_2SO_4 + Ca(OH)_2 \longrightarrow CaSO_4 + 2H_2O$ — ***Calcium sulphate***

$2HCl + Ca(OH)_2 \longrightarrow CaCl_2 + 2H_2O$ — ***Calcium chloride***

$2\,HCl + Mg \longrightarrow MgCl_2 + H_2$ — ***Magnesium chloride***

$H_2SO_4 + Mg \longrightarrow MgSO_4 + H_2$ — ***Magnesium sulphate***

$2\,HCl + Ca \longrightarrow CaCl_2 + H_2$ — ***Calcium chloride***

$2\,HCl + 2\,K \longrightarrow 2\,KCl + H_2$ — ***Potassium chloride***

$H_2SO_4 + Ca \longrightarrow CaSO_4 + H_2$ — ***Calcium sulphate***

$H_2SO_4 + 2\,Na \longrightarrow Na_2SO_4 + H_2$ — ***Sodium sulphate***

2. Ammonium sulphate (a fertiliser) is made by adding sulphuric acid (an acid) to ammonium hydroxide solution (an alkali). The steps are shown below.

a. What colour would the ammonia solution and universal indicator be to begin with?

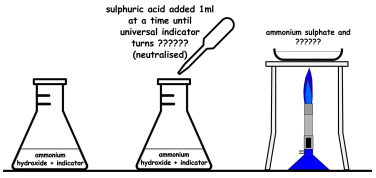
Blue/purple.

b. When enough acid is added to neutralise the ammonium hydroxide what colour would you expect?

Green.

c. After neutralisation, apart from ammonium sulphate what else is produced?

Water.



d. Why is the Bunsen burner used to heat the solution?

Evaporate the water to leave the salt.

3. Ammonium sulphate is a good fertiliser for grass (lawns). Explain how you could you test how affective it is? Think about;

- What would you measure?

  How many blades of grass in a certain area like $1m^2$. Or how tall the blades of grass grow on average. How much fertiliser is added.

- What would you keep the same / control?

  Keep how much ammonium sulphate is added the same to compare treated to untreated areas. Choose areas that have the same amount of light and water.

- How would you make it reliable (repeats?)

  Do the experiment over many areas of grass (repeat) to compare growth to grass that hasn't been fed with fertiliser.

Questions on Exothermic and Endothermic Chemical Reactions: Answers

Comprehension

1. Whenever a chemical reaction takes place heat is either emitted or absorbed.
2. When the reactants release heat (get hotter than surroundings) this is called exothermic.
3. You measure a temperature increase in an exothermic reaction.
4. If the reactants absorb heat energy (get colder than surroundings) the reaction is called endothermic.
5. You measure a temperature decrease in an endothermic reaction.
6. Chemical bonds are broken and made during a chemical reaction.
7. When chemical bonds are formed heat energy is released.
8. When chemical bonds are broken heat energy is absorbed.
9. During an endothermic reaction the heat energy that was present becomes chemical energy.
10. Energy level diagrams show that in endothermic reactions the products have more chemical energy afterwards and the opposite for exothermic.
11. Dissolving salt is endothermic, because more heat is needed to break bonds than is released when new bonds (attractions) are made in the water.
12. Combustion is an obvious endothermic reaction.
13. Neutralisation is when an acid reacts with an alkali, they are exothermic.
14. Respiration is the name of the chemical reaction of releasing energy from our food.

Additional tasks

1.

Starting temperature of reactants (°C)	Final temperature of products (°C)	Endothermic / exothermic ?
20	30	**Exothermic**
25	6	**Endothermic**
-10	15	**Exothermic**
22	65	**Exothermic**
16	5	**Endothermic**
18	-6	**Endothermic**

2. If we take away the **energy released** in **making** bonds from the **energy absorbed** in **breaking** bonds we can work out if a reaction is endothermic or exothermic.

a. Minus the **energy released** from the **energy absorbed** (the energy difference) and complete the last two columns of the table. Try **without** a calculator!

Chemical Reaction	***Energy absorbed breaking bonds (KJ/***	***Energy released making bonds (KJ/mole)***	***Energy difference***	***Exothermic/ endothermic***
$C + O_2 \rightarrow CO_2$	1200	1600	**-400**	**Exothermic**
$H_2 + Cl_2 \rightarrow 2HCl$	678	862	**-184**	**Exothermic**
$2HBr \rightarrow H_2 + Br_2$	732	629	**103**	**Endothermic**
$2H_2 + O_2 \rightarrow 2H_2O$	1368	1852	**-484**	**Exothermic**
$2H_2O \rightarrow 2H_2 + O_2$	1840	1371	**469**	**Endothermic**
$CaCO_3 \rightarrow CaO + CO_2$	178	0	**178**	**Endothermic**
$C + 2H_2O \rightarrow CO_2 + 2H_2$	394	484	**-90**	**Exothermic**
$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$	654	763	**-109**	**Exothermic**

3. a. What do you notice about the energy difference for an exothermic reaction?

It is negative.

b. Complete these two sentences.

Exothermic reactions have a **negative** energy difference, the **products** have less chemical energy. Energy is released. Endothermic reactions have a **positive** energy difference, the **products** have more chemical energy. Energy is absorbed.

Questions on The Periodic Table of Elements: Answers

Comprehension

1. Scientists began putting the elements in order of their weights.
2. Dimitri Mendeleev had great success with this method.
3. He arranged the rows so that elements with similar properties formed columns (groups).
4. He left gaps for elements he predicted should exist.
5. Each element is made from a different atom.
6. The atom is the smallest piece of matter that has the same properties as the chemical element.
7. Atoms are made from three even tinier particles that aren't normally found on their own.
8. The three particles the atom is made from are: the proton, the neutron and the electron.
9. The number at the top is called the atomic number and tells you the number of protons in the atom.
10. The charges of an atom cancel because there is the same number of positive charge as negative charge.
11. This means the atom is neutral.
12. The electrons are arranged in layers around the nucleus.
13. It is the number of electrons in the outer layer of an atom that decides how it will react with another element (atom).
14. The atomic number of chlorine is 17.

Additional tasks

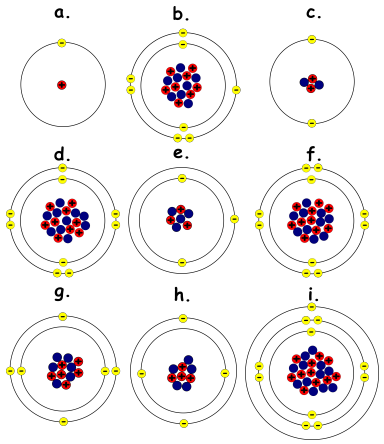
1. Use the periodic table to complete the number of protons, number of electrons and number of neutrons for each element. First one is done for you.

Element	Number of protons	Number of electrons	Number of neutrons
Boron - 11	5	5	11 - 5 = 6
Carbon - 12	**6**	**6**	**6**
Magnesium - 24	**12**	**12**	**12**
Fluorine - 19	**9**	**9**	**10**
Potassium - 39	**19**	**19**	**20**
Lithium - 7	**3**	**3**	**4**
Iron - 56	**26**	**26**	**30**
Gallium - 70	**31**	**31**	**39**

2. Unscramble these **amazing elements** from their description. Use the periodic table pg90 to help.

Precious, malleable metal - **GODL** GOLD
Liquid metal at room temperature - **ERRMYCU** MERCURY
Important for strong bones - **ALUCMCI** CALCIUM
Keeps our swimming pools clean - **HLNCIREO** CHLORINE
Gas that makes up 78% of air - **ITNNEORG** NITROGEN
Gas that makes up 21% of air - **OYNXEG** OXYGEN
Heaviest naturally occurring element - **RAUUMNI** URANIUM
(begins with U, on last column of wordsearch)
A magnetic metal - **CBTOLA** COBALT
Most reactive metal in group 1 - **CSAMEUI** CAESIUM
Use in computer chips - **ILOSNIC** SILICON
A radioactive gas in group 8 - **RANDO** RADON
Important in a healthy diet - **ELUSINME** SELENIUM
Most commonly used radioactive
element in medical imaging - **EHUTIEMCTN** TECHNETIUM
A gas that give us pretty lights - **NENO** NEON

3. Use the periodic table to identify elements a. to i. below.
   a. **Hydrogen**
   b. **Oxygen**
   c. **Helium**
   d. **Fluorine**
   e. **Lithium**
   f. **Neon**
   g. **Carbon**
   h. **Beryllium**
   i. **Sodium**



Questions on Properties of Metals and Non-Metals: Answers

Comprehension

1. A stepped line starting under boron and ending at astatine separates the metals from non-metals
2. Metals are good at conducting electricity and heat.
3. This means heat an electricity moves through them easily.
4. Sonorous is when metals make a ringing sound after being hit.
5. Objects that are dense are heavy for their size.
6. The three magnetic metals are iron, nickel and cobalt.
7. Much of the metal around us is magnetic because it is made from steel (iron).
8. The property of being able to pull metal into wires is called being ductile.
9. Copper is particularly ductile.
10. Malleable means being able to be hammered into thin sheet or other shapes without breaking.
11. A mixture of metals is called an alloy.
12. You might mix a strong, heavy metal with a light weak one, so the result might be a strong but light metal.
13. Non-metals are good at being insulators.
14. Non-metals often exist as gases at room temperature.
15. Non-metals are dull because they don't reflect light well.

Additional tasks

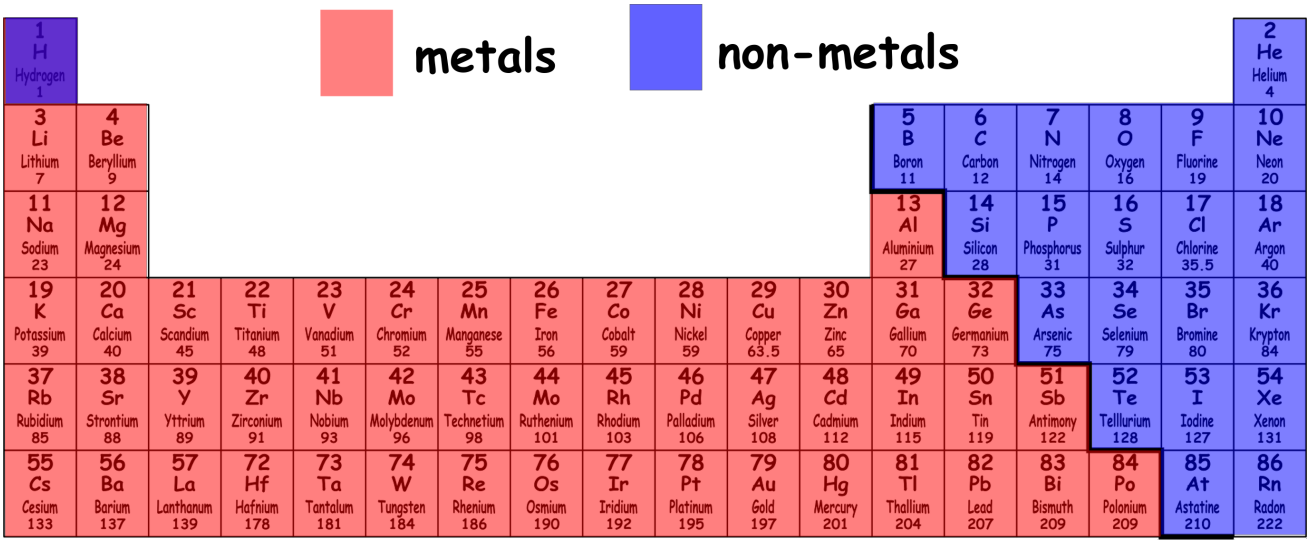
1.

Metals	Non-metals
malleable	**not sonorous**
good conductors	**bad conductors**
strong	**low melting points**
high melting points	**not malleable**
sonorous	**not ductile**
ductile	**not strong**

2.

ONUSORSO (SONOROUS)	***HYINS*** (SHINY)
UCLDETI (DUCTILE)	***DEENS*** (DENSE)
ALSLYO (ALLOYS)	***BDA NURIOASSTL*** (BAD INSULATORS)
GODO ODRCOCSNTU (GOOD CONDUCTORS)	***ALLMBEELA*** (MALLEABLE)
SRGTNO (STRONG)	***AGIMTECN*** (MAGNETIC)
IGHH GMLENTI PINTSO (HIGH MELTING POINTS)	***EHAVY*** (HEAVY)

3.



Questions on Properties of G1, G2, G7 and G8: Answers

Comprehension

1. The group 1 elements are called the alkali metals.
2. One of the ways to investigate group 1's reactivity is to drop them in water.
3. The alkali metals produce an alkaline solution and hydrogen gas when they react with water.
4. As you move down group 1, the reactivity increases
5. Rubidium sinks because it is more dense than water.
6. Group 1 elements react in a similar way because they all have one electron in their outer shell.
7. Group 2 elements are called the alkali earth metals.
8. Group 2 produce an alkaline solution and hydrogen gas when they react with water.
9. Group 2 elements melting point decreases as you go down the group.
10. Group 2 elements react in a similar way because they all have two electrons in their outer shell.
11. The group 7 elements are called the halogens.
12. At room temperature, fluorine and chlorine are gases, bromine is a liquid and iodine is a solid.
13. Group 7 elements get less reactive as you move down the group.
14. Group 7 elements behave in a similar way because they all have seven electrons in their outer shell.
15. The group 8 elements are called the noble gases.
16. They are very unreactive because they have a full outer shell of electrons.

Additional tasks

1.

Group 2 (the alkali earth metals), have two electrons in their outer shell

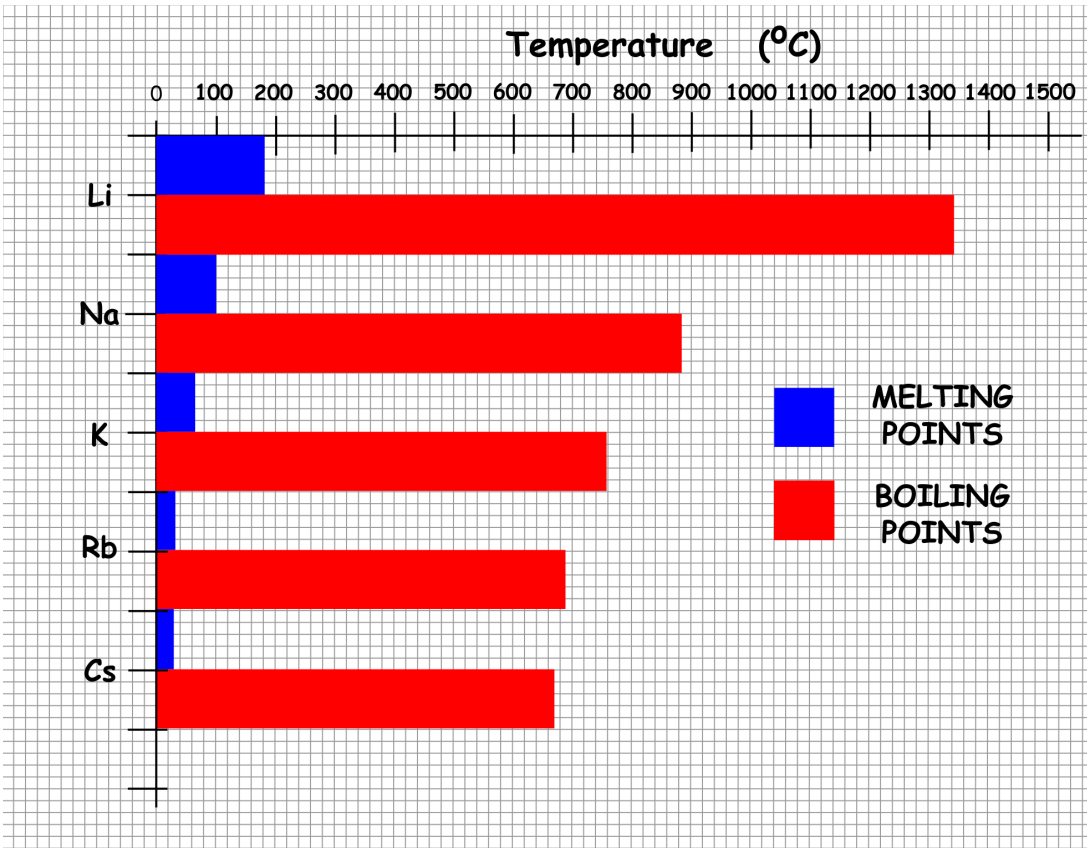
Group 7 (the halogens), have seven electrons in their outer shell

Group 8 (the noble gases), have full or eight electrons in their outer shell

Group 1 (the alkali metals), have one electron in their outer shell

Groups these are the columns in the periodic table and tell you the number of electrons in the outer shell. Elements in the same group behave similarly.

2.



3 a. How is **this** pattern different to the group 7 elements?

Group 7 element's melting and boiling points increase down the group.

b. What other pattern in behaviour of the group 7 elements is the opposite?

The halogens (G7) get less reactive as you move down the group.

Questions on Metals and Non-metal Oxides: Answers

Comprehension

1. When elements react with oxygen they form oxides.
2. If the compound formed has two oxygen atoms the second part of its name will be dioxide.
3. The example monoxides are carbon monoxide, sulphur monoxide and nitrogen monoxide.
4. Carbon, sulphur and nitrogen are non-metals.
5. Nearly all non-metal oxides dissolve in water to produce acidic solutions.
6. Sulphur dioxide and nitrogen dioxide are the compounds responsible for acid rain.
7. All metal oxides are bases.
8. An acid plus a metal oxide produces a salt and water.
9. The difference between an alkali and a base is that an alkali will dissolve, not all bases dissolve. They are both chemical opposites to acids.
10. Carbonates are also bases.
11. If a carbonate base reacts with an acid, the gas produced is carbon dioxide.
12. The formula for calcium carbonate is $CaCO_3$.
13. Calcium carbonate is often used as an ingredient in indigestion tablets because it neutralises acids.

Additional tasks

1. Use the difference between an **alkali** and **base** to put the following in the correct column.

Alkali	Base
Sodium oxide	**Iron oxide**
Lithium oxide	**Copper oxide**
Potassium oxide	**Tin oxide**

2.

a. Sulphuric acid + Zinc oxide ⟶ **Zinc sulphate** + *Water*

b. Sulphuric acid + Magnesium oxide ⟶ **Magnesium sulphate** + *Water*

c. Sulphuric acid + Calcium oxide ⟶ **Calcium sulphate** + *Water*

d. Hydrochloric acid + Zinc oxide ⟶ **Zinc chloride** + *Water*

e. Hydrochloric acid + Magnesium oxide ⟶ **Magnesium chloride** + *Water*

f. Hydrochloric acid + Copper oxide ⟶ **Copper chloride** + *Water*

g. Hydrochloric acid + Zinc carbonate ⟶ **Zinc chloride** + *Water* + **Carbon dioxide**

h. Hydrochloric acid + Magnesium carbonate ⟶ **Magnesium chloride** + *Water* + **Carbon dioxide**

i. Hydrochloric acid + Sodium carbonate ⟶ **Sodium chloride** + *Water* + **Carbon dioxide**

j. Sulphuric acid + Zinc carbonate ⟶ **Zinc sulphate** + *Water* + **Carbon dioxide**

k. Sulphuric acid + Magnesium carbonate ⟶ **Magnesium sulphate** + *Water* + **Carbon dioxide**

l. Sulphuric acid + Calcium carbonate ⟶ **Calcium sulphate** + *Water* + **Carbon dioxide**

3. Write out four equations of your own. Two for the reaction between **lithium oxide** and **lithium carbonate** with **sulphuric acid** and two for the reaction of **potassium oxide** and **potassium carbonate** with **hydrochloric acid**.

Lithium oxide + sulphuric acid ⟶ Lithium sulphate + water

Lithium carbonate + sulphuric acid ⟶ Lithium sulphate + water + carbon dioxide

Potassium oxide + hydrochloric acid ⟶ Potassium chloride + water

Potassium carbonate + hydrochloric acid ⟶ Potassium chloride + water + carbon dioxide

Questions on Using Carbon to Obtain Metal from Ores: Answers

Comprehension

1. Ores are rocks that contain enough useful material to make them worth digging up.
2. The useful metals are extracted using chemical methods.
3. Electrolysis uses an electric current to extract metal from its molten state.
4. Elements higher in the reactivity series are able to displace those lower in the series.
5. Magnesium can displace copper from copper sulphate.
6. The reactivity series means we can predict the outcome of reacting metals with other metal compounds.
7. Carbon is between zinc and aluminium in the reactivity series.
8. Carbon is cheap because there is a lot available from coal.
9. Carbon can be used to extract metals from their ores if they are lower down in the reactivity series.
10. Zinc, iron, tin, lead and copper are extracted using carbon.
11. Carbon is added to the ore and heated to displace the metal from its oxide.
12. Hematite is the name of an iron ore.
13. Iron is obtained by using carbon to displace the iron from iron oxide.
14. A mixture of carbon and lead oxide are heated to displace lead from lead oxide.
15. Lead is used in car batteries and glass making.

Additional tasks

2.

Acanthite an ore used for the production of **SLRIEV** (SILVER)

Bauxite an ore used for the production of **LUUAIIMMN** (ALUMINIUM)

Chalcocite an ore used for the production of **CPROEP** (COPPER)

Chromite an ore used for the production of **HRUCIMMO** (CHROMIUM)

Cinnabar an ore used for the production of **ERRMYCU** (MERCURY)

Cobaltite an ore used for the product **BLATCO** (COBALT)

Galena an ore used for the production of **ELDA** (LEAD)

Hematite an ore used for the production of **RNOI** (IRON)

Malachite an ore used for the production of **CPROEP** (COPPER)

Scheelite an ore used for the production of **UNETTSNG** (TUNGSTEN)

Sperrylite an ore used for the production of **LAUPNIMT** (PLATINUM)

Sphalerite an ore used for the production of **CZNI** (ZINC)

Pentlandite an ore used for the production of **NCLIEK** (NICKEL)

Rutile an ore used for the production of **ITUTINMA** (TITANIUM)

3. **Copper**

Electricity makes our lives better through all the electrical devices that we use to make life easier and more fun! Things like...

Zinc

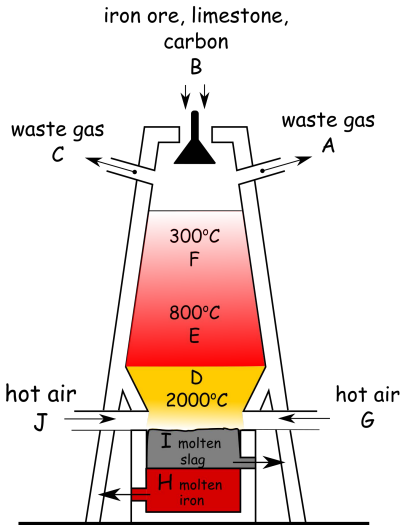
Zinc means the most commonly used metal in the world (steel) lasts longer.
Steel is used for....
Batteries and electric plugs mean...

Tin

Tin cans have meant that we can store food for much longer meaning less waste. It is easy to transport and convenient.

1.

Blast Furnace (obtaining iron)



Questions on Polymers (Plastics), Ceramics and Composites: Answers

Comprehension

1. Polymers or plastics are synthetic materials.
2. Polymers are made by joining molecules together in a chain.
3. The molecules that link together are called monomers.
4. Polyethene is made from thousands of ethene molecules linked together.
5. PVC can be used to make shoes and clothes because it can be made into fabric.
6. Composite means made of several parts or components.
7. Sand, cement, stones and water mix to make concrete.
8. Carbon fibre is used in making bikes and cars because it is strong and light.
9. MDF stands for medium density fibre board.
10. MDF is widely used in furniture manufacture.
11. We often think of pottery when we see the word ceramic.
12. Ceramics are hard, tough and durable.
13. Ceramics are used to make: toilets, sinks, plates and cups (and others).
14. Our houses are made of ceramics because bricks are ceramics.
15. Ceramics are useful on electricity pylons because they are brilliant insulators.

Additional tasks

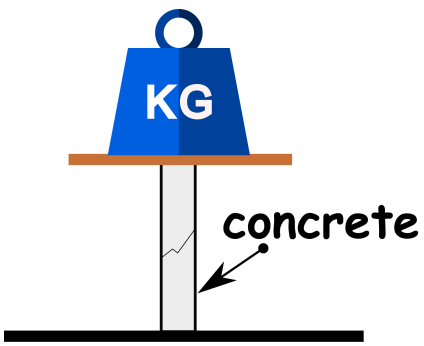
2. Write the materials below into the correct column in the table

NYLON, CHIPBOARD, HOUSE BRICK, BATHROOM SINK, PLAYDOUGH, PTFE, FALSE TEETH, POLYSTYRENE, REINFORCED GLASS, TILES, FIBRE-GLASS, RUBBER, PAPIER-MACHE, A SAUCER, SILK

Polymer	Composite	Ceramic
NYLON	*CHIPBOARD*	*HOUSE BRICK*
PTFE	*PLAYDOUGH*	*BATHROOM SINK*
POLYSTYRENE	*REINFORCED GLASS*	*FALSE TEETH*
RUBBER	*FIBREGLASS*	*TILES*
SILK	*PAPIER-MACHE*	*A SAUCER*

3.

- What you would change?
  The ratio or amount of sand, stone and cement.
- How many variables would you change at once?
  One at a time to see the affect of that change, e.g. the amount of cement whilst keeping the amount of sand stones the same
- Would you repeat and why?
  Yes repeat the test for each change so anomalies can be seen and averages calculated and so that the results produced are reliable
- What graph could you plot?
  Weight required to break the concrete on the y-axis against amount of cement on the x-axis. This assumes only the amount of cement is changed.
- The above test is under **compression.**
  How else could you test the strength of the concrete (clue pg152)?
  Pull / stretch the concrete to see how strong it is under tension.



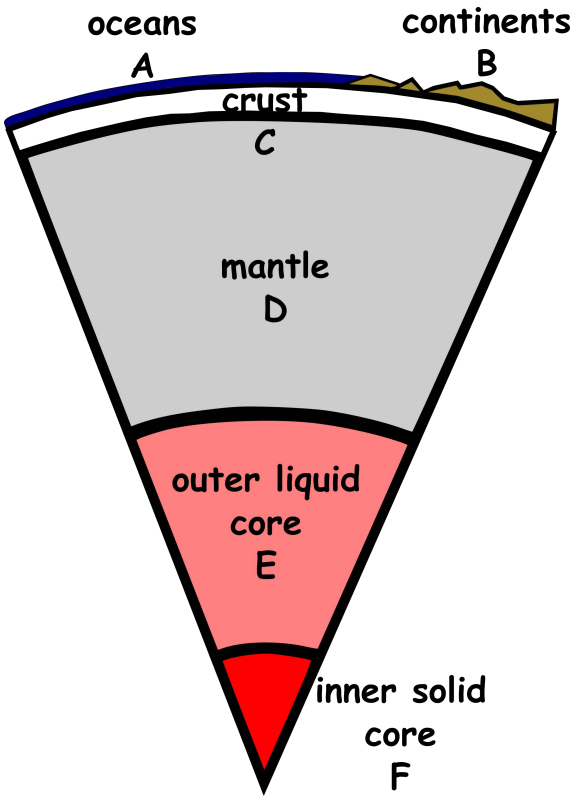
Questions on Composition and Structure of the Earth: Answers

Comprehension

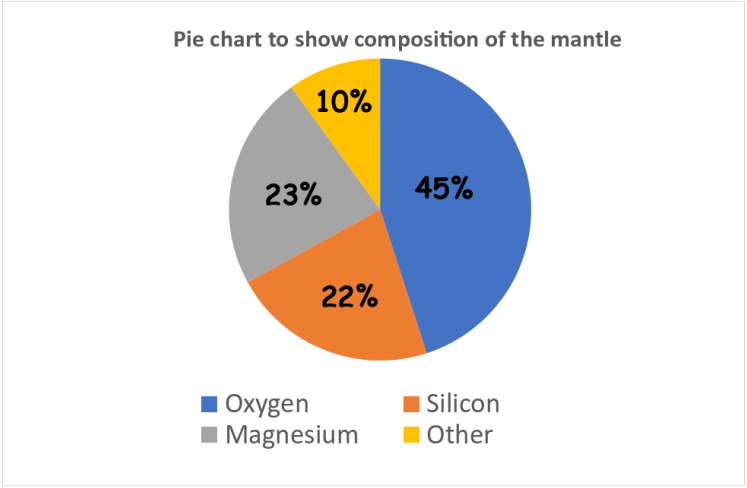
1. The earth is a ball shaped planet made mostly of rock.
2. A mineral is a compound that occurs naturally.
3. The earth is made from four distinct layers.
4. The names of the layers are: the crust, the mantle, the outer core and the inner core.
5. The mantle is the thickest layer.
6. The earth's thickness is about 4000 miles.
7. The density of the layers increases as you head towards the centre.
8. The inner and outer cores are mainly made from iron and nickel.
9. Most of our knowledge of the earth's interior comes from studying seismic waves.
10. The treacle moves so the plates also move.
11. This theory of movement is called plate tectonics.
12. Scientists have evidence the earth was one big continent called Pangaea.
13. The continent Pangaea split apart.
14. Colisions of the continents formed mountain ranges.
15. The two easy to understand pieces of evidence are: the continents seem to fit together and fossils of the same animals are found on continents thousands of miles apart.

Additional tasks

1.



3. In terms of **elements** the **composition** of the **mantle** is approximately **45% oxygen**, **22% silicon**, **23% magnesium** and **10% other** (includes iron, aluminium, calcium, sodium and potassium). Draw a pie chart of the composition below. Colour in or shade to make a key.



Calculating the angles (to the nearest °)

Oxygen = 45/100 x 360 = 162°

Silicon = 22/100 x 360 = 79°

Magnesium = 23/100 x 360 = 83°

Oxygen = 10/100 x 360 = 36°

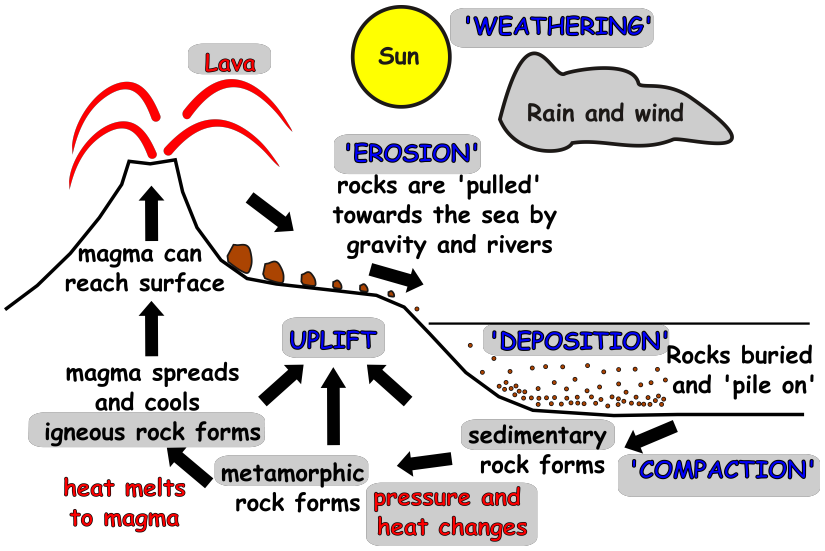
Questions on the Rock Cycle: Answers

Comprehension

1. There are three different types of rock.
2. The rock cycle describes how these rocks are formed and change over time.
3. The huge amount of heat inside the earth makes the rock cycle happen.
4. Liquid rock under the ground is called magma.
5. Liquid rock above the ground is called lava.
6. Extrusive rock is made from smaller crystals because it cools quickly.
7. When magma cools slowly rock with larger crystals are formed, it is called intrusive rock.
8. Weathered means the breaking down and dissolving of rocks.
9. Water, wind and gravity transports rocks to the oceans.
10. Sediment layers pile on top of each other and compact to form sedimentary rock. An example is sandstone.
11. Heat and pressure changes sedimentary rock to metamorphic rock.
12. Metamorphosis means to change.
13. Igneous rock is formed from magma that colls and solidifies.
14. We can use pumice stone to clean our skin.

Additional tasks

1.



3. Fossils of long dead sea animals can be found on Mount Everest.

a. How does this provide evidence for **uplift?**

The sea floor has moved upwards carrying the dead sea animals that had died and sunk to the bottom.

b. Scientists can now use satellites to measure uplift accurately. **Nanga Parbat** in the Himalayas is rising by 7mm per year.

i. How long would it take the mountain to rise the height of a desk (about 80cm = 800mm).
800 ÷ 7 = 114 years

ii. When Nanga Parbat does stop rising what will cause it to shrink in size again?
Weathering and erosion.

2.

a. Breaking down and dissolving of rock **ETNWIEGARH** (WEATHERING)
b. Molten rock at the surface **LAAV** (LAVA)
c. The name for rocks being forced to the surface from underground **ULTPFI** (UPLIFT)
d. An intrusive igneous rock **RATGENI** (GRANITE)
e. An extrusive igneous rock **BSTALA** (BASALT)
f. The moving of rocks by water, wind and gravity **ROOENSI** (EROSION)
g. The settling of sediment layers on top of each other **EOODIINPTS** (DEPOSITION)
h. An example of a sedimentary rock **ANNSOSEDT** (SANDSTONE)
i. Molten rock beneath the surface **MAAGM** (MAGMA)
j. An example of a metamorphic rock **MREALB** (MARBLE)

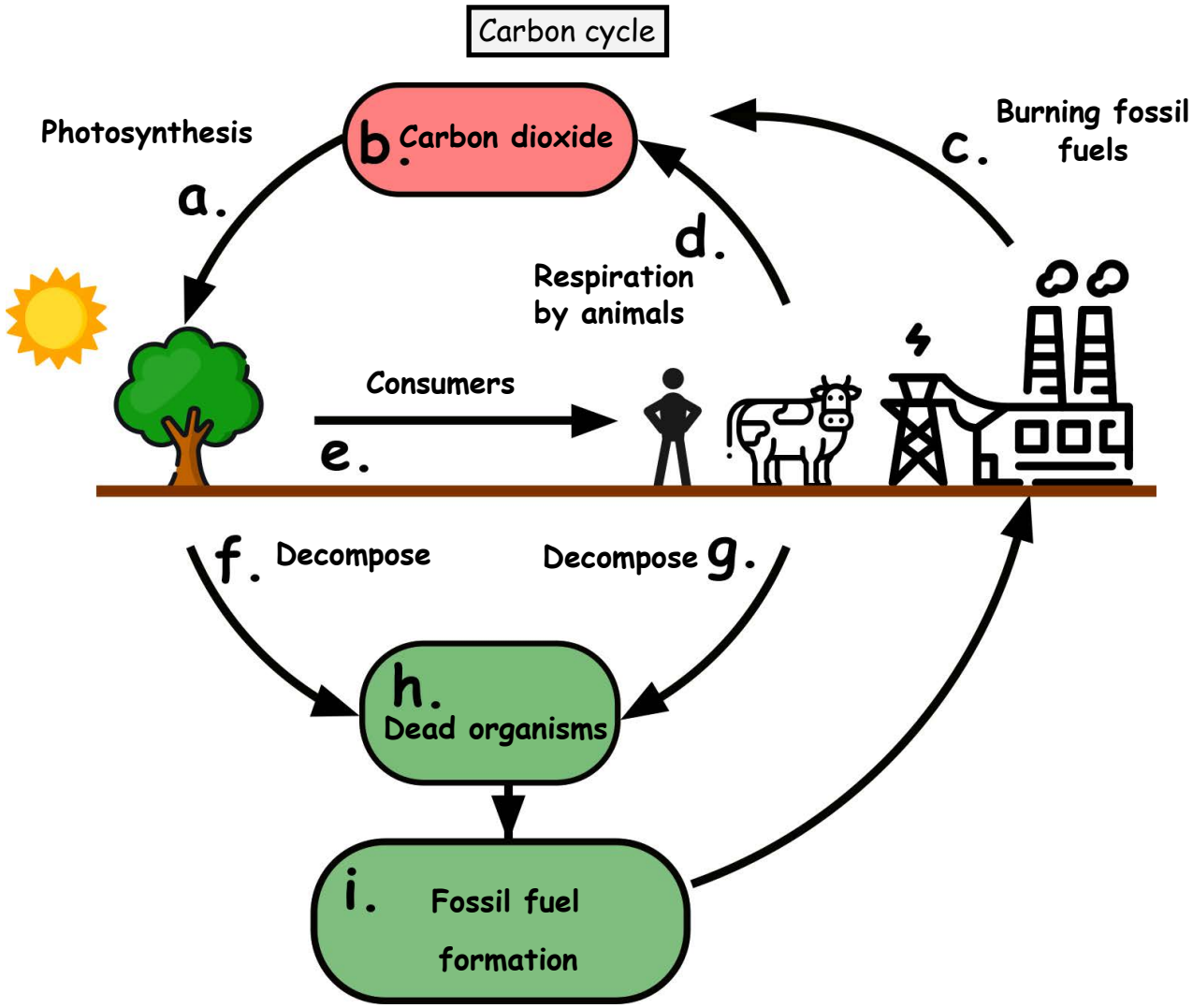
Questions on Earth's Limited Resources: Answers

Comprehension

1. All living things on earth are carbon based life forms.
2. The carbon cycle shows how carbon dioxide is released or removed from the atmosphere.
3. Fossil fuels take millions of years to form.
4. We are using earth's limited resources in a wasteful way.
5. Oil is the raw material for plastics.
6. Oil is also used for: making drugs, cosmetics, perfumes,lubricating oils, waxes, tarmac and paints.
7. Too much plastic is ending up in our seas.
8. Lithium and cobalt are used in batteries.
9. Most cobalt comes from Africa and most lithium comes from South America.
10. In many parts of the world there isn't enough clean water.
11. Wells can become polluted from human waste and chemicals from farming.
12. If more water is consumed than replaced by rainfall we get a drought.
13. Another word for drinkable water is potable water.
14. Our water supply can be put at risk from over population, global warming and farming.

Additional tasks

1. Label the **carbon cycle** using the diagram opposite to help.



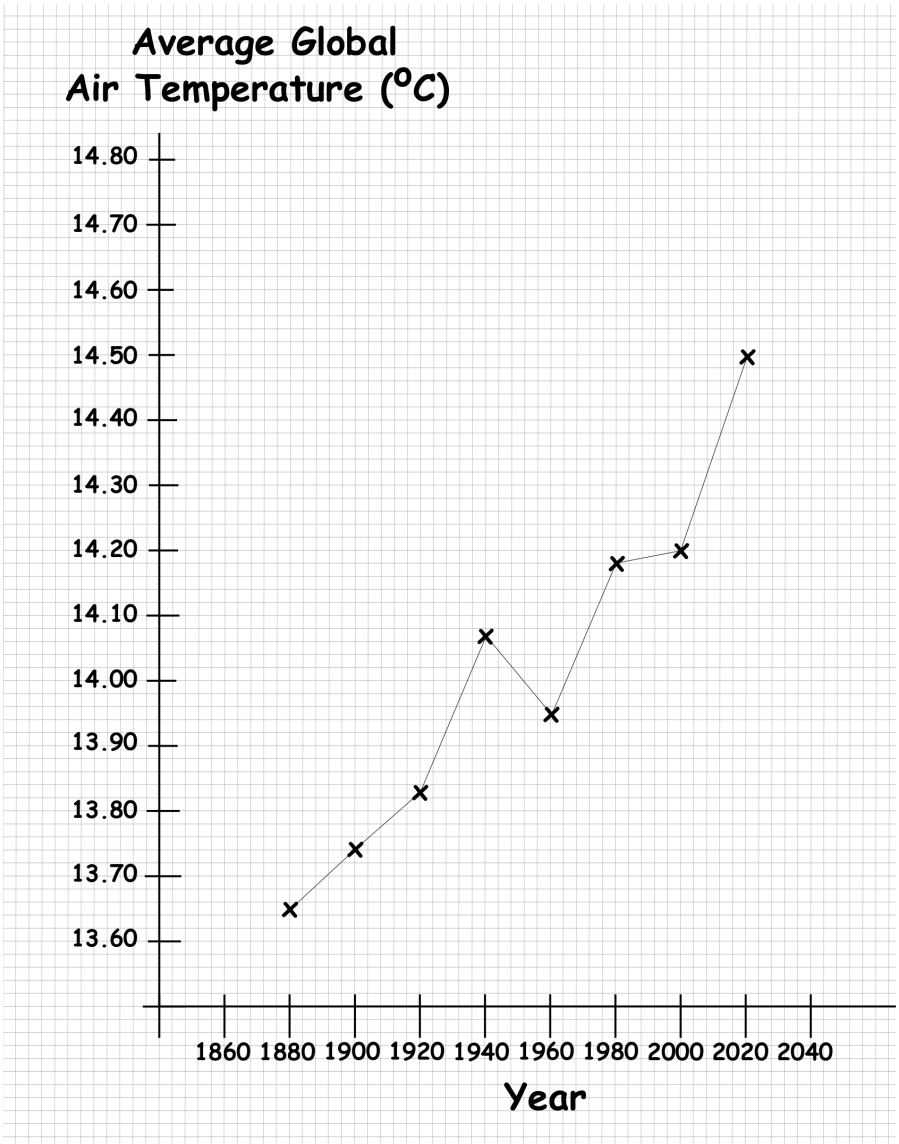
Questions on The Earth's Atmosphere and Climate Change: Answers

Comprehension

1. Our atmosphere is the gases that surround the earth.
2. The two main gases in earth's atmosphere are: nitrogen, 78% and oxygen, 21%.
3. The population has risen by 6 billion since the year 1800.
4. A lot of our energy still comes from burning fossil fuels.
5. A green house gas is good at trapping heat in the earth's atmosphere.
6. Without the carbon dioxide blanket the heat would escape into space.
7. A lot of the methane in the atmosphere comes from the cattle we farm.
8. The amount of methane has increase because of the rise in population and more of that population wanting to eat meat (so more cattle emitting methane).
9. The extra heat has caused more evaporation.
10. This causes droughts in some parts of the world.
11. In other parts of the world it causes floods as the extra water falls as rain.
12. Extreme weather is becoming more frequent.
13. Switching to electric vehicles would help.
14. Generating more electricity through renewable methods would help.

Additional tasks

1.



2 a. What is the 'general trend' (pattern) for the data in the table.

An overall increasing of the average global temperature.

b. What happens between 1940 and 1980?

There is a drop in temperature.

c. What sort of 'extra' data would make any trend clearer? (Think about range and frequency)

Data going back further in time and more data points e.g. for every year.

3. Complete the gap filling exercise on global warming. Choose from the words in bold below.

The two main **greenhouse** gases are **carbon dioxide** and **methane**. Carbon dioxide comes mainly from burning **fossil fuels**. Methane comes mainly from **animal** farming and **rotting** vegetation. **Water** in the atmosphere also helps trap heat that would escape into space. The **light** energy from the sun is absorbed by earth's **surface** heating it. This energy is **re-emitted** back towards space. Instead of escaping, this **heat energy** is absorbed by greenhouse **gases** which re-emit some of the heat **back** towards earth. The **extra** greenhouse gases from human activity mean that the earth is getting **warmer** too fast.

Questions on Reaction Rates and Catalysts

Additional tasks

2. The table contains data for the amount of hydrogen gas released every 10 seconds when the **same** amount of magnesium is reacted with **two different** concentrations of hydrochloric acid **A** and **B**.

a. Plot both sets of data on the graph.

b. How long does the reaction take to finish for **A** and for **B**?

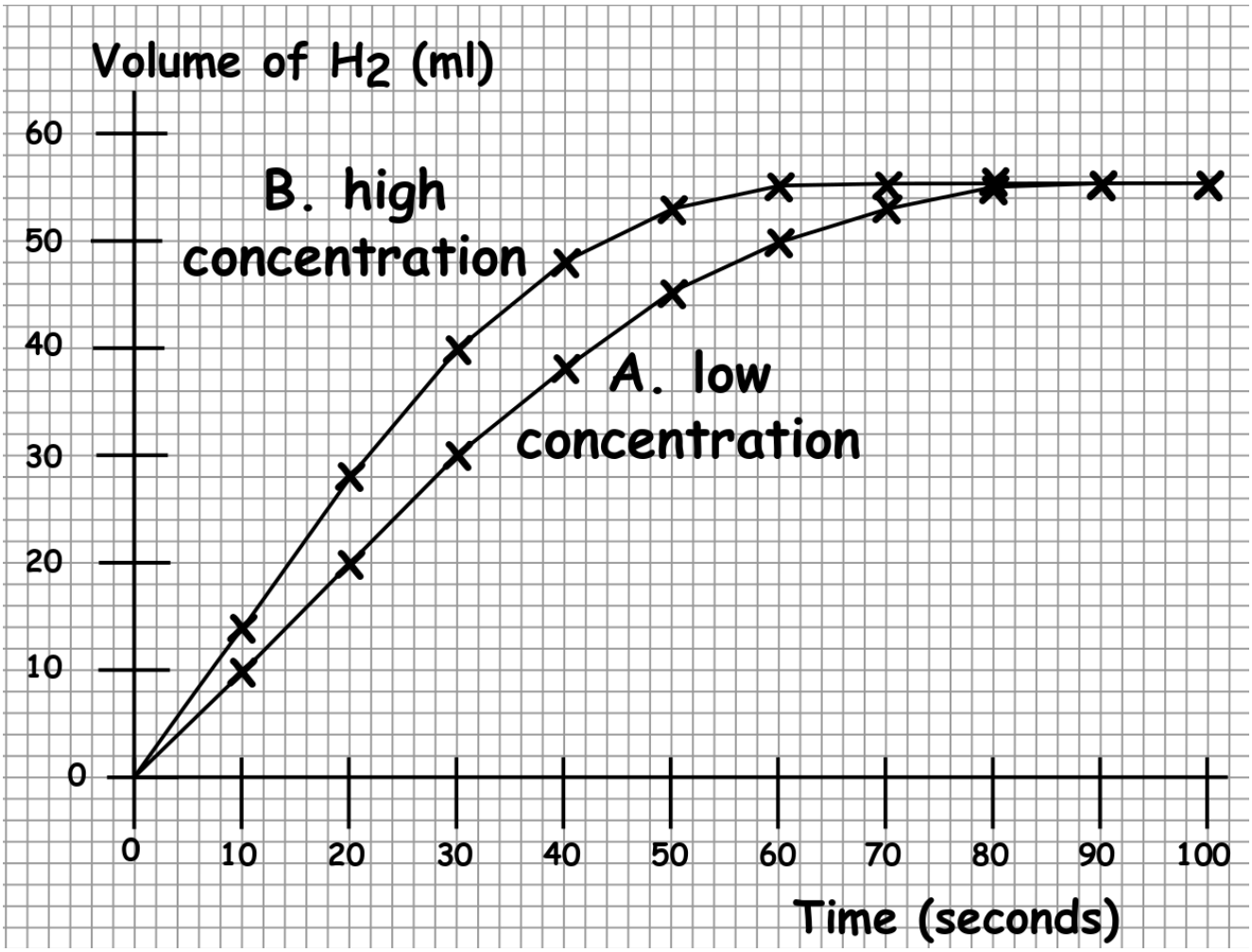
A. 90 seconds B. 60 seconds

c. Label one of the lines as **higher concentration** and the other as **lower concentration.**

d. How do we know from the **data** that the same amount of magnesium was used?

The same amount of gas is produced.

Time (seconds)	0	10	20	30	40	50	60	70	80	90	100
A. Volume of H_2 (ml)	*0*	*10*	*20*	*30*	*38*	*45*	*50*	*53*	*54.5*	*55*	*55*
B. Volume of H_2 (ml)	*0*	*14*	*28*	*40*	*48*	*53*	*55*	*55*	*55*	*55*	*55*



3. Put the following chemical reactions in order from **slowest** to **fastest**. *One of them is deliberately 'wrong' can you spot which one and explain why?*

1. Rusting 2. Rotting food 3. Concrete setting
4. A browning apple 5. Baking a cake 6. Burning toast
7. Sparkler 8. Firework rocket 9. A match
10. An explosion

An ice cream melting is a physical change not a chemical reaction so it's the wrong one.

RUSTING, A BROWNING APPLE, SPARKLER, BAKING A CAKE, EXPLOSION, ROTTING FOOD, CONCRETE SETTING, BURNING TOAST, A FIREWORK ROCKET, A MATCH, ICECREAM MELTING

Questions on Cost of Electricity and Power Ratings: Answers

Comprehension

1. The amount of energy an electrical appliance uses depends on its power rating and the amount of time it is switched on for.
2. Power ratings are normally found as labels on the appliance.
3. Mains voltage is 230V in the UK.
4. The unit of power is the Watt.
5. There are 1000 watts in a kilowatt.
6. You divide by 1000 to convert watts to kilowatts.
7. To calculate energy used we multiply the power of the appliance by the time it is on for.
8. The unusual unit of energy for electrical appliances is the kilowatt-hour.
9. Using the joule instead of the kilo-watt hour would mean very big values.
10. Energy (kWh) = 2.8 (kw) x 1 = 2.8 kWh
11. 14p for one kilowatt-hour.
12. Meter readings for bills are taken from the electricity meter in the house.
13. The average household electricity bill is about £1000 per year (now risen to £2500).
14. Two energy hungry appliances are the washer and the dryer (WHAT? box).

Additional tasks

1.

A. 30 minutes	*B. 80 minutes*	*C. 600 minutes*	*D. 10 minutes*	*E. 120 minutes*
0.5 hr	**1.33 hrs**	**10 hrs**	**0.17 hr**	**2hrs**
1/2hr	**1 1/3 hrs**	**10 hrs**	**1/6 hr**	**2hrs**
F. 90 minutes	*G. 15 minutes*	*H. 200 minutes*	*I. 20 minutes*	*J. 160 minutes*
1.5 hrs	**0.25 hrs**	**3.33 hrs**	**0.33 hr**	**2.66 hrs**
1 1/2 hrs	**1/4 hr**	**1 1/3 hrs**	**1/3 hr**	**2 2/3 hrs**

2.

A. 100 watts	*B. 1500 watts*	*C. 200 watts*	*D. 10,000 watts*	*E. 6000 watts*
0.1kw	***1.5kw***	***0.2kw***	***10kw***	***6kw***
F. 1000 watts	*G. 500 watts*	*H. 800 watts*	*I. 2,500 watts*	*J. 5,500 watts*
1.0kw	**0.5kw**	**0.8kw**	**2.5kw**	**5.5kw**

3.

Appliance	Energy (kWh)	Power (kW)	Time (hours)
Kettle	3.0	2.0	1.5
Shower	4.5	9.0	0.5
Iron	10.0	5.0	2.0
Xbox 1	1.1	0.11	10.0
Toaster	0.9	1.8	0.5
Sandwich maker	0.25	1.0	0.25
Washing machine	6.0	4.0	1.5
Vacuum cleaner	0.9	0.9	1.0
Tumble dryer	1.1	2.2	0.5

4.

Electricity bill

Date	15 May	15 August	Kilowatt hours used (kWh)
Quarterly meter reading (3 months)	8400	10,000	**1600**
Electricity charges Standard tariff@	20 pence per kWh		***Total charges***
	1600 @	20 p each	**£320**

5.

Hair dryer **SIX**	**SAIEHYXDRRRI**
PS3console **THREE**	**TSCLEPOHNRE3SEO**
LED torch **ONE**	**DCLEROONHTE**
Laptop Computer **TWO**	**PATLTOWPO**
Hover mower **FIVE**	**OEFEHWIVMRVORE**
Trimmer for lawns **FOUR**	**FUORIUETRMM**

6.

i) 1st May to 20th July (NOT A QUATERLY)
ii) 28th Feb to 18th May (NOT A QUATERLY)
iii) 10 December to 10th March (IS A QUATERLY)
iv) 16th June to 16th August (NOT A QUATERLY)
v) 15th May to 15th September (NOT A QUATERLY)
vi) 28th April to 28th July (IS A QUATERLY)

Questions on Energy Stores: Answers

Comprehension

1. Energy can be stored eight different ways.
2. Batteries store chemical potential energy.
3. When we recharge a battery we use an electric current to reverse a chemical reaction.
4. An object gains GPE by being raised above the ground.
5. An object's GPE is increased by being heavier or lifted higher.
6. Objects can be squashed to store elastic potential energy.
7. Nuclear energy is released from the nucleus of an atom.
8. Fission is a nucleus splitting apart, fusion is a nucleus joining with another nucleus.
9. You can store magnetic energy by pushing two north poles of a magnet together.
10. Positive and negative charges attract.
11. We transfer electric potential energy through an electric current
12. Another word for heat is thermal energy
13. An object stores kinetic energy when it is moving.
14. Kinetic energy can be increased by making an object move faster or if the object is heavier.

Additional tasks

1. Match the energy type to its description and memorise.

Elastic potential energy the energy an object has when stretched or squashed.

Electric potential energy energy stored due to the attraction or repulsion of charges.

Chemical potential energy the energy stored in chemical bonds.

Kinetic energy energy of motion.

Thermal energy another word for heat, due to the vibration or motion of the particles of a substance.

Gravitational potential energy the energy an object has by being raised above the ground.

Magnetic potential energy energy stored due to the attraction or repulsion of magnets.

Nuclear energy energy stored by the nucleus of an atom.

3. Below are examples of where we would find or have a lot of a particular energy store. Write down the energy store next to the example.

a. A bottle of cooking gas **chemical**

b. Helicopter hovering high in the sky **Gravitational potential energy**

c. A bow and arrow fully pulled back **Elastic potential energy**

d. A radioactive element **Nuclear**

e. The strip around a fridge door to keep it shut **Magnetic potential**

f. A lightning storm **Electric potential**

g. A speeding bullet **Kinetic energy**

h. A sauna **Heat or thermal energy**

Questions on Energy Transfers (flows): Answers

Comprehension

1. Energy is most useful when it is flowing.
2. Forces are involved in bringing about energy transfers.
3. Emission means 'giving off'.
4. A battery stores chemical energy.
5. When you switch on, the current flow transfers electric potential to heat and light energy.
6. The light energy eventually ends up as heat by being absorbed.
7. The ball stores GPE due to its height.
8. As the ball falls the GPE decreases and the Kinetic energy increases.
9. The chemical energy is transferred by the force your muscles apply to stretch the elastic band.
10. Contract means to become smaller.
11. Kinetic energy increases when the elastic band is let go.
12. Elastic potential energy decreases when the elastic band is let go.
13. Increasing the height of an object increases its GPE.
14. In increasing the height, chemical reactions make the muscles exert a force to lift.

Additional tasks

1.

Examples	Energy flows
A car speeding up	Chemical potential to heat (explosion in engine) to kinetic energy
A kettle boiling water	Electric potential forces an electric current to flow producing heat
A falling yoyo	GPE to kinetic
A rising yoyo	Kinetic to GPE
A catapult being released	Elastic potential to Kinetic energy
A wind turbine	Kinetic energy to Electric potential
A catapult being pulled back	Chemical potential to elastic potential
A solar cell powered by sunlight	Nuclear energy to light energy to Electric potential
A tumble dryer	Electric potential forces an electric current to flow producing heat and kinetic energy
A car at constant speed	Chemical potential to heat energy

2. What is wrong with these statements?

a. Water has less GPE flowing down hill because its height is lower

b. A squashed ball has more elastic energy because it can spring back into shape releasing the stored elastic potential as kinetic energy.

c. Pushing them closer together increases the magnetic potential because they will repel with greater force and this can push them apart transferring the magnetic potential into kinetic.

d. It is decreasing through nuclear reactions releasing energy as heat and light.

e. It has more. The hotter an object is the more thermal energy it has.

f. It decreases, a faster car has more kinetic energy than a slow one.

g. It does have electric potential because it is attracted to the wall.

h. It has less, the chemical energy it had is transferred to heat and light when the match ignites.

3.

i. Increasing is kinetic energy and decreasing is gravitational potential.

ii. Increasing is gravitational potential as the ball gets higher, decreasing is kinetic energy as it slows down.

iii. Increasing is heat energy and light, decreasing is the chemical energy of the wax that is the fuel that's burning.

iv. Chemical energy of the battery is decreasing as a current flows transferring this energy into light and heat.

v. Decreasing is their kinetic energy as they slow down stretching the springs, increasing is the elastic potential in the stretched springs.

Questions on Energy Transfers (Continued): Answers

Comprehension

1. Light is emitted by the sun through nuclear reactions.
2. The light energy forces the plant to make new chemicals.
3. Kinetic energy store increases for a bicycle speeding up.
4. Chemical energy store decreases.
5. The tyres and moving parts of a bike get warmer.
6. When riding a bike you have to push the air out of the way.
7. When pedalling at constant speed your kinetic energy isn't increasing because your speed isn't increasing.
8. A bullet has a store of chemical energy.
9. Hot gases expanding forces the bullet from the gun.
10. This decreases the thermal energy store.
11. Another name for the voice box is the larynx.
12. The vibration we call a sound wave.
13. Eventually the energy of the vibrations ends up as thermal energy.
14. In one hour enough energy reaches the earth to supply us with all our energy needs for a whole year.

Additional tasks

1. Solve the clues to do with energy below.

1.	If the kinetic energy of an object is increasing it must be? **SPEEDING UP**
2.	Objects have to push air out of the way when they move, this is called? **AIR RESISTANCE**
3.	Earth gets most of its energy from the? **SUN**
4.	The chemical energy of a battery decreases through the flow of an? **ELECTRIC CURRENT**

2. *i. a car slowing down (remember the brakes get hot!)*

Friction **force** from brakes slows car

Kinetic energy ⟶ **Heat energy**

ii. a smart phone (the same as a torch?)

means an electric potential **forces** an electric current to flow

Chemical energy ⟶ **Light and heat**

iii. released after being pulled back on a swing

Gravity **force** pulls the swing back to the start

GPE ⟶ **Kinetic energy**

iv. squashing a bed spring

Chemical reaction makes muscle exert **force** to squash spring

Chemical energy ⟶ **Elastic potential**

*v. a bullet fired straight up **after** leaving a gun*

Gravity **force** slows the bullet down as it goes higher

Kinetic energy ⟶ **GPE**

vi. a car at constant speed

force from chemical reaction (explosion) in the engine ends up as heat as the car overcomes friction and air resistance but doesn't go faster

Chemical energy ⟶ **Heat**

3.

10,000,000,000 J	**500,000J**	**2,500,000J**	**1J**	**240,000J**
120J	**8,800,000J**	**3,000,000J**	**100,000,000J**	**1800J**

1. Boil a kettle	**2.** Lift an apple from the floor to the table
3. An LED torch switched on for 10 minutes	**4.** Drive 100 miles in an electric car
5. Have a five minute shower	**6.** Get one person to the moon
7. Hair dry your hair (2 minutes)	**8.** Climb Mount Everest

ANSWERS

6. 10,000,000,000 J 1. 500,000J **5** 2. 500,000J 2. 1J 7. 240,000J
9. 120J **8**. 8,800,000J **10**. 3,000,000J **4**. 100,000,000J **3**. 1800J

Questions on Conservation of Energy: Answers

Comprehension

1. Energy cannot be created or destroyed.
2. All this means is that the total energy before a transfer is the same as afterwards.
3. Another way of thinking of this is that you don't get something for nothing.
4. If 100J of energy flows into the bulb, 100J must also flow out.
5. This is always true.
6. This enables us to explain anything to do with energy.
7. We could calculate how much fuel a space craft needs to reach the moon.
8. 1 kg weighs 10N.
9. The 10J of GPE transforms into 10J of KE just before hitting the ground.
10. Increase the length of an elastic band by 10cm, you will store about 0.25J of energy.
11. Dissipation means spreading out and becoming less useful.
12. An 'AA' battery stores about 12,000J of chemical energy.
13. The energy stored by a battery is really useful, because you can do lots of things with it.
14. The energy will be mostly transferred to kinetic energy of the air from the fan.
15. The heat comes from friction in the motor and the electric current in the wires.
16. A Newton's cradle eventually stops because energy is dissipated as heat and sound.

Additional tasks

1.

Energy changes	Possible / Not possible ?
A light bulb, 100J of electric current flow changes into 30J heat and 71J of light	**Not possible**
Stretching an elastic band, 0.25J of chemical energy changes into 0.25J of elastic potential	**Possible**
Lifting a ball, 10J of chemical energy changes into 8J of GPE for the ball	**Not possible**
A falling bouncy ball, 2J of GPE changes to 1.9J of KE and 0.1J of heat	**Possible**
A bouncy ball hitting the ground, 1.9J of KE changes into 1.9J of elastic potential	**Possible**
A growing plant, 1000J of light energy changes into 800J of chemical and 100J of heat	**Not possible**
Mixing hot and cold drinks, the hot drink loses 20,000J, cold drink gains 18,000J	**Not possible**
Pushing two repelling magnets together, 0.05J of chemical energy changes to 0.05J magnetic potential energy	**Possible**

2.

a. A hand held fan for cooling you down
Useful = KE Wasted = heat

b. A remote controlled toy car powered by an electric motor
Useful = KE Wasted = heat

c. Sliding down a slide at the park
Useful = KE Wasted = heat

d. A wind turbine
Useful = Electric potential Wasted = heat and sound

e. A candle
Useful = light Wasted = Heat

f. Watching TV
Useful = light and sound Wasted = Heat

g. An electronic keyboard
Useful = sound Wasted = heat

h. A lift in a building powered by an electric motor
Useful = GPE (height) Wasted = heat

i. A loudspeaker
Useful = sound Wasted = heat

j. A smart phone
Useful = light and sound Wasted = Heat

3.

Often **wasted** energy, the energy we don't want, ends up being transformed into **heat** energy. This heat energy becomes less and less **useful**, we say the energy has **dissipated**. It is now so **spread** out we can't do anything useful with it. Energy is most often **wasted** as heat due to the flow of an electric current or because moving parts rub together and generate heat through **friction**.

Questions on Work and Energy: Answers

Comprehension

1. Doing housework or homework requires energy.
2. The work done is equal to the energy transferred.
3. To calculate work, we need to know the force applied and the distance it was applied for.
4. It makes sense because the further you move something and the more force you apply the more energy is required.
5. Work done = 2N (two apples) x 1m = 2J.
6. The unit of work and hence energy is the Joule.
7. Work done = 0.1N x 4m = 0.4J.
8. Often you are working against a force that is trying to stop what you are doing.
9. Pushing your pen along the paper you do work against friction.
10. Lifting your clothes off the floor you do work against gravity.
11. When pushing a chair some of the work you do to begin with increases the kinetic energy of the chair.
12. Once the chair is moving at a steady speed, work is done against friction only.
13. On 'zero friction' ice the work you do on the chair increases its kinetic energy.
14. No friction means the kinetic energy can't transfer into heat.
15. Push the chair for a greater distance it will have more kinetic energy.
16. Power tells us how quickly work is done.

Additional tasks

1. Solve the jumbled words to do with work and energy.

Letters	Description	Answer
OUELJ	The unit of work	**JOULE**
ANSRTERFRED	When work is done, energy is always ……..	**TRANSFERRED**
TREME	The unit of distance when calculating work	**METRE**
CTIIORFN	What we often do work against	**FRICTION**
ARGTIVY	Doing work against this increase GPE	**GRAVITY**
EHTA	Work against friction always transfers some energy to..	**HEAT**
IKETICN	If there is no friction or air resistance the work we do in pushing an object is equal to the …… energy gained	**KINETIC**
TWENNO	The unit of force	**NEWTON**

2. Calculate the work done (force x distance) in the following examples.

a. Sweeping the patio a force of 10N is applied over 15m.

b. Pushing a car, a force of 800N is applied for 12m.

c. Climbing the stairs, legs exert 600N for a height of 3m.

d. A cars brakes apply 2000N over 12m to stop.

a. **10N x 15m = 150J**
b. **800N x 12m = 9600J**
c. **600N x 3m = 1800J**
d. **2000N x 12 = 24,000J**

3. An electric motor lifts people in an elevator between floors. Calculate the useful work done (here it is GPE, an increase in height) in lifting the people (force x distance) and then the energy wasted as heat. This is the difference between useful work done and energy consumed by motor.

Energy consumed by the motor (J)	Force from motor (N)	Distance / height lift rises (m)	Useful work done (J)	Energy wasted as heat (J)
2,500	1000	2	**2,000**	**500**
37,500	6000	5	**30,000**	**7,500**
87,500	5000	14	**70,000**	**17,500**
60,000	8000	6	**48,000**	**12,000**

Questions on Fuels and Energy Resources: Answers

Comprehension

1. Most of the worlds energy is still generated by burning fossil fuels.
2. The fossil fuels are coal, oil and gas.
3. Fossil fuels were formed by dead plant and animal material compressed over millions of years.
4. Non-renewable means a resource that will eventually run out.
5. Kinetic energy of the steam decreases as it forces the turbine to spin.
6. The generator produces an electric potential.
7. The energy from the generator flows to our homes as an electric current.
8. We can't burn nuclear fuel.
9. Nuclear fuel is non-renewable because it has to be dug out of the ground (so will eventually run out).
10. Solar panels convert the sun's energy directly into electricity.
11. The blades of a turbine connect to a generator.
12. Geothermal power uses heat beneath the earth, the produces steam, that drives a turbine connected to a generator.
13. The up and down motion of air forces a turbine to move connected to a generator.
14. The water is allowed to flow through pipes, which turns a turbine connected to a generator.
15. Burning fossil fuels produces CO_2.
16. Wave, solar and wind are weather dependent.
17. Renewables don't pollute or contribute to global warming.
18. Nuclear power produces dangerous waste which is difficult to dispose of.

Additional tasks

1. Solve the jumbled words below.

Letters	Description	Answer
ONBNAEWLEERNO	Energy resource that will run out	**Non-renewable**
CLUREAN EACRIONST	Nuclear power releases its energy through these	**Nuclear reactions**
HIANC	Country that generates most electricity from hydroelectric	**China**
CIAD INRA	Burning fossil fuels contributes to ……	**Acid rain**
IBNEUTR	Spins very fast like a jet engine and connected to a generator	**Turbine**
OTARRENEG	Transfers kinetic energy into electric potential	**Generator**
IKETICN	Type of energy wind has	**Kinetic**
BLOLAG IRAMGNW	Burning fossil fuels also contributes to ……	**Global warming**
BNAEWLEERO	Energy resource that won't run out	**Renewable**

2.

a. sometimes birds accidentally get killed **Disadvantage / Wind turbines**

b. there is a lot of energy washing up on our shores everyday **Advantage / Wave power**

c. works best in hot countries **Disadvantage / Solar power**

d. only practical in certain countries like Iceland **Disadvantage / Geothermal**

e. limited by having the right landscape to flood valleys **Disadvantage / Hydroelectric**

f. can generate on existing space like roofs **Advantage / Solar power**

g. can be built out to sea **Advantage / Wind turbines**

h. does not pollute and we live on an island so the potential is huge **Advantage / Wave power**

i. once built they can generate electricity quickly by 'opening a tap' **Advantage / Hydroelectric**

j. some countries with the right landscapes can generate up to 30% of their electricity this way **Advantage / Geothermal**

3.

An example of **biomass** is cutting down **trees** and **burning** them to generate electricity. The **carbon dioxide** released through burning is absorbed by the replanted trees through **photosynthesis** so it is claimed not to contribute to **global** warming. Another example is growing **corn** or sugar cane that can be **fermented** to make ethanol (**alcohol**). This alcohol can then be used as a **fuel** in vehicles. About 5% of **unleaded** petrol is actually ethanol.

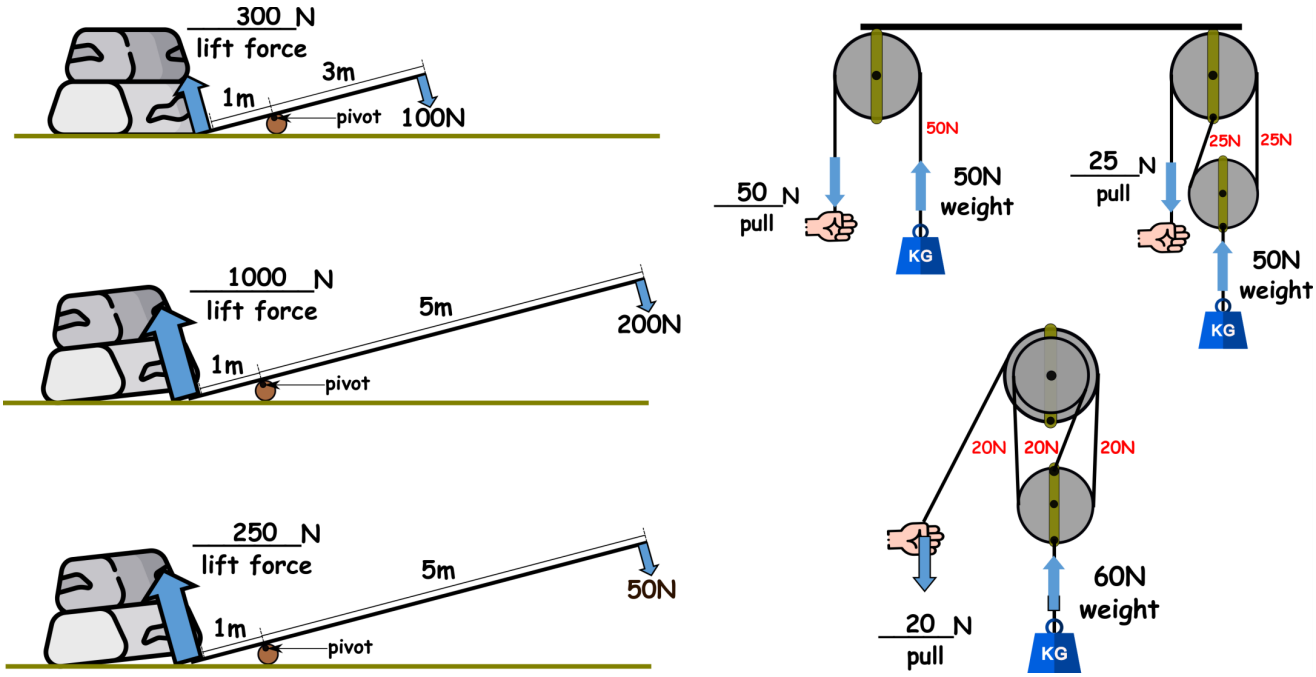
Questions on Simple Machines: Answers

Comprehension

1. A machine makes doing a job easier.
2. The energy you put in ends up transforming into another energy store.
3. The simple name for an inclined plane is a ramp or slope.
4. It's too difficult to lift the mower into the car directly.
5. When you use a ramp the distance is greater.
6. The force would be 1/3 as much because it is three times further.
7. The work done would still be 800J (the same).
8. A lever can be described as a force magnifier.
9. Ancient civilisations used levers to help move huge stones.
10. Nowadays you are most likely to use a lever to open a tin of paint, remove a bottle top or take off a bike tyre.
11. Levers rely on the fact that, the further the force is from the pivot the greater the turning effect of the force.
12. The turning effect of a force is called the moment of the force.
13. Mechanical advantage is how much easier it is to lift something.
14. There is no mechanical advantage for the pulley on the left.

Additional tasks

1.



2.

Used for cleaning clothes	**SIIWCMEAHHNGAN** (WASHING MACHINE)
Can be used for opening a tin of paint	**LERVE** (LEVER)
This machine makes getting around easier	**ELWEH** (WHEEL)
This machine is really useful in the kitchen	**IHEDHASRWS** (DISHWASHER)
Used to raise sails on sailing boats	**PLYUEL** (PULLEY)
This machine is useful when you're hungry	**INETNPROE** (TINOPENER)
A machine good for splitting wood	**DEWGE** (WEDGE)
This machine comes as a pair	**OCRSSSIS** (SCISSORS)
Good for moving heavy stuff	**HERWRBWEOLA** (WHEELBARROW)
A simple way of lifting objects	**NHWCI** (WINCH)
This machine works like a lever	**SPEAD** (SPADE)
Good for lifting heavy objects slowly	**RAPM** (RAMP)

Questions on The States of Matter: Answers

Comprehension

1. When thinking of solids liquids and gases, water is very familiar.
2. A water molecule is shaped like a boomerang.
3. We draw circles to represent the atoms or molecules.
4. The forces of attraction are strong in a solid.
5. The particles vibrate about their fixed positions.
6. When a solid is heated the particles vibrate more, they need more room for this so move apart.
7. The particles in a liquid have weaker forces of attraction than a solid.
8. The spacing of particles in a liquid is slightly further apart than in a solid.
9. The particles are spaced far apart in a gas.
10. Density normally increases as you move from liquid state to solid state.
11. This is because the particles become more tightly packed.
12. Anomaly means doesn't follow the pattern.
13. As water changes from liquid to solid it expands and becomes less dense.
14. Ice floats on water because it is less dense than water.
15. Power lines sag more in the summer. They expand and lengthen.
16. Thermometers work because an expanding liquid rises as the temperature rises.
17. Bridges have expansion joints that look like giant zips.

Additional tasks

1. Match and memorise the words below.

Freezing changing from a liquid to a solid
Contraction reduction in size of a material usually when cooled
Expansion increase in size of a material usually when heated
Melting changing from a solid to a liquid
Deposition changing from a gas to a solid without the liquid stage, opposite to sublimation
Sublimation changing from a solid straight to a gas without the liquid stage opposite to deposition
Condensing changing from a gas to a liquid

2.

a. What will happen to the water level when the test tube is placed in boiling water?
It will rise.

b. Why does it happen?
As the water gets hotter it expands.

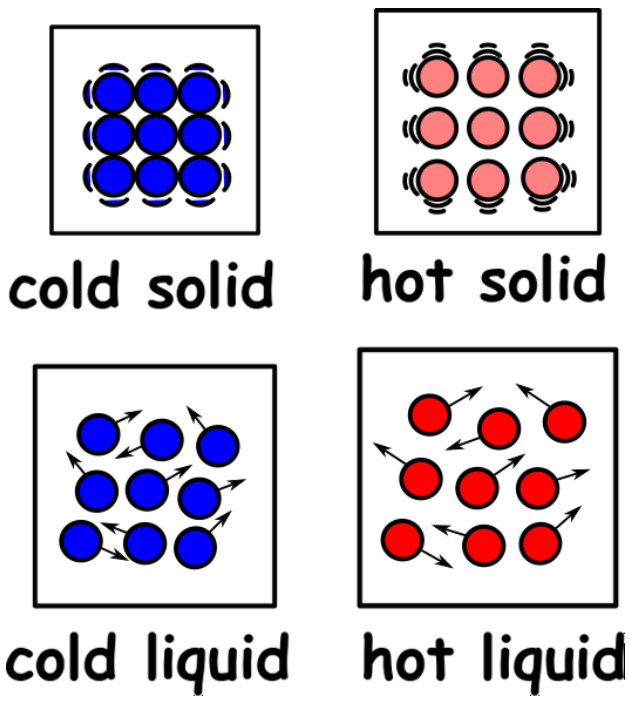
c. When the red water is added to the test tube it is 20°C. What will be the temperature change when it is put into the boiling water?
100 - 20 = 80°C.

d. How could the student use a ruler to make a scale on the tube?
Measure from where the water level started to where it finished. Divide this distance by the temperature rise 80°C to get a scale e.g. if the rise was 80mm then 80mm ÷ 80°C = 1mm for every degree rise in temperature.

e. What would happen to the water level if the test tube was put in ice water at 0°C and why?

The level would drop below where it started from because the water would contract in size as it cools.

3.



Heat Energy and Temperature: Answers

Comprehension

1. Everything has heat energy.
2. The particles that a substance is made from, move.
3. Temperature tells us how quickly particles move or vibrate.
4. Heat energy always flows (moves) from a hot object to a cold one.
5. Climb into an ice cold bath, you heat the water up.
6. In a hot bath, the water heats you up.
7. If we know the temperature of a gas we can work out how fast the particles are moving.
8. We normally measure temperature in degrees Celcius.
9. Degrees Celcius is convenient because water boils at 100°C and freezes at 0°C which we are familiar with.
10. In a thermometer, the higher the liquid moves up the tube the hotter the temperature.
11. Many methods use the principle of how easily an electric current passes through a circuit (the resistance).
12. These devices give a readout on a digital display.
13. Probes are used to measure the temperature of cooked food to check if it is cooked properly.
14. Internal energy is due to the vibration of particles and the attraction between them.
15. We can just think of internal energy as heat energy.
16. We can melt more ice cubes because the bath has more internal energy (heat energy) because there are more water molecules in a bath of water than a cup of tea.

Additional tasks

1. Write the temperature values next to the examples in the table below, choose from;

   0°C, 37°C, 100°C, 4°C, 30,000°C, 20°C, -15°C, 6000°C, 40°C.

Examples	Temperature (^0C)
Human body temperature	**37**
Average freezer temperature	**- 15**
Boiling point of water	**100**
Average fridge temperature	**4**
Average room temperature	**20**
Temperature of lightning	**30,000**
A hot bath	**40**
Surface of the sun	**6,000**
Freezing point of water	**0**

2. Choose from the words below to complete the following statements.

   fast, number, gain, Probes, movement, 1000 mph, temperature, resistance, mass, particles, lose, thermal, Celsius, Fahrenheit, attraction

- Another word for heat energy is **thermal** energy.
- If we know the temperature of a gas we can work out how **fast** the particles are moving.
- Electronic thermometers often use a change in **resistance** to measure temperature.
- Digital thermometers show us a **number** for the temperature.

- Objects at the same **temperature** have more internal energy if they have more **mass**. This is because they will be made from more **particles.**
- In a cold bath you **lose** heat energy.
- The usual unit of temperature is degrees **Celsius**.
- A less often used unit of temperature is **Fahrenheit**.
- Particles in a gas move at about **1000mph** at room temperature .
- **Probes** are used for measuring the temperature of food.
- Internal energy is the energy a substance has due to the **movement** of the particles and the **attraction** between them.
- In a hot bath you **gain** heat energy.

3. On the Fahrenheit temperature scale **68°F** is equal to **20°C**. To work this out we use the equation;

   $°C = 5/9 \times (F-32)$

   So 68°F gives; 5/9 x (**68**-32) = 5/9 x 36 = **20°C**

   Convert the following temperatures from Fahrenheit to Celsius and check that they are roughly correct by looking at the thermometers opposite.

A.	122°F	B.	212°F	C.	77°F
	50°C		**100°C**		**25°C**
D.	104°F	E.	113°F	F.	176°F
	40°C		**45°C**		**80°C**

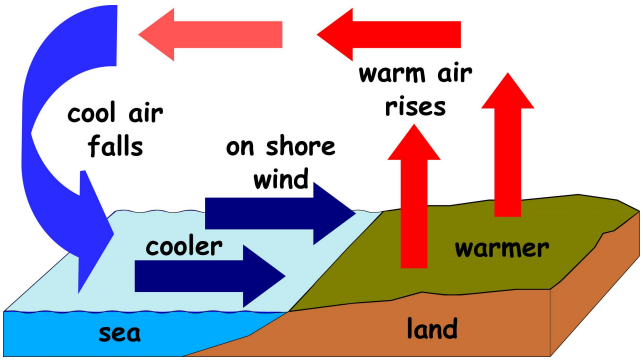
Questions on Heat Transfer: Answers

Comprehension

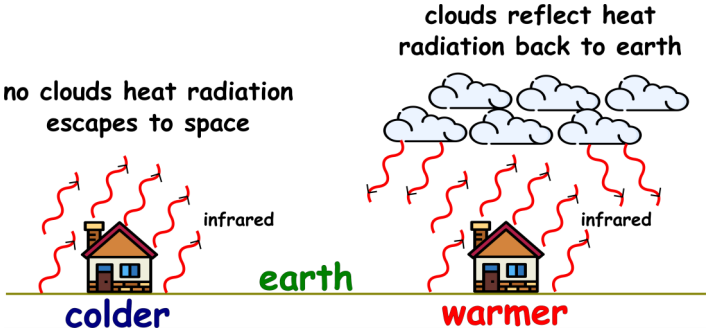
1. Heat energy will always flow from hot to cold.
2. Conduction happens best in solids.
3. A metal often feels cold to touch.
4. Metals feels cold because it is a good conductor, heat flows from your hand to it.
5. Wood is a poor conductor, heat flow from your hand would be slow so it wouldn't feel cold.
6. The tickled person, because they are linked, makes the person next to them jiggle.
7. If a solid is heated the vibrations of the particles are passed down the chain.
8. All objects emit heat radiation.
9. Heat radiation is infrared waves.
10. Hotter objects emit more heat radiation.
11. We get hot near to a fire because it emits a lot of heat radiation.
12. Convection happens in liquids and gases.
13. If air is heated it becomes less dense.
14. This causes the warm air to rise or float on top of the cooler air.
15. Wind is an example of a convection current.
16. Radiators are badly named because they transfer most of their heat through convection.

Additional tasks

1.



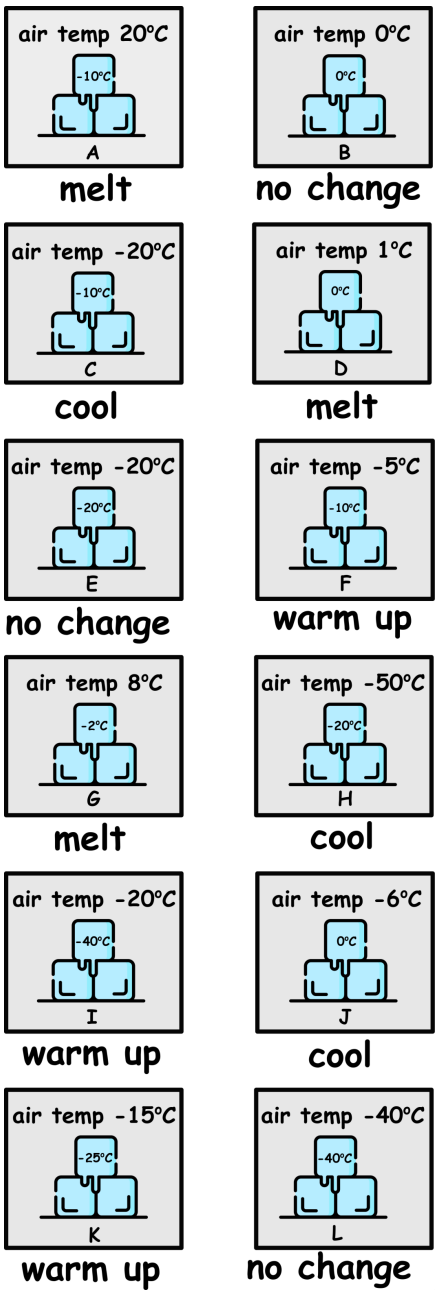
2. Complete the gap fill to explain what is happening below. Choose from the words in bold.



absorbed, day, infrared, heat, space, left, reflect, earth, warmer, blanket

At night, heat **absorbed** by the earth during the **day** is emitted as **infrared** or **heat** radiation. If the heat radiation escapes into **space** it is colder. That is what happens to the house on the **left**. Clouds **reflect** heat radiation emitted from the **earth** back down so the house on the right is **warmer**. The clouds act like a **blanket**.

3.



Questions on Insulators and Insulation: Answers

Comprehension

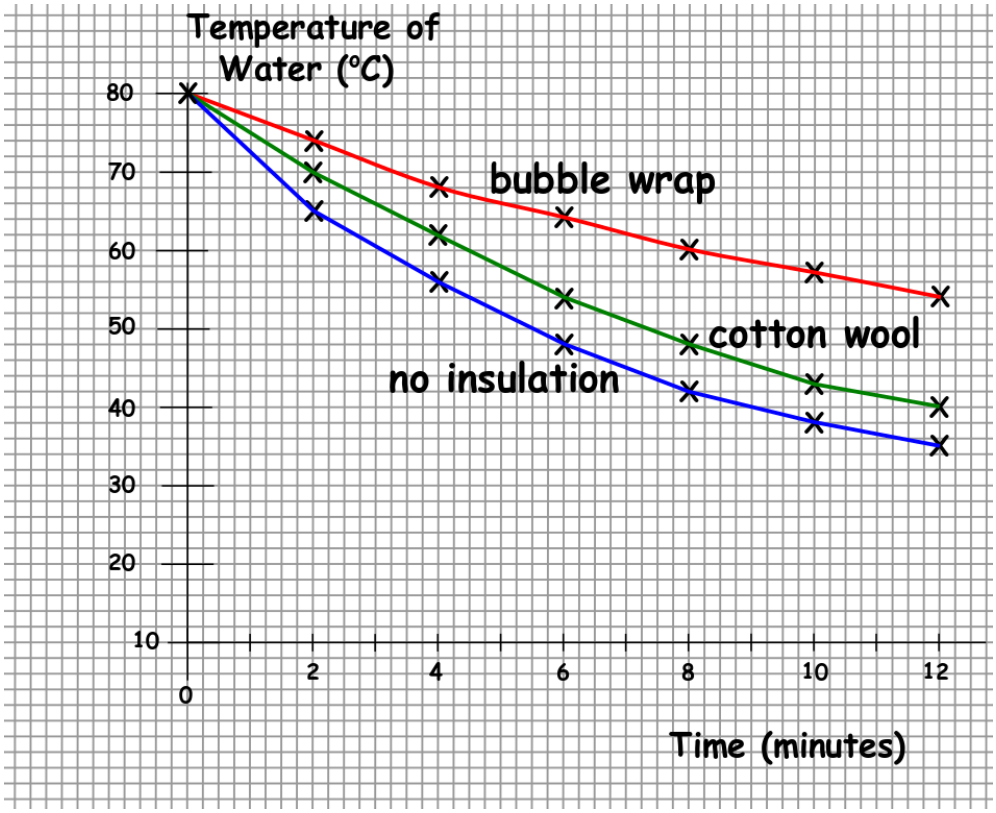
1. An insulator is a material that is poor at conducting heat.
2. Metals are good conductors of heat.
3. The base of frying pans are often made from copper because it is a good conductor.
4. The handles are often made from wood or plastic because they are good insulators.
5. Some of the warmest coats are insulated with down feathers because they are brilliant insulators.
6. We want to slow down heat loss from our homes because it costs us money to heat them.
7. Three effective methods of insulating homes are: cavity wall insulation, loft insulation and double glazing.
8. They all work by trapping air which is a good insulator.
9. Trapped air cannot move so prevents convection current circulating.
10. Modern insulating panels are made from a plastic foam.
11. The foil reflects heat radiation back into the house.
12. In hot countries this can be useful to keep heat radiation out.
13. Argon gas is often used instead of air because it is a better insulator than air.
14. The purpose of insulating a fridge is to stop heat getting in.
15. Space craft have insulating panels to protect them from high temperatures on re-entry.

Additional tasks

1.

1. The gas often used in double glazing? **ARGON**
2. What cavity wall and loft insulation rely on to insulate? **TRAPPED AIR**
3. The diagram of double glazing doesn't have a ? **CAVITY WALL**
4. Best conductor listed in the table? **COPPER**
5. Fridges are insulated to stop _____ entering? **HEAT**
6. Brilliantly insulating bird feathers? **DOWN**
7. Trapped air stops _____ _____ circulating? **CONVECTION CURRENTS**

2.



3 a. **80°C.**

b. **The beaker with no insulation, it loses heat the fastest.**

c. **20°C.**

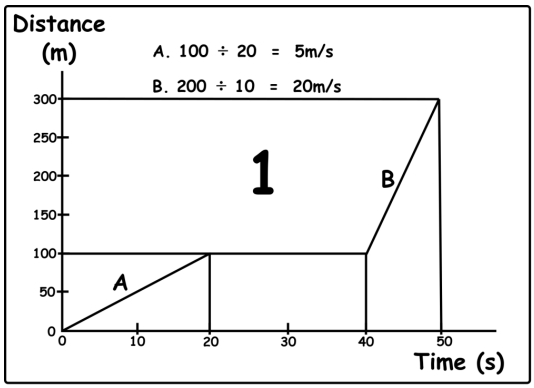
Questions on Speed: Answers

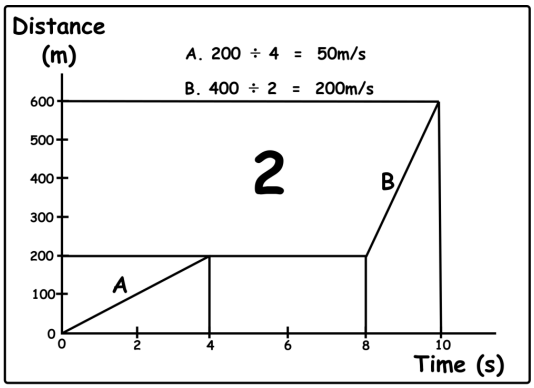
Comprehension

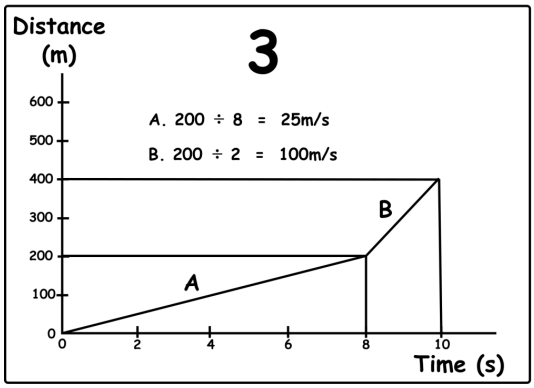
1. Speed is an example of a rate.
2. Speed tells us how far we've travelled in a given time.
3. The scientific unit for speed is metres per second.
4. We are more used to miles per hour.
5. The word average appears because things don't always move at the same speed.
6. Most runners reach their top speed at about 50 metres when running 100 metres.
7. The steepness of the line tells us how fast we are moving on a distance time graph.
8. Flat sections tell us there is no movement.
9. The gradient is found by dividing how much the y-axis changes by how much the x-axis changes.
10. If you move 200m in 10 seconds your speed is: 200 / 10 = 20m/s.
11. The object moves 200m between 20 to 25 seconds.
12. Speed cameras calculate a cars average speed. Two photographs are taken 0.5 seconds apart and the distance is found using lines painted on the road.

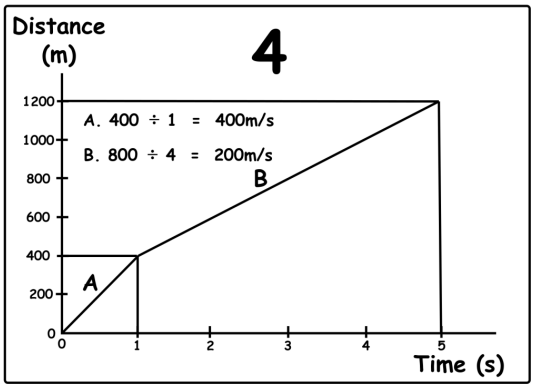
Additional tasks

1.





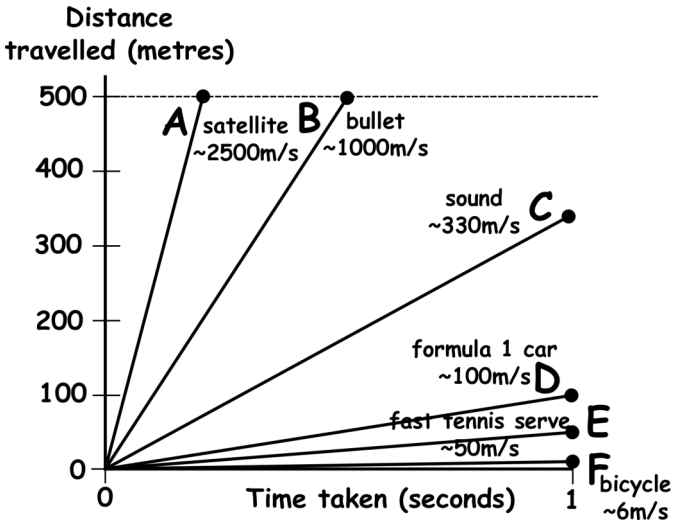




2.

What's moving?	Distance travelled (m)	Time taken (s)	Speed (m/s)	Speed (mph)
Bugatti Chiron	272	2	**136**	**305**
Skydiver	220	4	**55**	**123.2**
Bus	108	6	**18**	**40.3**
Peregrine falcon	320	3	**106.7**	**239**
A Snail	1	78	**0.013**	**0.029**
A Bullet	1609	1.8	**894**	**2002**

3.



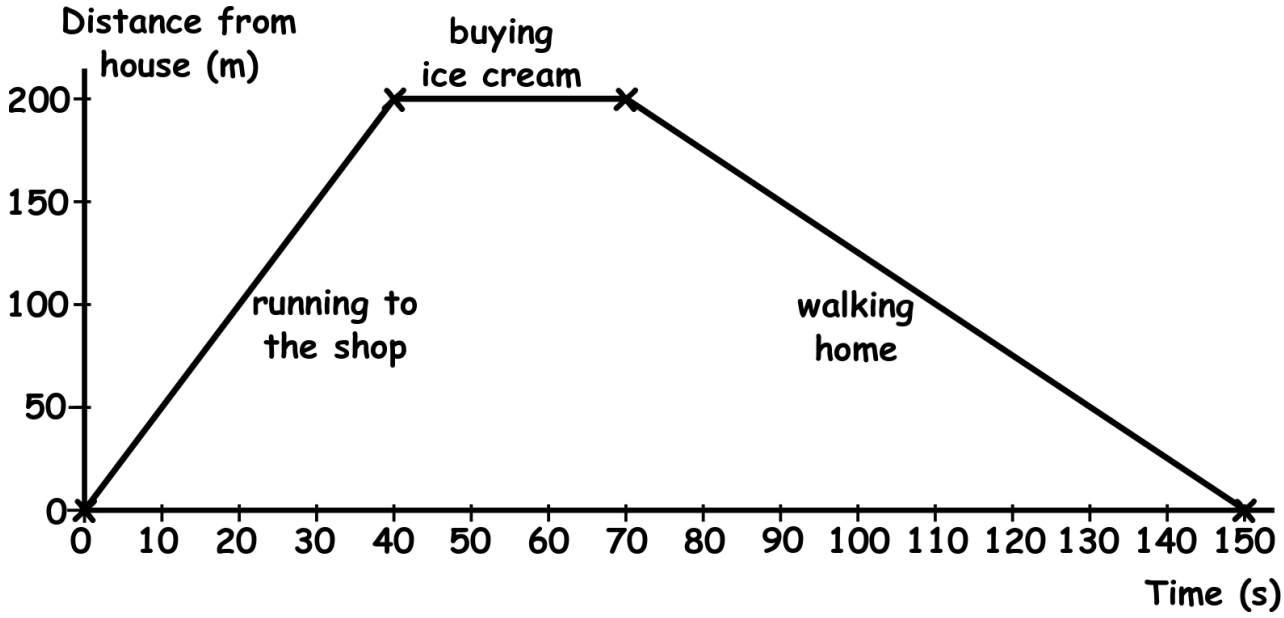
Questions on Relative Speed and more Distance Time Graphs: Answers

Comprehension

1. Plotting our distance from a starting point means we can then move away from or back towards the starting point.
2. It takes the man 30 seconds to walk 100m.
3. The man stops for 10 seconds.
4. His walking speed was 100/30= 3.33 m/s.
5. His running speed was 100/15 = 6.7 m/s.
6. Most objects don't move at a nice constant speed.
7. They usually speed up or slow down.
8. The steepness of a distance time graph tells us the speed.
9. If a line is getting steeper an object is accelerating (speeding up).
10. If a line is gettting less steep the object is slowing down (decelerating).
11. It is not a silly question to ask how can you tell you are moving.
12. When moving at the same speed the car next to you appears not to be moving.
13. Cars moving at the same speed are really moving.
14. We normally think of our speed as how fast we are moving over the ground.
15. The red and black car are approaching each other at 40 m/s, because they are moving in opposite directions.
16. If cars are moving in the same direction we minus their speeds (to find out how fast they are approaching or receding).
17. The black car always moves across the ground at 20 m/s.

Additional tasks

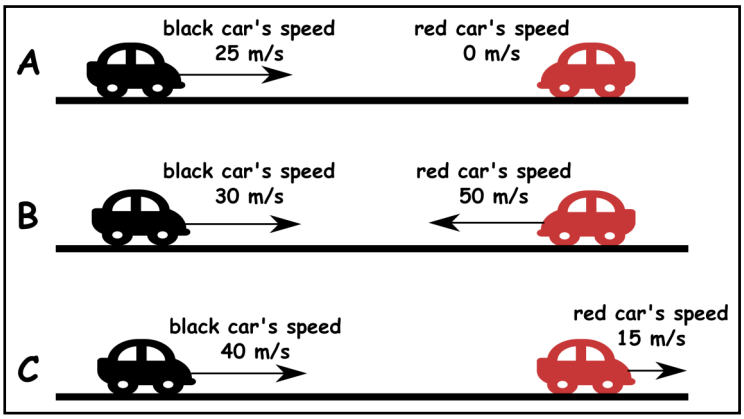
1.



2. **Speed (running to shop) = 200 ÷ 40 = 5m/s** **Speed (walking home) = 200 ÷ 80 = 2.5m/s**

3 a. Calculate how fast the **black car** is approaching the **red car** in A, B and C opposite.

A. 25m/s **B. 30 + 50 = 80m/s** **C. 40 - 15 = 25m/s**



b. **70 - 40 = 30mph**

c. **60 + 40 = 100mph**

Questions on Contact Forces: Answers

Comprehension

1. The size of a force is measured in newtons.
2. We show forces as arrows on diagrams.
3. Contact forces are forces where objects (stuff) actually touch.
4. Push against a wall and it pushes back with the same force.
5. We call this force the reaction force.
6. Upthrust is the upward force on something placed in a fluid.
7. For an object to float, the upthrust must be the same as the object's weight.
8. Helium balloons rise because the upthrust from the air is greater than its weight.
9. Friction acts in the opposite direction to the movement of the object.
10. Friction can be useful for climbing a rope or stopping a car with brakes.
11. A rusty bicycle chain is difficult to pedal because there is a lot of friction.
12. Oiling or lubrication can reduce friction.
13. Another name for air resistance is drag.
14. Air resistance increases with speed.
15. Air resistance can be reduced by making objects streamlined.
16. Tension is created when we pull things.

Additional tasks

1.

Air resistance a force that tries to stop an object moving through air

Lubrication using oil or grease to reduce friction between surfaces

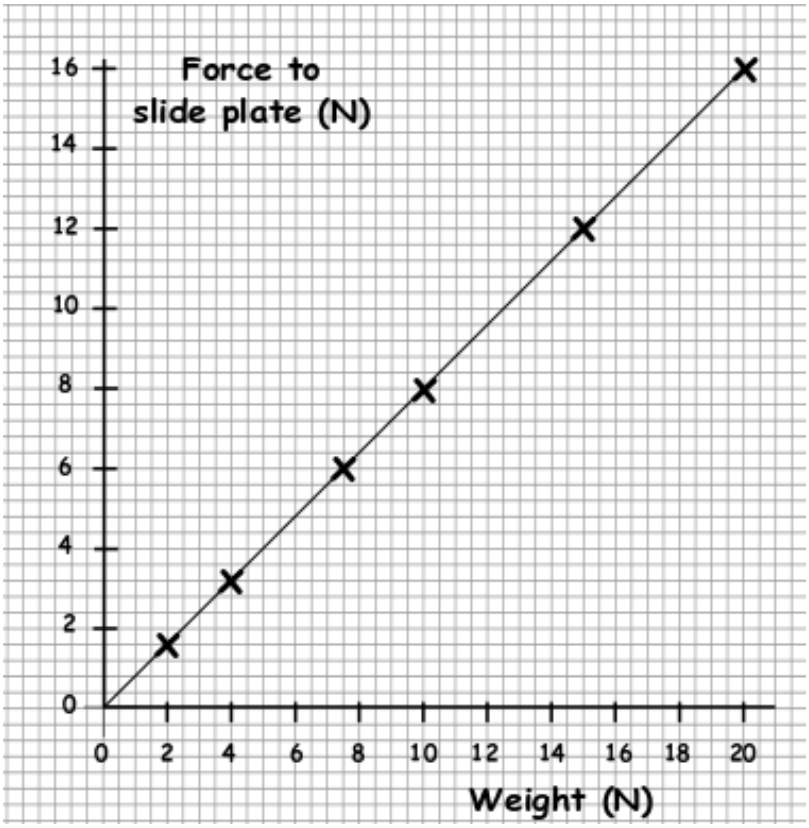
Lubrication a force created when an object is pulled, suspended by a rope, cable or string

Friction a force that tries to stop an object moving over a surface

Reaction force the force pushing back on an object

Upthrust upward force on an object placed in a fluid

2.



3a. **above**

b. **Increasing the weight increases the friction force.**

c. **Directly proportional.**

d. **Lubrication / oil.**

e. **Friction would be less so the force required to slide would be smaller.**

f. **Shallower / less steep line.**

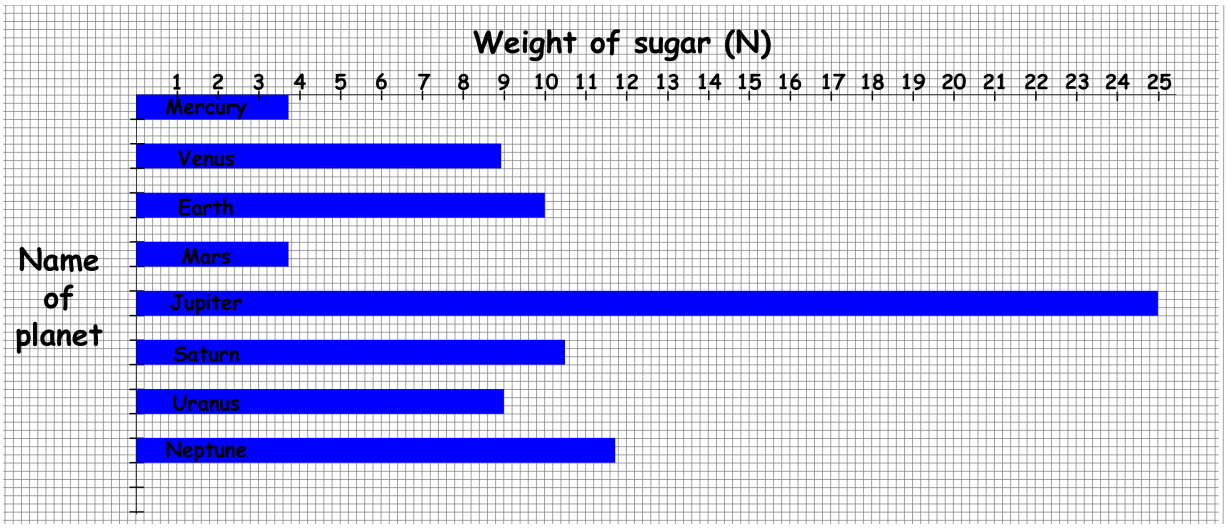
Questions on Non-contact Forces: Answers

Comprehension

1. Action at a distance describes forces that affect objects without touching.
2. These forces are simply described as non-contact forces.
3. We feel gravity all the time and it also keeps the earth in orbit around the sun.
4. Mass tells us the amount of atoms we're made from and it is measured in kilograms.
5. Everything with mass attracts everything else with mass.
6. You don't feel the attraction of the person next to you because earth's gravity is so big you only feel that (the attraction of the person next to you is also very small).
7. Gravity can only attract.
8. The gravitational field strength on earth is 10 newtons per kilogram.
9. Weight is the pull of gravity acting on an object.
10. An object that feels the force of a magnetic field is said to be magnetic.
11. An electric current also produces a magnetic field.
12. The three magnetic metals are iron, nickle and cobalt.
13. Charges have an electric field around them.
14. A negatively charged ruler attracts the positive side of the water molecules bending the stream.

Additional tasks

1.

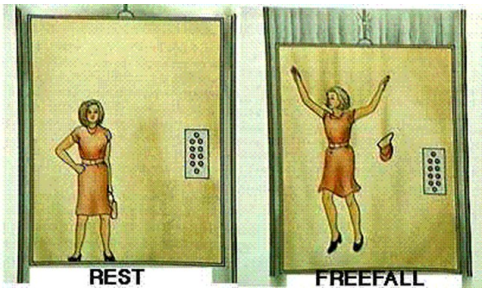


2.

Mass is a force (**false**) Gravity repels objects with mass (**false**)
The unit of weight is the newton (**true**) Mass is usually measured in stones (**false**)
You weigh the same on earth as you do on the moon (**false**) A feather has no weight (**false**)
Gravitational field strength is measured in newtons (**false**)
On Jupiter you'd be much heavier (**true**)
A kilogram mass has the same mass anywhere (**true**) Gravity only attracts (**true**) Gravity is the attraction between masses (**true**) Mass is not a force (**true**)
Mass tells us how many atoms we are made from (**true**)
There is no gravity on the moon (**false**) Mass is measured in kilograms (**true**)

3. One boy said '*there is no gravity in space because I've seen Tim Peake floating in the space station*'. A girl says '*there must be gravity keeping the space station moving around the earth, like the earth moves around the sun*'. Write a sentence or two saying who you think is correct and why. Ask your teacher who is correct afterwards!

The girl is correct. The pull of gravity keeps the space station orbiting the earth like your arms do when you swing someone round in a circle. Without this force the space station would 'fly off' in a straight line like the person you are swinging round would if you let go. Astronauts in the space station appear to float because they (the astronaut and the space station) are falling around earth at the same rate. This would be like a cable being cut on a lift that you are in and the lift and you fall at the same speed so you 'feel' weightless. It is called being in freefall (see opposite). Google 'Vomet Comet' for how this is simulated on earth.



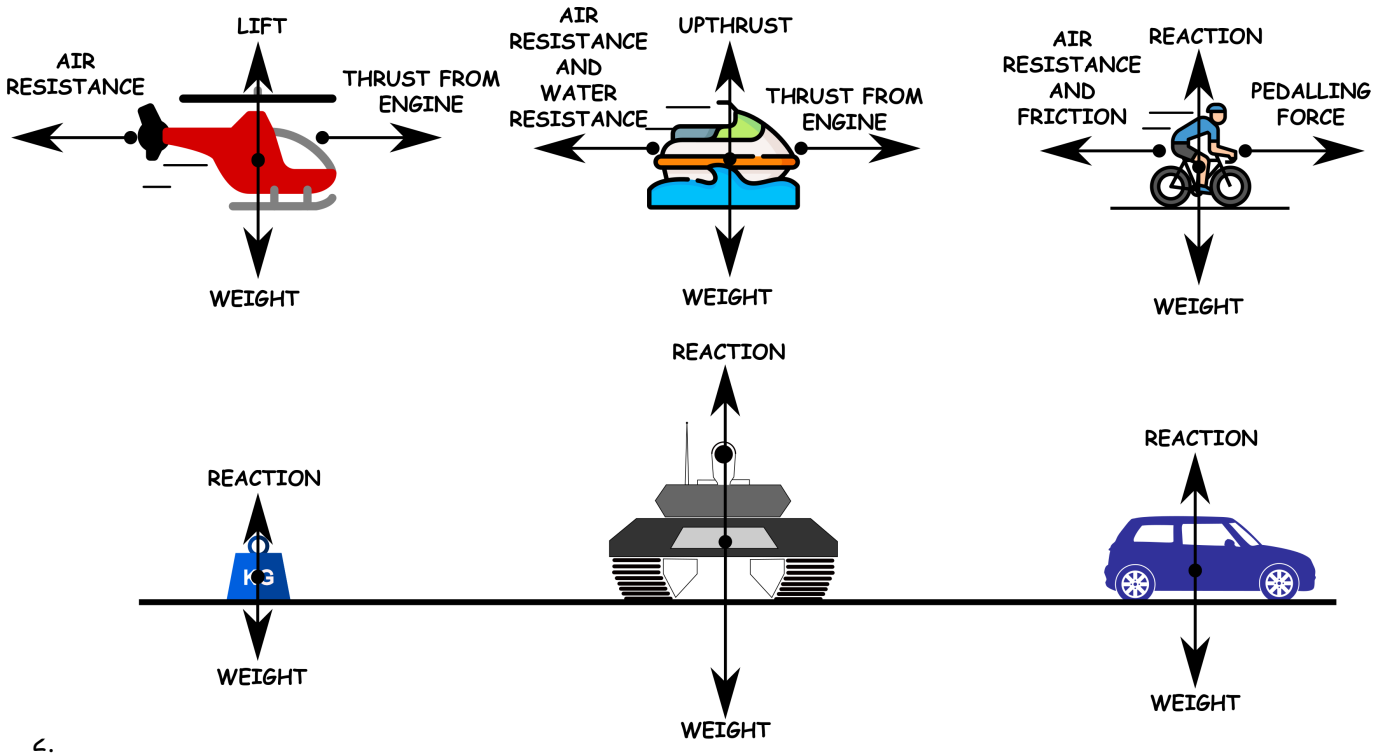
Questions on Balanced Forces: Answers

Comprehension

1. The arrows show us the size and direction of the force.
2. The up and down and left and right forces are equal in size if the forces are balanced.
3. This means the overall force is zero.
4. If forces are in the opposite direction we take them away.
5. If the forces are in the same direction we add them.
6. The force on the car is 5000N to the left because 4500 + 500 = 5,000N.
7. If the forces on an object are balanced it remains stationary or moving at a constant speed.
8. This is Newton's first law.
9. Not long after opening their parachute, skydivers fall to earth at a constant speed.
10. This is because air resistance is the same size as their weight.
11. Lift balances weight and thrust balances air resistance for a plane at constant speed.
12. Helium balloons experience upthrust from the air.

Additional tasks

1.



2.

If the forces acting on an object are **balanced** it will either be moving at a **constant** speed or **stationary**. This is Newton's **first** law. A raindrop and a **parachutist** fall at constant speed because **air resistance** is equal to their **weight**. There is no **overall** force acting. A stationary bus has a reaction from the **ground** that is equal to its weight. Float on your back and the **upthrust** from the water **equals** the weight due to gravity pulling you down. The reaction from the **desk** balances the weight of your stationary **laptop** when doing school work.

3.

Jumping in the air (**unbalanced**) A stationary cloud in the sky (**balanced**)
A spider sitting in its web (**balanced**) Bouncing on a trampoline (**unbalanced**)
Swinging on a swing (**unbalanced**) Releasing a stretched catapult (**unbalanced**)
A Speck of dust falling towards the ground (**balanced**)
Lying in bed (**balanced**) Starting to sledge down a hill (**unbalanced**)

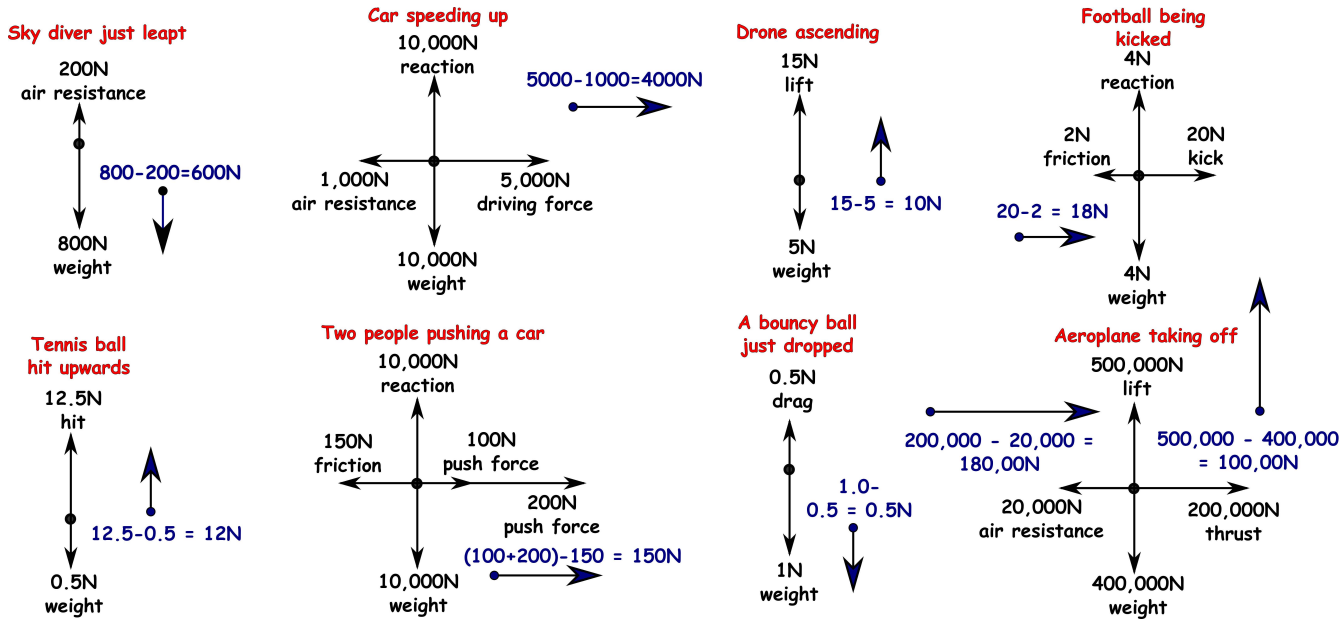
Questions on Unbalanced Forces: Answers

Comprehension

1. If the forces are balanced the object remains stationary or at a constant speed.
2. If the forces are unbalanced there is a change in motion.
3. The overall force is called the resultant force.
4. The two main things that resultant forces do, is speed up or slow down objects.
5. Accelerate means to speed up.
6. The driving force and air resistance and friction are unbalanced.
7. It can't accelerate forever because the air resistance increases as the car speeds up and the forces become balanced again.
8. The driving force disappears once the driver takes their foot off the accelerator.
9. Air resistance and braking friction produce the resultant force on the drag car.
10. The resultant force acts in the opposite direction to motion.
11. The resultant force cause the drag car to decelerate (slow down).
12. Newton's 3rd law tells us that if one object pushes on another, there is an equal reaction back.
13. We only need to think about four forces the because we are only interested in the forces on the ball.
14. After the ball has been kicked and rolls along the ground, the **resultant** force from **friction**, **slows** it down to a stop.
15. The dropped ball pulls back on the earth.

Additional tasks

1.



2.

a. During take off, a plane **speeds up** until the **lift** force from the **wings** is bigger than the **weight**.

b. Foot to the floor, a car will continue to speed up until the **air resistance** and friction is equal to the **driving force** from the engine.

c. Drop a cup cake and it speeds up until the **air resistance** is equal to its **weight**.

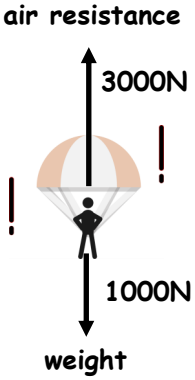
d. Kick a ball and it only speeds up whilst your **foot** is pushing it.

e. A Resultant force in the **opposite** direction to motion **slows** objects down.

f. Brakes on a bike produce a **resultant force** in the **opposite** direction to motion to **decelerate** (slow down) the bike.

3.

a. What will happen to the parachutist and why?
The parachutist will slow down / decelerate because the air resistance of the parachute is bigger than their weight.



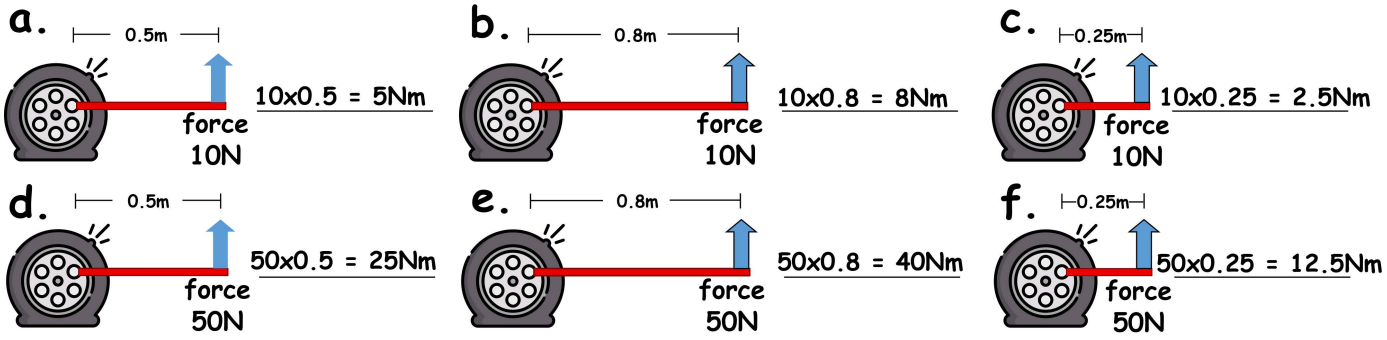
Questions on Moments: Answers

Comprehension

1. To open a door near to the hinges you have to push harder.
2. Pushing the handle requires a smaller force for a greater distance.
3. The turning effect of a force is called the moment of a force.
4. You multiply the force by the distance from the pivot to calculate the moment of a force.
5. A short brace wouldn't wouldn't produce enough turning force.
6. Nail scissors have large handles to produce a large turning effect to cut your nails.
7. The Principle of moments is the scientific name for balanced moments.
8. It means the clockwise and anticlockwise moments are equal.

Additional tasks

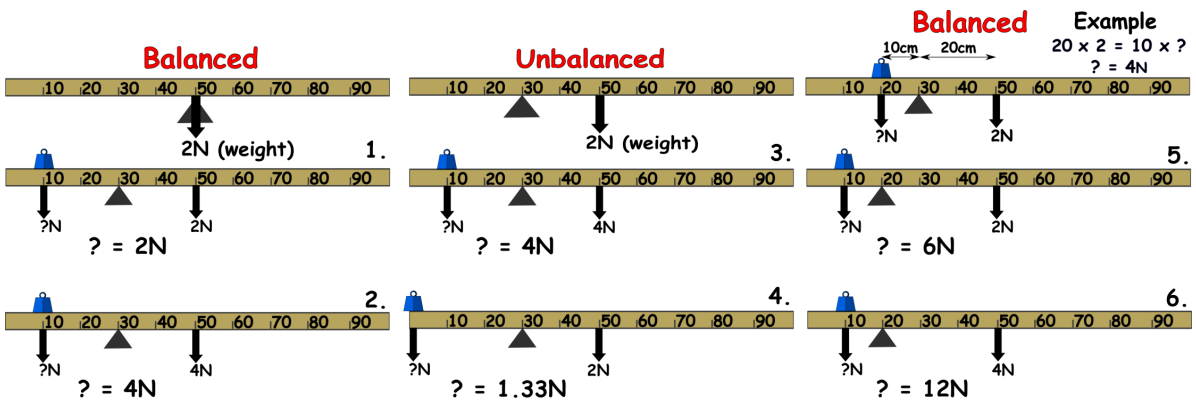
1.



2.

A. anticlockwise = 500 x 2 = 1000Nm	*balanced/unbalanced?*
clockwise = 500 x 2 = 1000Nm	**balanced**
B. anticlockwise = 500 x 2 = 1000Nm	*balanced/unbalanced?*
clockwise = 600 x 2 = 1200Nm	**unbalanced**
C. anticlockwise = 1000 x 2 = 2000Nm	*balanced/unbalanced?*
clockwise = 1000 x 2 = 2000Nm	**balanced**
D. anticlockwise = 500 x 2 = 1000Nm	*balanced/unbalanced?*
clockwise = 1400 x 1 = 1400Nm	**unbalanced**
E. anticlockwise = 500 x 2 = 1000Nm	*balanced/unbalanced?*
clockwise = (500 x 2)+(500 x 0.5) = 1250Nm	**unbalanced**
F. anticlockwise = 625 x 2 = 1250Nm	*balanced/unbalanced?*
clockwise = (500 x 2)+(500 x 0.5) = 1250Nm	**balanced**

3. a.



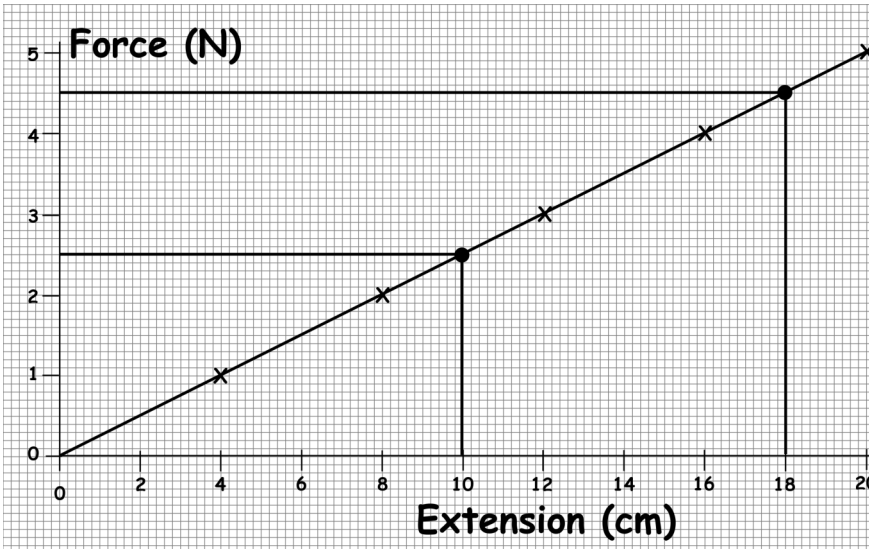
Questions on Hooke's Law: Answers

Comprehension

1. The more you stretch an elastic band the harder it gets.
2. The relationship where one quantity doubles so does the other is called directly proportional.
3. Plotting a graph of this relationship gives a straight line through the origin.
4. Another name for a spring balance is a force meter.
5. Inside a force meter a spring stretches.
6. The size of the force tells you the weight of the object you are lifting.
7. You can investigate friction by pulling objects with a force meter.
8. An object returning to its original length after the force is removed is called elastic behaviour.
9. Most objects will stretch then return to their original length even just a tiny bit.
10. On bed matresses and trampolines we see elastic behaviour (many others too).
11. The elastic limit is where an object doesn't return to its original length after the force is removed.
12. We call an object becoming permanently stretched, plastic behaviour.
13. line 'a' is steeper because the spring is stiffer (harder to stretch).
14. Stiffness is how difficult it is to stretch an object.

Additional tasks

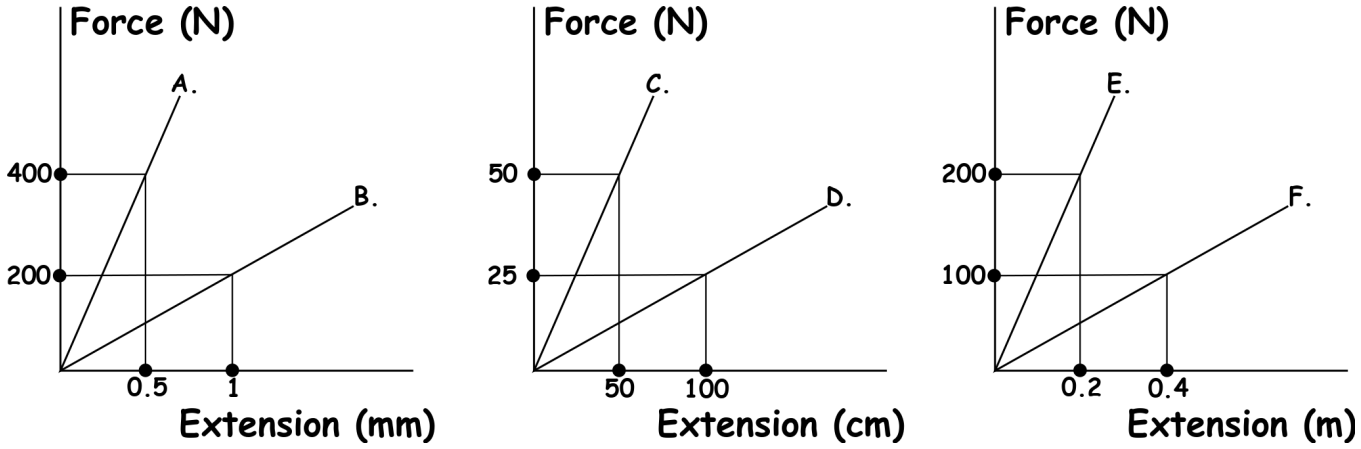
1.



2.

yes		no		yes		no	
A.		B.		C.		D.	
X	Y	X	Y	X	Y	X	Y
1	2	1	6	2	10	1	4
2	4	2	8	4	20	2	7
3	6	3	10	6	30	3	10
4	8	4	12	8	40	4	13
✓		X		✓		X	

3.



Line?	B	C	D	A	E	F
Force	400N	25N	12.5N	100N	800N	150N
Extension	2mm	25cm	50cm	0.125mm	0.8m	0.6m

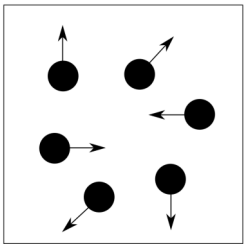
Questions on Gas Pressure: Answers

Comprehension

1. If you push air from your lungs into your mouth space, your cheeks move outwards.
2. The pressure inside your mouth starts to rise.
3. The air rushes out because the pressure inside your mouth is greater that outside.
4. The air stops rushing out when the pressure inside and outside is the same.
5. The force comes from the particles hitting the container.
6. The gas particles move around randomly.
7. Pressure is defined as force divided by area.
8. Gas pressure acts in all directions.
9. There are three ways to increase the pressure of a gas.
10. They are easy to understand since we know it is the particles hitting the walls that causes the pressure.
11. Pumping up a tyre means pushing more particles into the same space.
12. This means the collisions occur more often.
13. Heating up the gas means the particles move faster.
14. Reducing the space is the same as reducing the volume.

Additional tasks

1. LOW temperature
LOW pressure



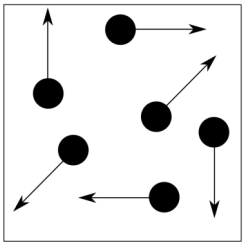
Statements

particles move slow

particles collide with the walls less often

particles exert less force

HIGH temperature
HIGH pressure



Statements

Particles move fast

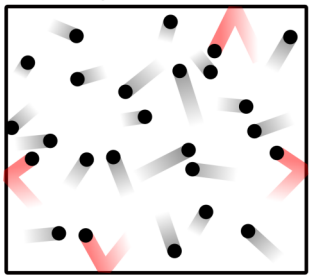
particles collide with the walls more often

particles exert more force

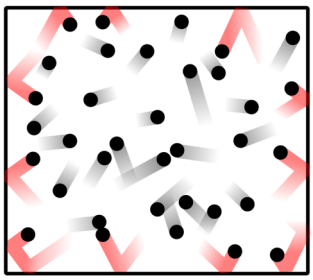
2. **Box B** has the highest pressure even though the particles will be moving at the same speed because the temperature is the same, box B has more particles so they will collide with the wall more often (more collisons per second) so the force and therefore pressure will be greater.

Box D will have the highest pressure because there is less space for the particles to move and they will hit the wall more often leading to a greater pressure.

A. Less particles

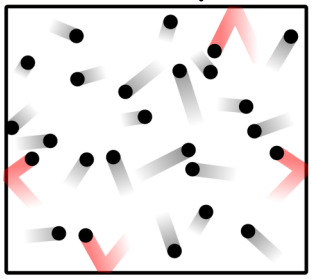


B. More particles

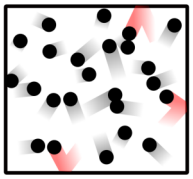


Same temperature

C. More space

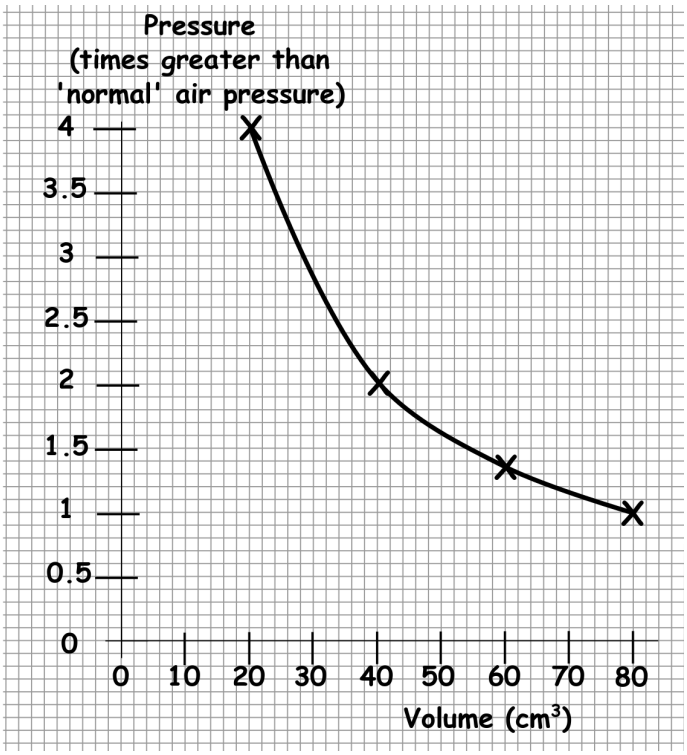


D. Less space



Same temperature and same number of particles

3. **The graph shows that decreasing the volume increases the pressure.**

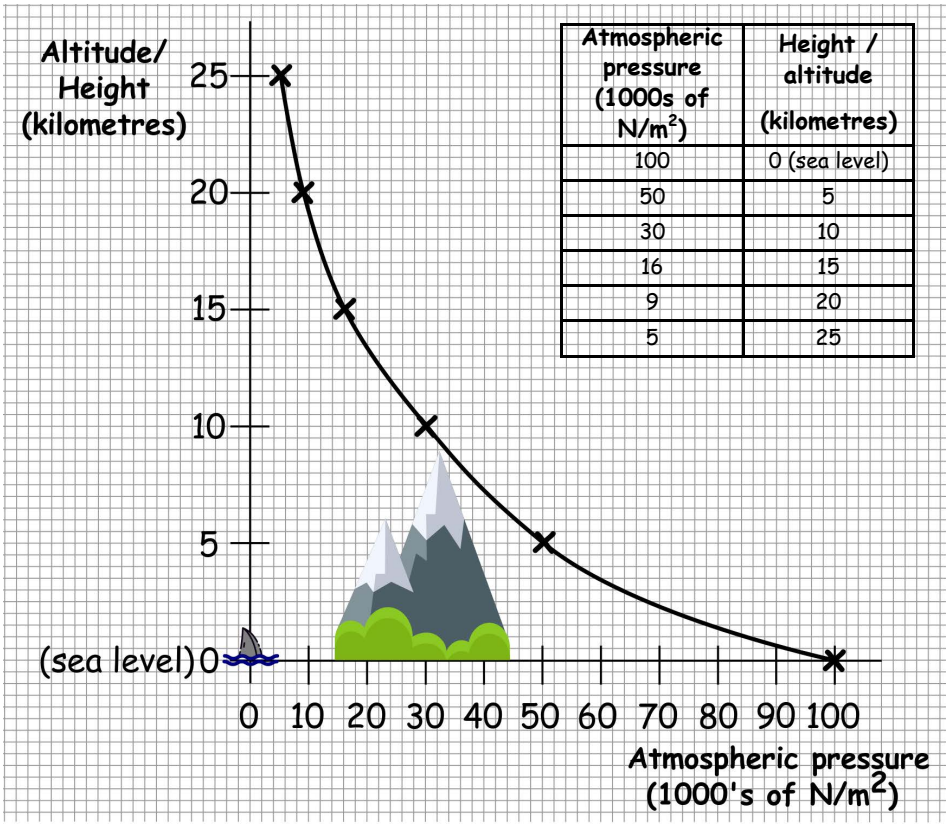


Questions on Atmospheric Pressure: Answers

1. We don't normally feel atmospheric pressure.
2. If more covers are placed on top you feel their weight, like the layers of air above us.
3. Miles high.
4. 100,000N.
5. About the same weight of 10 small cars.
6. We have the same pressure pushing outwards as inwards.
7. There are less air particles the higher you go.
8. There is less oxygen to breathe higher up.
9. 100,000/3 = 33,333 N/m^2
10. When pressure differences are created.
11. The lid is off so pressure in and out are the same.
12. The steam condenses back to water.
13. The force from the air pushing inwards is bigger than the force pushing outwards.
14. There is no push from air inside the sphere to balance the push from the atmosphere outside.

Additional tasks

1. Plot the points from the table and draw a smooth curve to show how atmospheric pressure changes with height.



Atmospheric pressure (1000s of N/m^2)	Height / altitude (kilometres)
100	0 (sea level)
50	5
30	10
16	15
9	20
5	25

2. Complete the gap fill on atmospheric pressure. Choose from the words below.
higher, **decreases**, **less**, **pressure**, **oxygen**, **thinner**, **volume**, **surface**, **lower**, **70**, **higher**, **boils**

Atmospheric pressure **decreases** as you move **higher** up in the atmosphere. This is because in a certain **volume** of air there are **less** particles. Climbers sometimes need to carry **oxygen** tanks when ascending high mountains because the air is **thinner** which means there is less oxygen. Water **boils** at a higher temperature when the pressure on top of the water's surface is **higher** this is used to cook foods quicker in a **pressure** cooker. When the pressure above the **surface** of water is lower water boils at a **lower** temperature. Water boils at about **70** degrees Celsius on top of Mount Everest because of the lower pressure.

3. Write **true** or **false** in brackets next to the statements on atmospheric pressure.

Gravity stops our atmosphere escaping into space (**true**) Air weighs nothing (**false**)
Our atmosphere is made mainly from nitrogen and oxygen (**true**)
Air can't be frozen (**false**) Vacuum cleaners don't suck, air gets 'pushed' in due to a difference in air pressure (**true**) 1000 litres of air 'weighs' 1.3 kilograms (**true**)
Most of earth's atmosphere is within 10 miles of the surface (**true**)

Questions on Pressure in Water: Answers

Comprehension

1. Upthrust makes the float rise to the surface.
2. Any object in a fluid will experience upthrust.
3. If the upthrust is less than the object's weight it will sink.
4. A pressure can can be used to show pressure increases with depth.
5. Pressure increases with depth due to the weight of more layers of water molecules lying above.
6. The increased pressure leads to a greater force.
7. This is shown by water spurting out furthest at the bottom of the can.
8. It is the difference in pressure with depth that causes upthrust.
9. The forces on the side of objects cancel.
10. A submerged object will always displace its own volume in water.
11. The water is trying to get back into the space that the metal cube occupies.
12. If the 100cm^3 ice cube was pushed under water it would displace 100cm^3 of water.
13. Archimedes noticed that the upthrust is always equal to the weight of water displaced.
14. We call objects feeling lighter in water the apparent weight.
15. Ice is unusual because it is solid yet less dense than water.
16. Huge ships float because their overall density is less than water.

Additional tasks

1. Complete the table to say whether the example will float (yes/no) and whether it will displace its own weight in water.

Example	Density (g/cm^3)	Floats (yes/ no?)	Displaces its own weight in water (yes/ no?)
Beeswax	0.96	**yes**	**yes**
Aluminium	2.7	**no**	**no**
Baking powder	0.72	**yes**	**yes**
Brick	2.0	**no**	**no**
Coal	1.5	**no**	**no**
Potassium	0.86	**yes**	**yes**
Steel	7.82	**no**	**no**
Butter	0.86	**yes**	**yes**
Pencil Rubber	1.1	**no**	**no**
Sand	1.6		**no**

2. A boy lifts several objects with string attached to them using a force meter. He records their weights. All have a volume of 100cm^3.

a.

They all become completely submerged in the water (sink), so displace the same volume of water each, 100cm^3. This means they will all experience the same upthrust because upthrust is equal to the weight of water displaced.

Material	Weight (N)	Apparent weight in water	Upthrust (N)
Aluminium	2.7	1.7	**1.0**
Steel	7.8	6.8	**1.0**
Brick	2.0	1.0	**1.0**
Copper	8.8	7.8	**1.0**
Glass	2.5	1.5	**1.0**
Coal	1.5	0.5	**1.0**

3.

a. **Unpeeled the orange is less dense than water. Peeled it is more dense than water.**

b. **The orange peel contains a lot of air, this makes the orange less dense than water unpeeled. The peel acts like a float, when it is removed the orange sinks.**

Questions on Pressure on Solid Surfaces: Answers

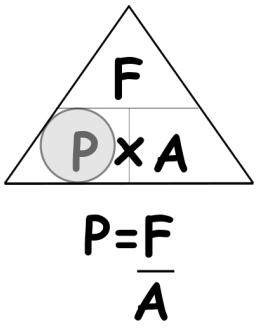
Comprehension

1. When two solid surfaces come into contact pressure is produced.
2. The two factors that affect the size of the pressure is: area of surfaces in contact and the size of the force exerted.
3. The usual units for pressure is: newtons per m^2 squared, N/m^2.
4. We use cm^2 to begin with because it is more familiar.
5. The pressure under stiletto heels is 250 times greater than trainers ($500\ N/cm^2$ divided by $2\ N/cm^2$).
6. Stiletto heels often leave imprints in the floor.
7. They are terrible for walking in mud because the high pressure means they sink.
8. Knives cut well when they are sharp.
9. The thin edge of a sharp knife means the force is concentrated on small area producing a high pressure.
10. The small area tip of a drawing pin enables the pin to penetrate into walls because of the high pressure.
11. The weight of a tank needs to be spread over a large area because it is very heavy (to reduce the pressure).
12. One of the adaptations of a polar bear is large paws.
13. This stops them sinking into the snow.
14. Humans wear snow shoes to stop themselves sinking into the snow.
15. If we tried to sit on one nail it would penetrate our skin.
16. On a bed of nails, your weight is spread over hundreds of nails, the pressure is lowered and your skin does not pierce.

Additional tasks

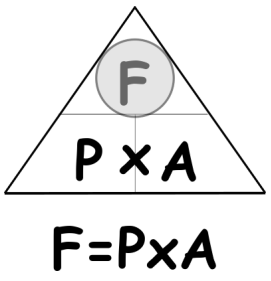
1. Calculate the **pressure** in the table below (divide force by area).

Example	Force (Newtons)	Area (cm^2)	Pressure (N/cm^2)
Knife edge	5	0.02	**250**
Tank tracks	300,000	25,000	**12**
Drawing pin tip	10	0.005	**2000**
Polar Bear's paws	5000	800	**6.25**
Under a **car** tyre	2500	100	**25**
Razor blade	5	0.001	**5000**
A punch	400	30	**13.3**
Pressure of a human bite	500	8	**62.5**



2. Calculate the **force** in the table below for the slightly different examples (multiply pressure by area).

Example	Force (Newtons)	Area (cm^2)	Pressure (N/cm^2)
Knife edge (blunt)	**8**	0.06	133.33
Tank tracks	**250,000**	25,000	10
Drawing pin tip (blunt)	**20**	0.01	2000
Polar Bear's paws (cub)	**625**	100	6.25
Under a **truck** tyre	**7500**	250	30
Razor blade (blunt)	**24**	0.008	3000
A punch	**375**	25	15
Pressure of a human bite	**300**	6	50



3. Complete the gap fill on pressure. Choose from the words below.

The equation for pressure is **force** divided by **area**. This means that for a given **force** the bigger the area the smaller the **pressure** or the smaller the area the **bigger** the pressure. Also for a given area the **bigger** the force the bigger the pressure this will **always** be true. You always hit a nail into wood **sharp** end first. This means that when you hit the nail, the force at the sharp end is **concentrated** on a small area and the high pressure means the nail **penetrates** the wood. The straps on **backpacks** are always wide so the **weight** of the backpack is spread over a **wider** area and the straps don't dig in due to a high pressure.

Questions on Waves and their Properties: Answers

Comprehension

1. When we wave our hands we move them back and forth.
2. Waves on the surface of water are called ripples.
3. When we say waves have common properties we mean things that they all do.
4. The up and down back and forth motion is called an oscillation.
5. Waves can also add together or cancel out.
6. The two types of wave motion are called transverse and longitudinal.
7. Light is a transverse wave and sound is a longitudinal wave.
8. The top of a wave is called the peak.
9. The wavelength is the distance from peak to peak, it is how long one wave is.
10. The distance from the centre line to the peak is called the amplitude.
11. The amplitude tells us about how much energy the wave carries. The bigger the amplitude the more energy the wave carries.
12. Frequency is the number of wavelengths that pass per second, its unit is Hertz.
13. The particles move at right angles to the direction of travel for transverse waves.
14. The higher pressure is caused by the air particles being squashed closer together in a sound wave.
15. An important difference is, transverse waves oscillations are at right angles to wave travel, longitudinal waves, oscillations are parallel to wave travel.
16. Interference is caused by waves meeting.

Additional tasks

1.

Transverse waves where the vibrations are at right angles to wave travel, e.g. light

Amplitude distance from centre line (rest position) to peak or trough

Interference waves adding or cancelling when they meet

Longitudinal waves where the vibrations are parallel to wave travel, e.g. sound.

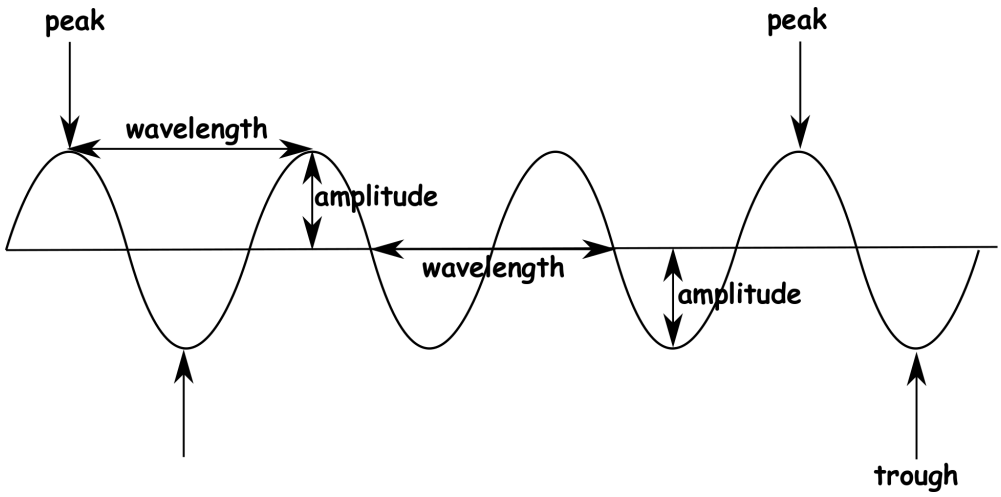
Peak top of the wave

Frequency number of wavelengths that pass per second

Wavelength distance from peak to peak

Trough bottom of the wave

2.



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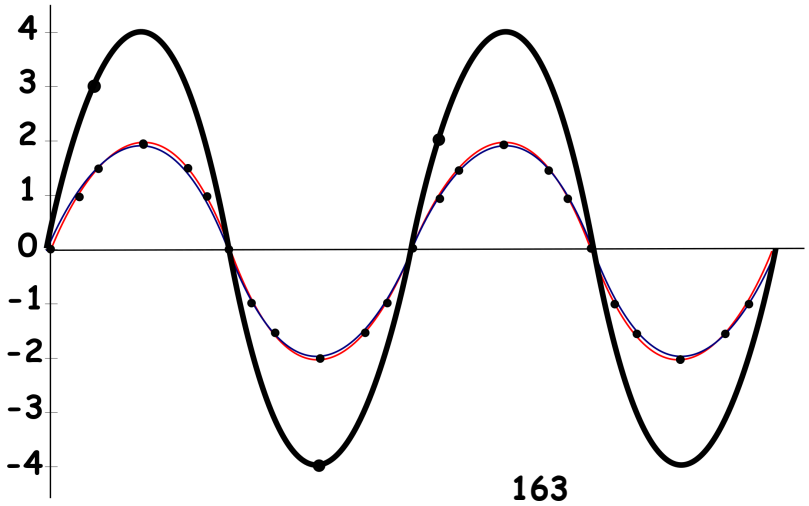


Questions on Sound: Answers

Comprehension

1. Sound is made when something vibrates.
2. The way in which the object vibrates changes the sound we hear.
3. We can describe sounds as being loud or quiet and high or low pitched.
4. Another word for loudness of a sound is volume.
5. Loud sounds carry a lot of energy.
6. Loud sounds can damage our ear drums.
7. The unit for the loudness of sound is the decibel, dB.
8. By high pitched we mean high frequency.
9. Frequency means the number of vibrations per second, the unit is Hertz, Hz.
10. Sound travels by vibrations being passed on to the next particle, then the next particle and so on.
11. By the medium we mean the substance the sound is travelling through.
12. Sound travels fastest in solids because the particles are closer together so the vibrations are passed on quicker.
13. You can't hear the sound when the bell (object) vibrates in a bell jar with no air.
14. The vibrations can't be passed on because there are no particles to pass on the vibrations.

Additional tasks

1.

Frequency the number of vibrations per second
Medium the substance sound travels through
Hertz (Hz) the unit of frequency
Vibration the to and fro or back and forth motion that produces sound
Decibels (dB) the unit for the loudness of sound
Amplitude the size of the vibration

2.

High frequency so high ……. (**ITEPDCH**) (PITCHED)
Also called volume (**OUSLENSD**) (LOUDNESS)
If this is big the sound is loud (**MPDAUIELT**) (AMPLITUDE)
What sound travels through (**MDMEUI**) (MEDIUM)
The study of sound (**COCAISSUT**) (ACOUSTICS)
The unit of frequency **(THZER**) (HERTZ)
This produces sound (**IBOVIANRT**) (VIBRATION)
Sound can't travel through this (**VCMAUU**) (VACUUM)
Unit of loudness (**ECLDEBSI**) (DECIBEL)
This causes low pitched sounds (**OFNLEQYWUREC**) (LOW FREQUENCY)
This causes high pitched sounds (**IHNHEEYGUFRQC**) (HIGH FREQUENCY)
A bass drum produces this sort of sound (**OPELHTDWCI**) (LOW PITCHED)
Sound travels fastest in (**SLSODI**) (SOLIDS)
The number of vibrations per second (**RECFNUYQE**) (FREQUENCY)

3.

An erupting volcano **(loud and low)**

- Squeaky brakes **(loud and high)**
- The wind rustling leaves **(quiet and low)**
- A lion's raw **(loud and low)**
- A female opera singer **(loud and high)**
- A referee's whistle **(loud and high)**
- Drilling a hole in the wall **(loud and lowish)**
- A honey bee hovering **(quiet and lowish)**

4.

Sound travelling through treacle **(in-between)**
Sound travelling through a helium balloon **(slowest)**
Sound travelling through the ground **(fastest)**

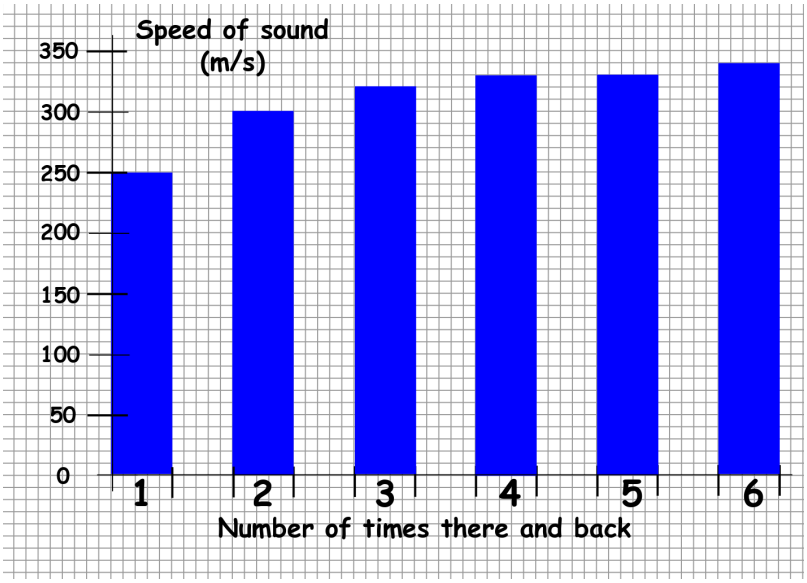
Questions on Picturing Sound: Answers

Comprehension

1. As the sound wave travels outwards, no particles move from place to place.
2. A sound wave is a longitudinal wave.
3. We can detect the vibrations of a sound wave using a microphone.
4. Microphones convert sound waves into electrical signals.
5. We can display sound waves on an oscilloscope.
6. We can tell a sound is loud on an oscilloscope by how high the trace is (higher is louder).
7. The tops of the waves are close together for high pitched sounds.
8. If the pitch is high the frequency is high.
9. It means the sound is low pitched if the peaks of the wave are more spread out.
10. When sound waves bounce off an object we call it an echo.
11. You hear an echo 2 seconds later, because it takes the sound 1 second to get to the wall and 1 second to get back.
12. Some of the sound's energy passes through the walls so the person inside hears it.

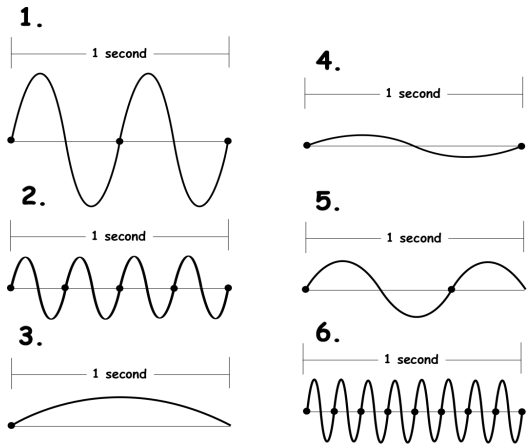
Additional tasks

1.

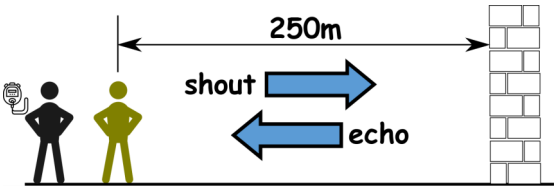


2 a.

Wave number	Frequency (waves per second, Hz)
1	2
2	4
3	0.5
4	1
5	1.5
6	8



2b. **highest pitch = 6**
lowest pitch = 3
loudest = 1
quietest = 4



3. • What to change? What to keep the same? What to measure?

Put the buzzer in the box and turn on. Connect the microphone to the oscilloscope place the microphone at a fixed (keep the same) distance from the buzzer and measure the height of the trace (amplitude). Repeat this method adding a layer of cotton wool at a time and measuring the amplitude (height of trace) for each number of layers.

Questions on Hearing and Using Sound: Answers

Comprehension

1. The two main ways to detect sound are: using ours ear or a microphone.
2. Both methods convert the energy of the sound wave into an electrical signal.
3. The pinna helps direct the sound down the ear canal.
4. The ear drum is like a thin piece of skin.
5. The sound wave pushes the ear drum back and forth (makes it vibrate).
6. The ossicles are the three tiny bones in the ear, also called the hammer, anvil and stirrup.
7. The bones act as levers to amplify the vibrations.
8. The cochlea contains a liquid and has tiny hairs inside.
9. The electrical impulses travel along the auditory nerve to reach the brain.
10. Range means the distance from highest to lowest.
11. The large hearing range of a moth helps it evade its predator the bat.
12. Frequencies above 20,000Hz are called ultrasound.
13. Bats use ultrasound for echolocation to find their prey.
14. Bats know the prey is close if the echo time is short.
15. Different echo times are used to build a picture of the baby in an ultrasound scan.
16. Physiotherapists use ultrasound because the vibrations pass deep into the flesh which improves circulation for healing.

Additional tasks

2. Complete the gap fill on echolocation.

echolocation, hear, emitting, echo, frequency, closer, Longer, 20,000Hz

Ultrasound is sound of **frequency** above **20,000Hz** . Humans can't **hear** ultrasound.

Bats, dolphins, submarines and ships use ultrasound for **echolocation**.

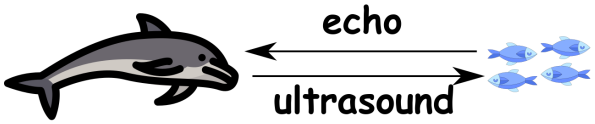
This means **emitting** ultrasound and listening for how long it takes the **echo** to return.

Shorter echo times mean an object is **closer**. **Longer** echo times means an object is further away.

3. The speed of sound in water is **1500m/s,** this means that an object 1500 metres away will have an echo time of 2 seconds. One second for the sound to get there and one second for the sound to get back. In each of the examples in the table calculate the **distance** to the object. Use the example below. Reminder, the speed of sound in water is **1500m/s**.

EXAMPLE

echo time = 4 seconds



distance to fish = speed x (echo time/2)
= 1500 x 4/2
= 3000m

Example	Echo time (seconds)	Distance (m)
A bat hunting moths **Speed of sound in air = 340 m/s**	0.2	**34**
A Ship testing the depth of water	0.6	**450**
A whale hunting squid	8	**6000**
A submarine detecting a ship	6	**4500**
A dolphin hunting a shoal of herring	1	**750**

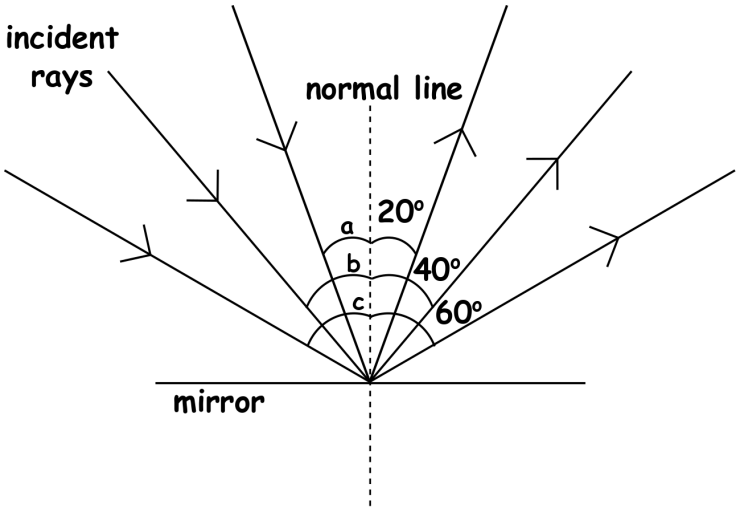
Questions on Light and Reflection: Answers

Comprehension

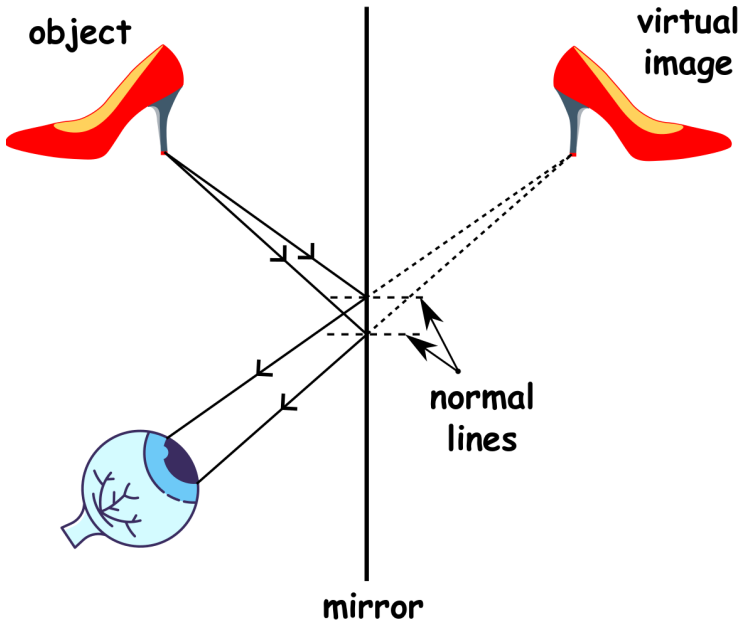
1. Light travels as a wave.
2. To investigate light we use a thin beam called a ray.
3. Light travels 186,000 miles in one second.
4. We call a material that light passes through transparent.
5. Light can partially pass through a translucent material.
6. The law of reflection tells us the way in which light bounces off a substance.
7. We use a ray of light and a mirror to show this.
8. The angle of **incidence** is **equal to** the angle of **reflection**.
9. The normal line is a dashed line at right angles to the surface to measure angles from.
10. The law of reflection is true for all surfaces.
11. To see an object light must travel from the source, reflect off the object and enter our eyes.
12. Light reflects of the spot and travels in all directions.
13. We use two rays to show the image produced.
14. Our brains have learned to form images from light that has travelled in a straight line.
15. The image appears to be the same distance behind the mirror as the object is in front.

Additional tasks

1.



2. Complete the ray diagram (as shown opposite) to show how a virtual image of the stiletto heel is formed.



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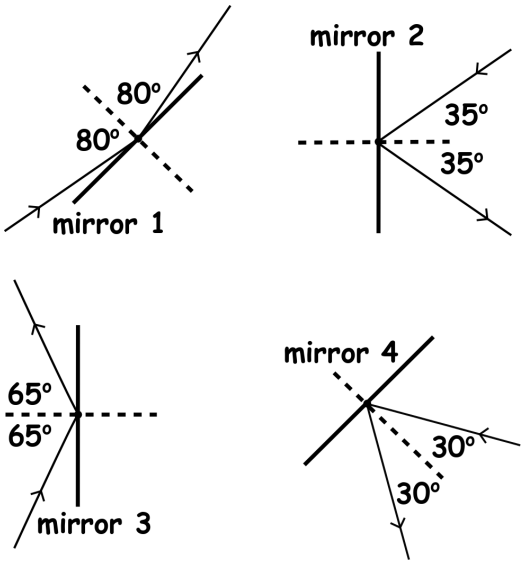

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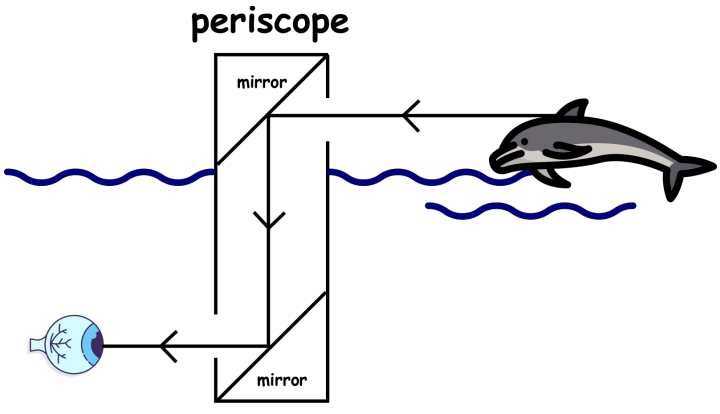


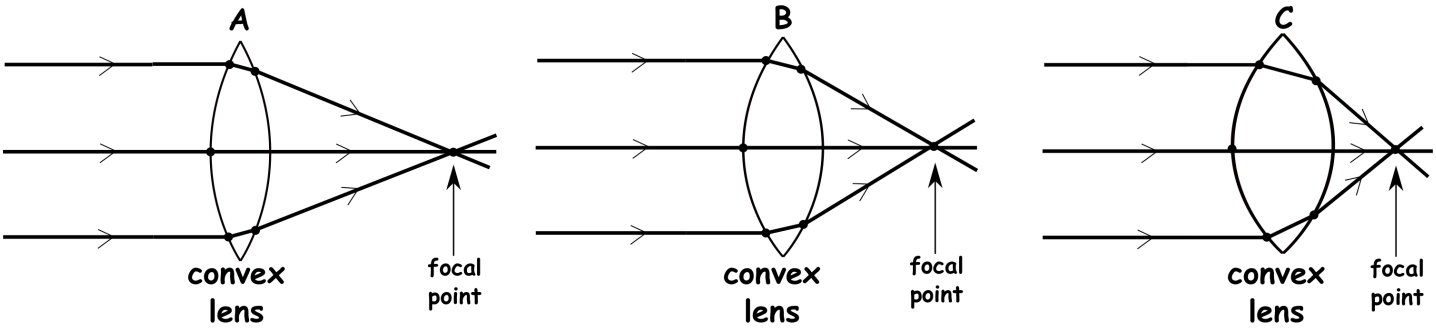
Questions on Refraction, Lenses and the Eye: Answers

Comprehension

1. They transfer energy by making the substance they travel through vibrate.
2. Light doesn't need anything (a medium) to travel through.
3. Another word for the emptiness of space is a vacuum.
4. Hitting earth's atmosphere from space, light slows down a tiny bit.
5. The slowing down of light can cause a change in direction.
6. The change in direction is called refraction.
7. If light hits the block head on it doesn't change direction.
8. It takes a new path closer to the normal line.
9. When leaving the glass block light's new path is further away from the normal line.
10. Your eye has a convex lens which is able to focus light to form an image.
11. Parallel rays of light pass through the focal point after the lens.
12. Myopia is shortsightedness.
13. Myopia can be corrected using a concave lens.
14. A diverging lens makes the light rays move apart.
15. Refraction can cause object to seem to be in a different position.

Additional tasks

1. Complete the ray diagrams below by 'joining the dots'. **A**, **B** and **C** show how the focal point changes with lens thickness.



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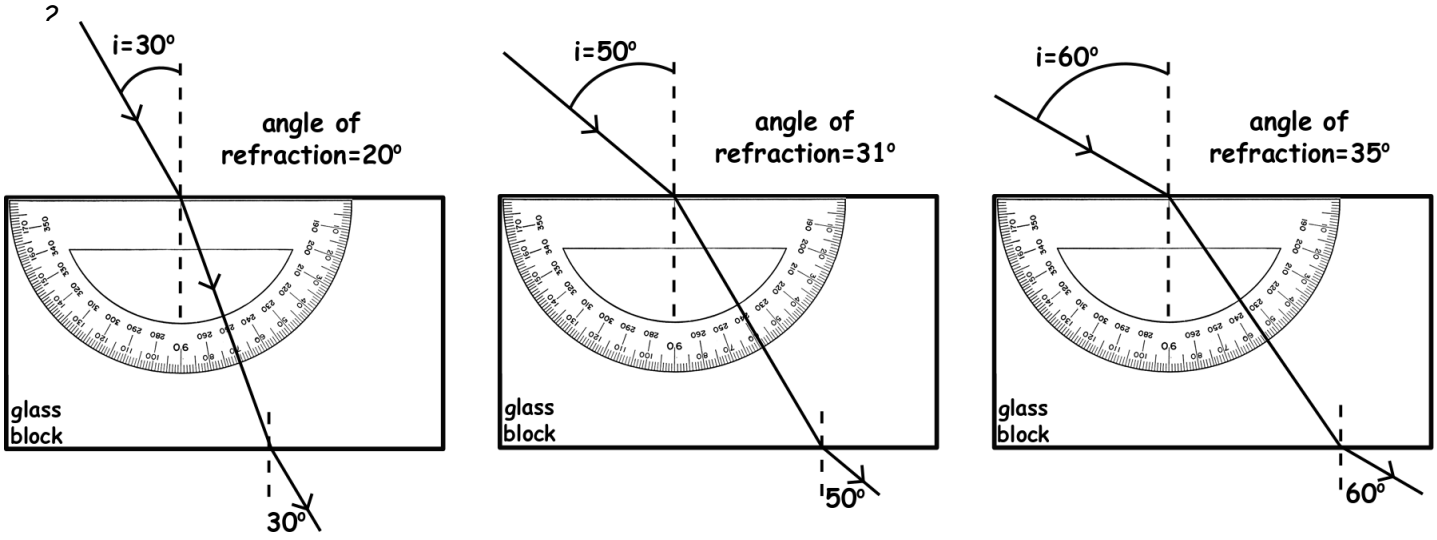

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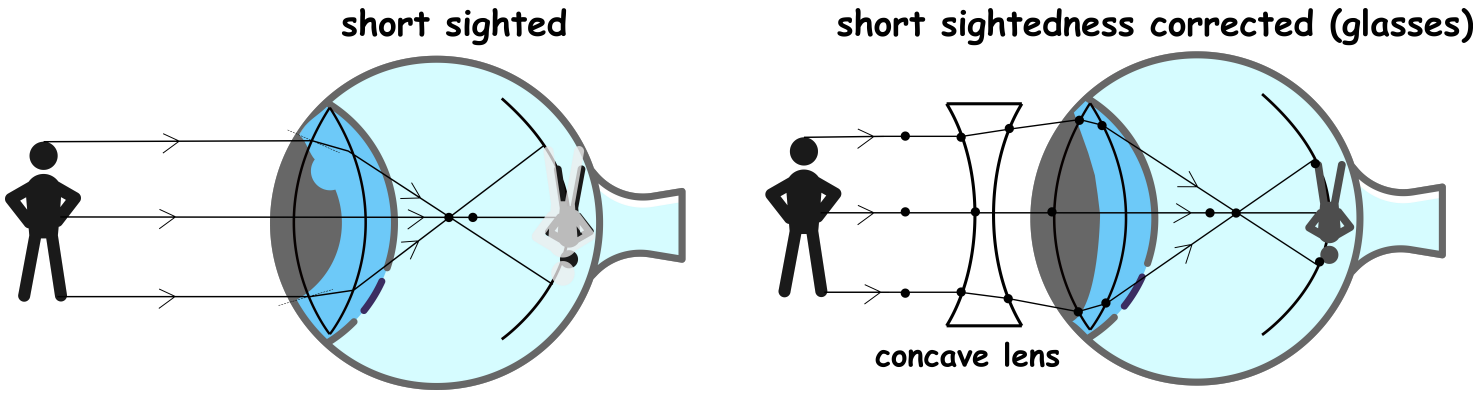


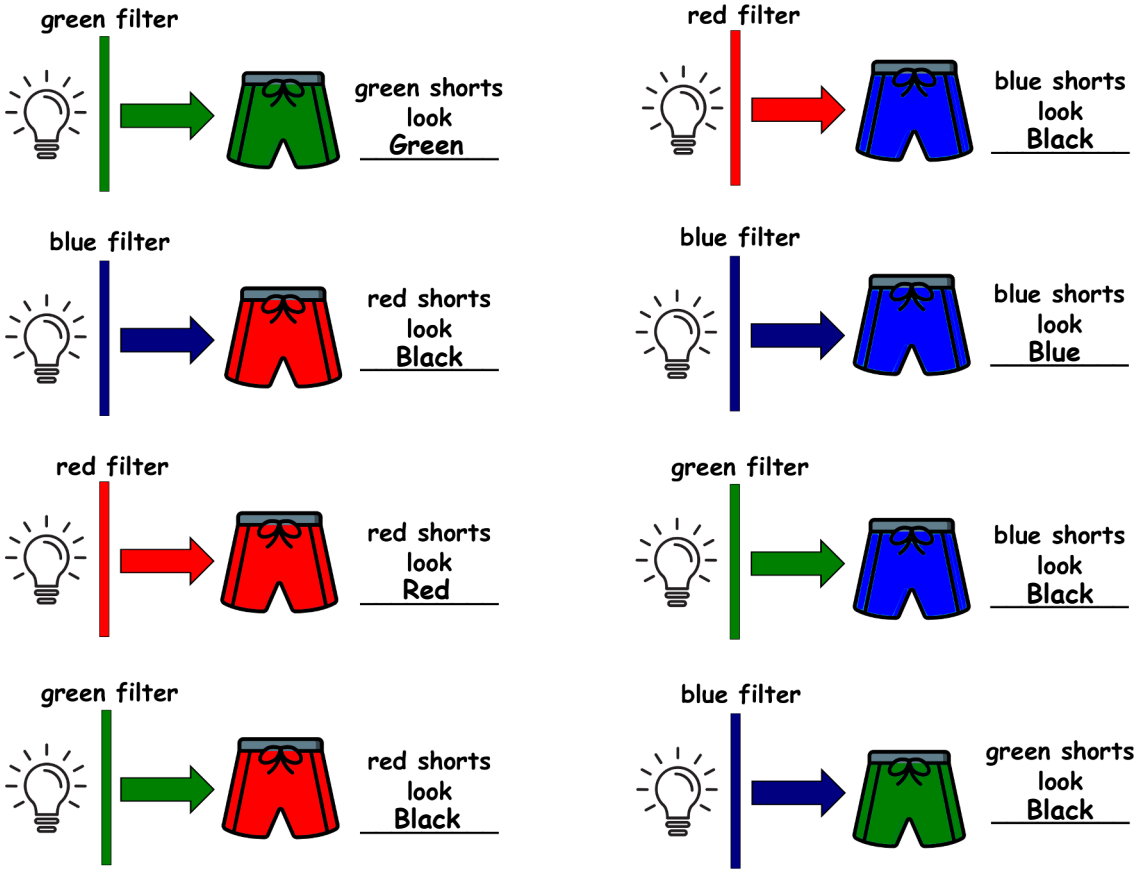
Questions on Dispersion and Colour: Answers

Comprehension

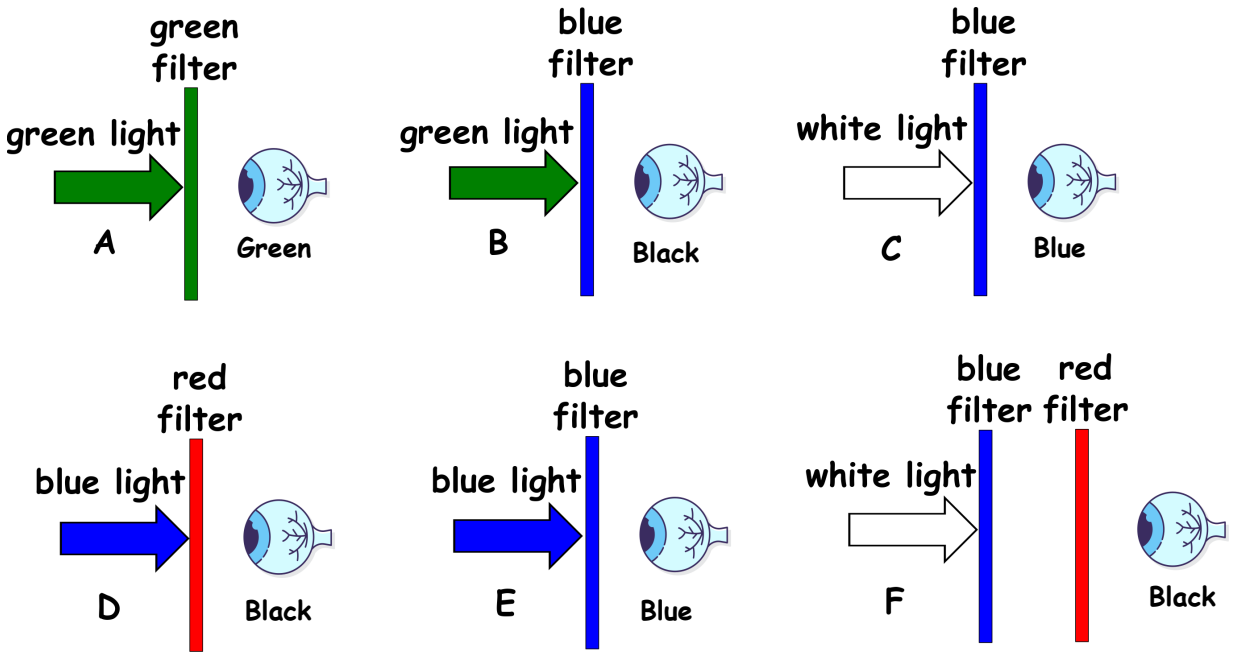
1. Rainbows show us that sunlight must contain many different colours.
2. Light that contains all the colours of the visible spectrum is called white light.
3. ROY G BIV is a useful memory aid (Red, Orange, Yellow, Green, Blue, Indigo and Violet).
4. He placed a prism in the path of the light ray.
5. Using another prism the spectrum can be recombined to produce white light.
6. Dispersion happens because different colours of light are refracted different amounts.
7. An object looks a particular colour because it reflects that colour (wavelength) of light.
8. A red T-shirt absorbs all other colours apart from red.
9. The socks look white because they reflect all wavelengths of light.
10. Objects look black because they absorb all wavelengths.
11. A green filter allows green light through.
12. Green shorts look black under blue light because they absorb blue.

Additional tasks

1.



2.



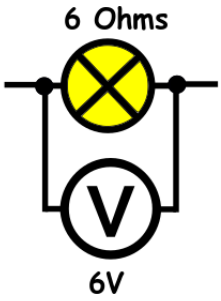
Questions on Electric Circuits: Answers

Comprehension

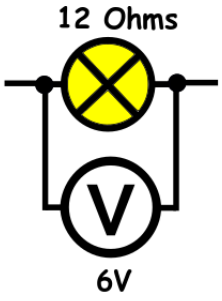
1. Electric circuits allow energy to be transferred from the source to the appliance.
2. Electricity is so useful because it can be transformed into many other forms of energy.
3. Electricity can increase a chemical energy store when recharging a battery.
4. Electrons need a push to get them moving.
5. The flow of electrons is like water in a pipe.
6. Another name for voltage is potential difference.
7. Voltage tells us the amount of push or energy the electrons are given.
8. The unit of voltage is the volt and we measure it with a voltmeter.
9. A current is the flow of charge.
10. The size of a current tells us how much charge has passed in one second.
11. The current carries energy.
12. The unit for current is the amp, it is measured using an ammeter.
13. Resistance tells us how easy or difficult it is for current to flow.
14. The unit for resistance is the ohm, the symbol is capital R.
15. A voltmeter has a very high resistance.
16. Increasing the resistance reduces the size of the current.

Additional tasks

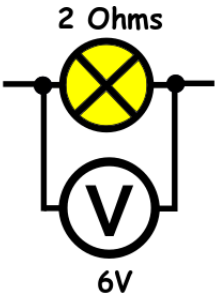
1. Use current = voltage ÷ resistance to calculate the current in each case.



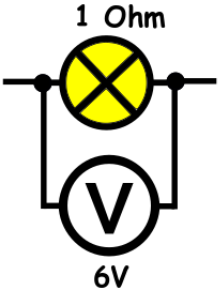
I = 6 ÷ 6 = 1.0A



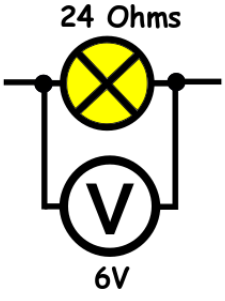
I = 6 ÷ 12 = 0.5A



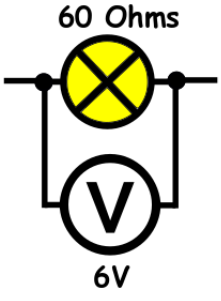
I = 6 ÷ 2 = 3.0A



I = 6 ÷ 1 = 6.0A



I =6 ÷ 24 = 0.25A



I = 6 ÷ 60 = 0.1A

2. Complete the gap fill below.

Choose from the words; **bigger, fixed, smaller, bigger, inversely, smaller**

If the voltage has a **fixed** value then as the resistance gets **smaller**, the current gets **bigger**. Or as the resistance gets **bigger**, the current gets **smaller**.
This relationship is called being **inversely** proportional.

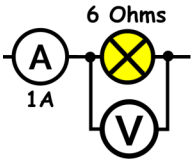
Questions on Series Circuits: Answers

Comprehension

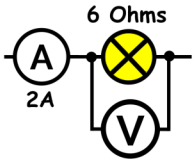
1. Series means one after the other.
2. There are four important facts to learn about series circuits.
3. The voltage in series circuit is shared between the components.
4. An ammeter can be connected before, after or in-between the components (always 'in series').
5. Voltmeters are always connected in parallel.
6. No current flows in circuit 1 because it is incomplete.
7. There is only one bulb so it gets all the voltage/ energy from the battery.
8. It is twice as hard for the current to flow inc circuit 3 compared to circuit 2.
9. In circuit 3 the energy/voltage is shared between two bulbs.
10. The total resistance of circuit 4 is 18 ohms.

Additional tasks

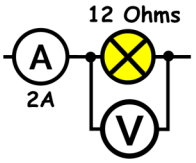
1. Calculate the voltage across the bulbs below (multiply current by resistance).



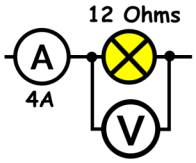
V =1 x 6 = 6V



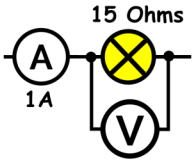
V = 2 x 6 = 12V



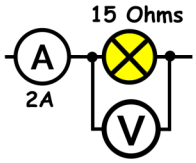
V =2 x 12 = 24V



V = 4 x 12 = 48V

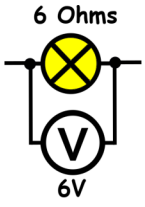


V =1 x 15 = 15V

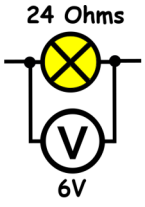


V = 2 x 15 = 30V

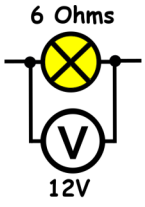
2. Calculate the current through the bulbs below (divide voltage by resistance).



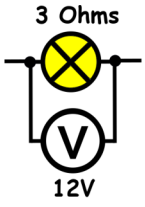
I =6 ÷ 6 = 1A



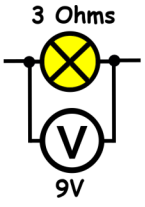
I =6 ÷ 24 = 0.25A



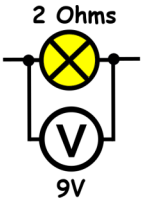
I = 12 ÷ 6 = 2A



I = 12 ÷ 3 = 4A

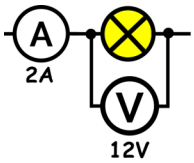


I = 9 ÷ 3 = 3A

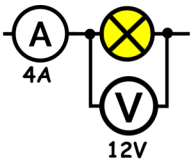


I = 9 ÷ 2 = 4.5A

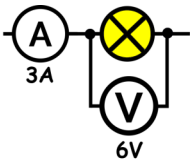
3. Calculate the resistance of the bulbs below (divide voltage by current).



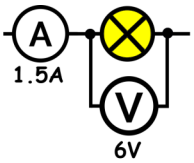
R =12 ÷ 2 = 6 Ohms



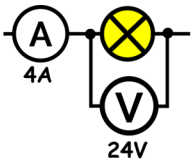
R =12 ÷ 4 = 3 Ohms



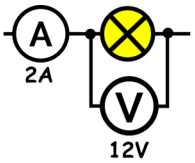
R = 6 ÷3 = 2 Ohms



R = 6 ÷3 = 4 Ohms



R = 24 ÷ 4 = 6 Ohms



R = 12 ÷ 2 = 6 Ohms

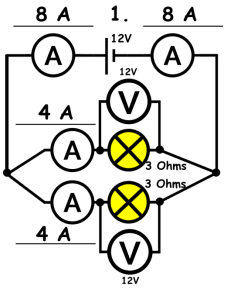
Questions on Parallel Circuits: Answers

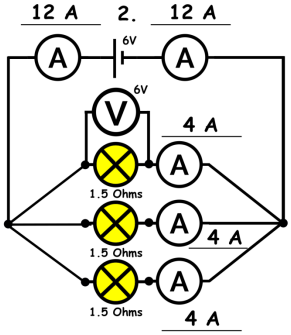
Comprehension

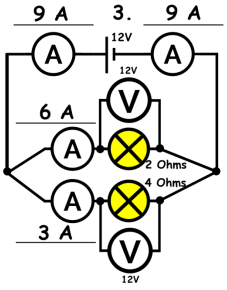
1. What makes parallel circuits different is that they have junctions.
2. This means that the current can split and flow along a different branch.
3. This is just like arriving at a 'T' junction in a car, you can take the left or right path.
4. More paths (branches) make it easier for the current to flow.
5. The total current is the sum of the current flowing along all branches.
6. The voltage across each branch is the same so we know it is 6V.
7. The total current is the sum of the branches, 2 + 2 = 4 amps.
8. Circuit 2 has **three** branches, each with 2 amps rather than **two** branches with 2 amps.
9. The 1.5 ohm bulb's current is: I = V/R = 6/1.5 = 4.0 amps. **Or** The 1.5 ohm bulb has has half the resistance of the 3.0 ohm bulb so it has twice the current.
10. Dividing voltage by total current tells us the total resistance of the circuit.

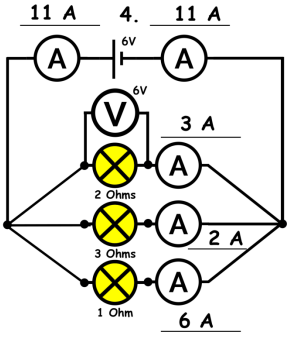
Additional tasks

1.

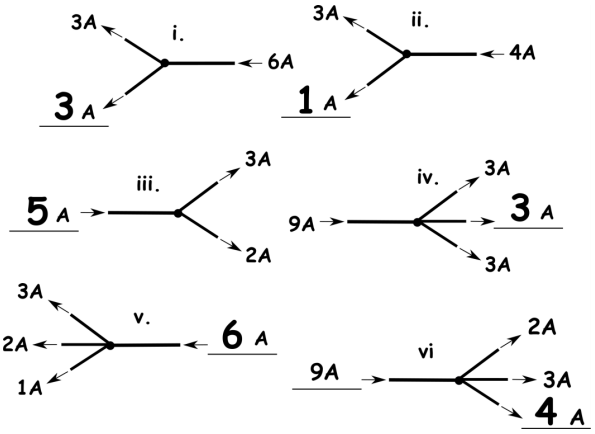




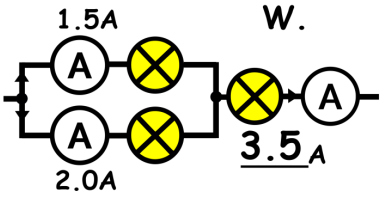


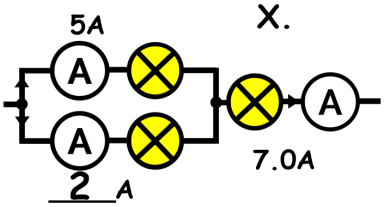


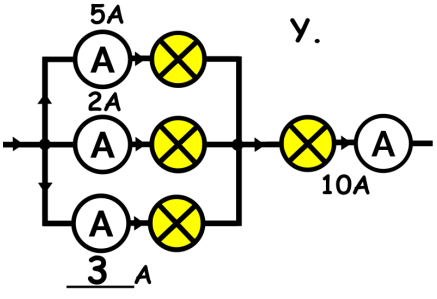
2. Use the fact that the current into and out of a junction is the same to write down the missing currents in **i**, **ii**, **iii** , **iv**, **v** and **vi** below.

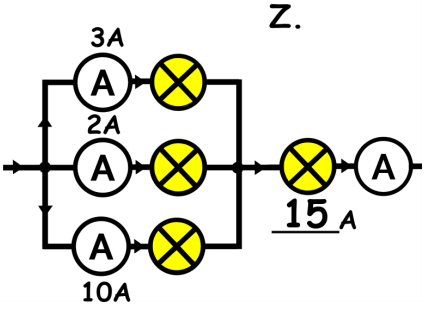


3 a.









b. **Top bulb. Both bulbs have the same voltage because they are in parallel but the top bulb has the smallest current so must have a higher resistance.**

c. **Bottom bulb for the same reason as the answer to b.**

Questions on Electric Fields: Answers

Comprehension

1. Electric charges have electric fields around them.
2. If a charge enters another electric field it experiences a force.
3. This can happen when charges are close enough to enter each others electric fields.
4. The diagram shows that when charges are in electric fields they experience a force.
5. The forces electric fields exert are non-contact.
6. The KG mass experiencing the pull of gravity is just like charges experiencing the force of an electric field.
7. Oppositely charged particles attract each other.
8. Electric field lines point outwards for positive charges.
9. Strong electric fields can make lightning.
10. Rain and ice crystals bumping into each other can build up charge in clouds.
11. Air doesn't normally conduct electricity.
12. Thunder is the noise of the lightning spark.

Additional tasks

1. Choose from the words below to match to the statements.

Electric fields, attract, gravitational fields, repel, magnetic fields, air

Normally doesn't conduct **air**

Opposite charges **attract**

Magnetic materials experience forces in **magnetic fields**

Alike charges **repel**

Charges experience forces in **electric fields**

Masses experience forces in **gravitational fields**

2. Underneath each of the charges write down whether they will attract or repel.

attract **repel** **repel** **attract** **repel** **attract**

3. Complete the gap fill. Choose from the words below.

balloons, repel, force, close, electric, attract, field, atoms, inwards, inside, static, stands, electric, outwards

All charges have **electric** fields around them. The electric field lines point **outwards** for positive charges and **inwards** for negative charges. If a charge is **inside** another electric field (not its own), then it experiences a **force**. If two charges are **close** enough they experience the force of each other's electric field. This means two close positive charges will repel and two close negative charges will **repel**. Close positive and negative charges will **attract** when in each other's electric **field**. It is the force from electric fields that holds **atoms** and molecules together so it also holds us together! Electric fields are responsible for the effects of **static** electricity, when your hair **stands** on end, getting an **electric** shock and sticking **balloons** to walls.

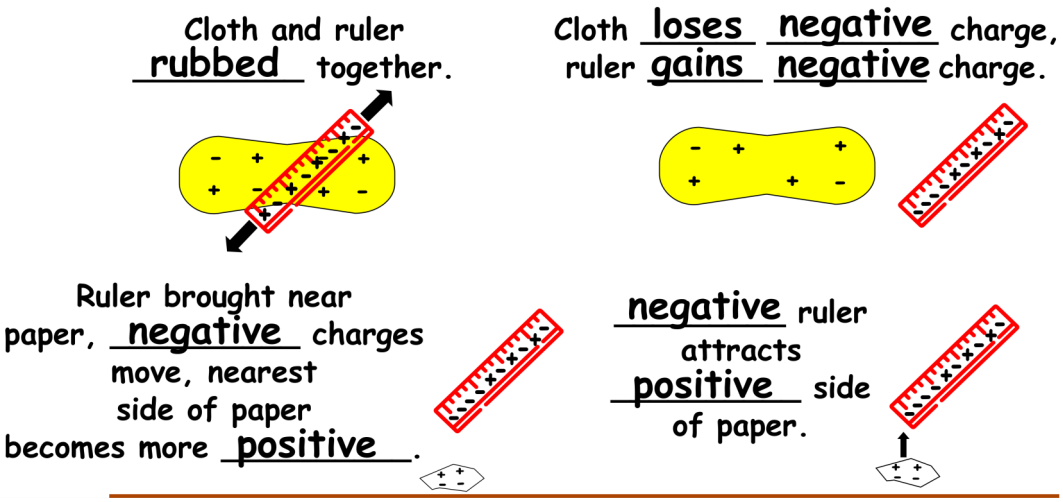
Questions on Static Electricity

Comprehension

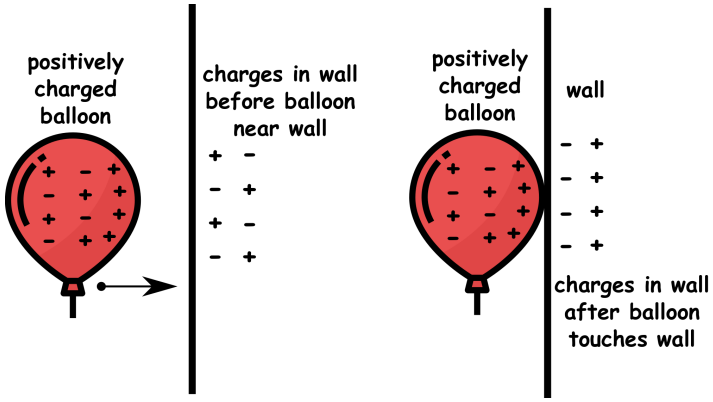
1. You might get a shock off a car door, taking off a jumper or touching someone else.
2. The negative charges that atoms have are called electrons.
3. Electrons can move from one object to another.
4. This effect can be increased using friction.
5. An object becomes positive after losing electrons, because it has more positive than negative charge.
6. The cloth gains negative charge when rubbed with the ruler.
7. When the positive ruler is brought near to the paper, the negative charges move (nearest side of paper becomes negative).
8. As the charge on an object increases, the voltage of the object increases.
9. If the voltage of the car becomes large enough, when we touch the car we can get a shock.
10. When we touch the car we create a path for the excess charge to flow down to earth.
11. As the charge flows through us we get an electric shock.
12. A Van de Graaff generator makes it possible to build up a large amount of charge on a metal dome.
13. Standing on an insulator a touching the dome means the charge builds up on your body.
14. Strands of hair gain the same charge so are repelled away from each other and away from your head.

Additional tasks

1.



2.



3. Complete the gap fill below explaining how an **electrostatic air cleaner** works.

Choose from the words in bold and look at the diagram to help.

negatively, dust, positive, Clean, brushing, charged, attracted, stick, lose

Dirty air containing **dust** particles is blown over a **positive** grill. This makes the neutral dust particles positive because they **lose** electrons. The now positively **charged** dust particles pass between **negatively** charged plates. The positive dust particles are **attracted** to the negative plates and **stick** to them. **Clean** air leaves the other end of the air cleaner. The plates can be taken out and cleaned by **brushing** the dust off.

Questions on Magnetic Fields: Answers

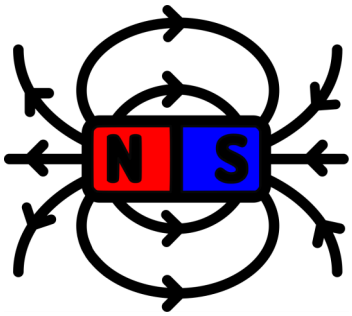
Comprehension

1. It's lucky for us that earth has a giant magnetic field.
2. The three magnetic metals are iron, nickel and cobalt.
3. A nice way to observe the magnetic field around a bar magnet is to use plotting compasses at different positions.
4. The magnetic field lines continue to run through the magnet.
5. If you cut a magnet in half you have a new north and south pole.
6. The magnetic field lines leave the north pole and curl around to enter the south pole.
7. Like poles repel and opposites attract.
8. When a north and south pole come together they form on new longer magnet.
9. An iron paper clip is not normally magnetic.
10. The paper clip becomes an induced magnet when picked up with a permanent magnet.
11. The earth's magnetic field comes from earth's core.
12. The needle of a plotting compass lines up with earth's magnetic field.

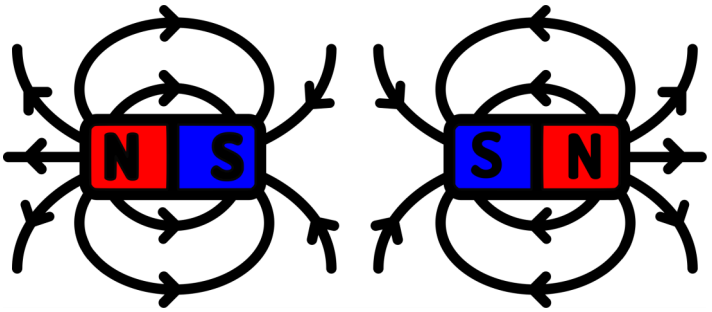
Additional tasks

1.

MAGNET ON ITS OWN



TWO MAGNETS REPELLING



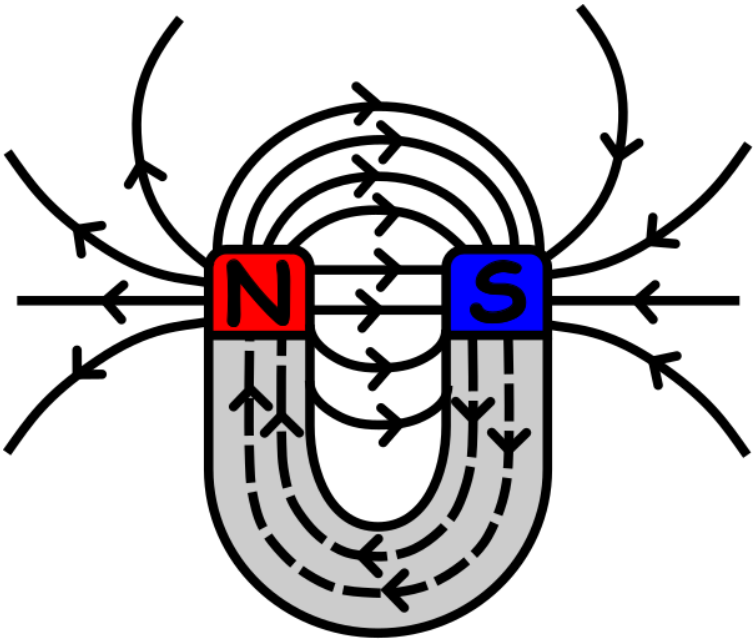
2. Write underneath the magnets below whether they will attract or repel.

attract **repel** **repel** **repel** **attract** **attract** **repel**

3.

Item	Can pick up?
Paper clip	**yes**
Plastic ruler	**no**
Permanent magnet	**yes**
Rubber	**no**
Nickel coin	**yes**
Paper	**no**
Iron nail	**yes**
Plotting compass	**yes**
Aluminium Can	**no**
Chewing gum	**no**
Piece of wood	**no**
Cobalt cube	**yes**

4.



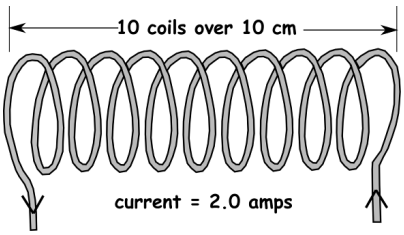
Questions on Electromagnetism: Answers

Comprehension

1. An electric current also produces a magnetic field.
2. The magnetic field produced by an electric current can be turned on or off.
3. A straight wire carrying a current produces a circular magnetic field.
4. A loop of wire produces a magnetic field like a bar magnet.
5. The magnetic field of a solenoid looks just like a bar magnet.
6. Increasing the current makes the magnetic field of a solenoid stronger.
7. If we add an iron core to a solenoid we make an electromagnet.
8. Electromagnets can be made strong enough to pick up cars.
9. Electromagnets are used in circuit breakers.
10. Electric motors convert the energy carried by an electric current into kinetic energy.
11. When a current passes through the coil of a motor, one end becomes a north pole and the other end a south pole.
12. The split in the ring briefly stops the current so the coil keeps moving.

Additional tasks

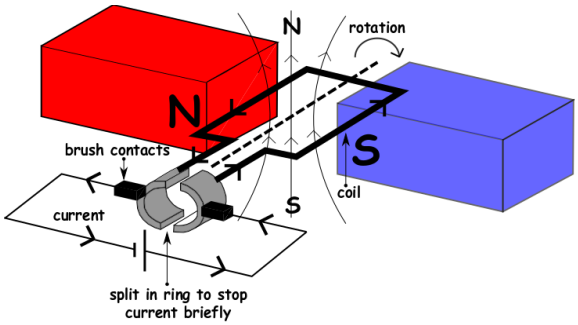
1.



Coils	Current	Magnetic field Stronger/ Weaker/ Same
10 coils over 10cm	3.0 amps	**Stronger**
20 coils over 20cm	2.0 amps	**Same**
5 coils over 10cm	2.0 amps	**Weaker**
10 coils over 10cm	0.5 amps	**Weaker**
40 coils over 10cm	2.0 amps	**Stronger**
20 coils over 10cm	2.5 amps	**Stronger**
6 coils over 10cm	1.0 amp	**Weaker**

3.

Magnets' position	Current	Faster/ Slower/Same	Same way/ Other way
same as above	**smaller** than above **same direction**	**Slower**	**Same way**
north south swapped over	**same size** as above **same direction**	**Same speed**	**Other way**
same as above	**bigger** than above **same direction**	**Faster**	**Same way**
same as above	**bigger** than above **opposite direction**	**Faster**	**Other way**
north south swapped over	**bigger** than above **same direction**	**Faster**	**Other way**
north south swapped over	**same size** as above **opposite direction**	**Same speed**	**Same way**



2.

A speaker works because an electric current makes a **magnetic** field. Two magnetic fields can exert **forces** on each other. The coil of a loudspeaker is connected to the **output** of a source like a **phone** jack. This forces a **current** to flow in the speaker **coil** that changes **direction**. The current in the coil makes a **magnetic** field. As the current flows back and forth, the permanent magnet of the loudspeaker pushes or **pulls** on the magnetic **field** from the coil as it **changes**. This forces the speaker to **vibrate** to and fro in time with the music. This produces the sound we hear.

Questions on The Day, the Year and the Seasons

Comprehension

1. About 4.5 billion years ago the earth was hit by a huge rock.
2. The earth's tilt causes our seasons.
3. It takes the earth one day (24hrs) to spin round once.
4. When our 'bit' of the earth is is facing away from the sun it is night time.
5. The pull of the sun's gravity keeps the earth in its orbit.
6. An ellipse is a squashed circle shape.
7. It takes earth 365 and 1/4 days to orbit the sun.
8. The northern hemisphere is tilted towards the sun during the summer.
9. In the northern hemisphere, the torches show that in winter, the same amount of light from the sun is spread over a larger area.
10. In the southern hemisphere in summer the same amount of light is concentrated on a smaller area, it is warmer.
11. During the summer the sun's path is more directly overhead.
12. Looking from above the north poles, the earth rotates anticlockwise.
13. The sun always rises in the east and sets in the west.
14. At the north pole in winter, you can't see the sun (it doesn't rise above the horizon).

Additional tasks

1.

Northern hemisphere the half of earth north of (above) the equator **Southern hemisphere** the half of earth south of (below) the equator

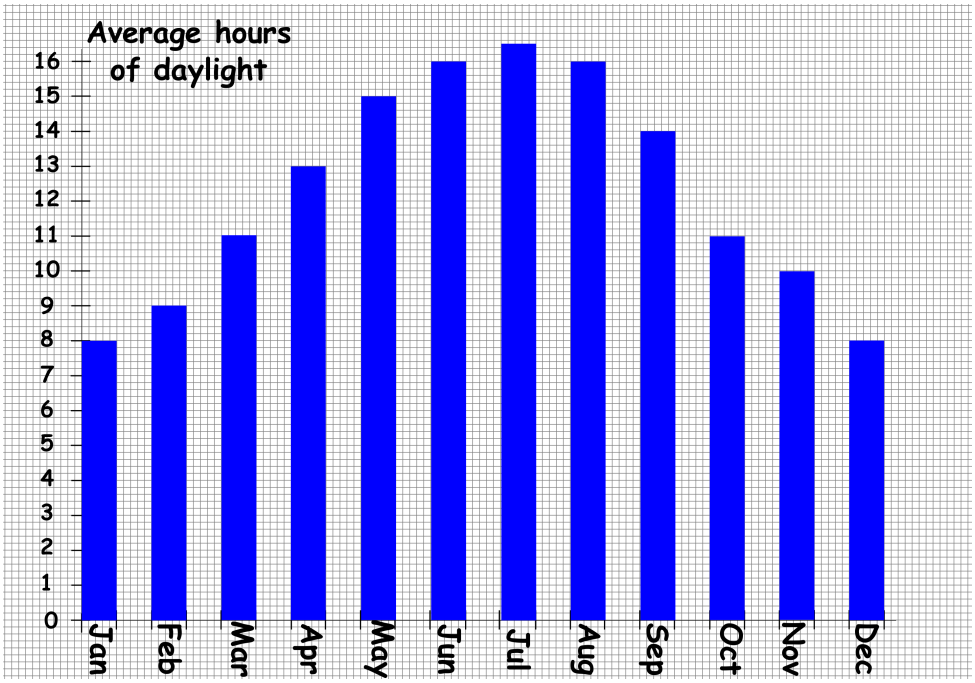
Leap year every fourth year in which an extra day is added to February because the earth takes 365 and 1/4 days to orbit the sun not 365

Equinox spring 21st March and autumn 22nd September, when **day** and **night** are **equal** length (12hrs of day and 12hrs of night)

Solstice summer solstice is the **longest day**, 21st June.
winter solstice is the **shortest day**, 21st December

Equator an imaginary line drawn around the centre of earth half way between the north and south pole

2.



3. Match the statements to the correct answers.

	Answers
When it's summer in the northern hemisphere	**it's winter in the southern hemisphere**
The sun is lower in the sky during	**winter**
The angle of the earth's tilt is	**23.5°**
In one day the earth rotates	**360°**
When it's winter in the northern hemisphere	**it's summer in the southern hemisphere**
The sun is more directly overhead during	**summer**

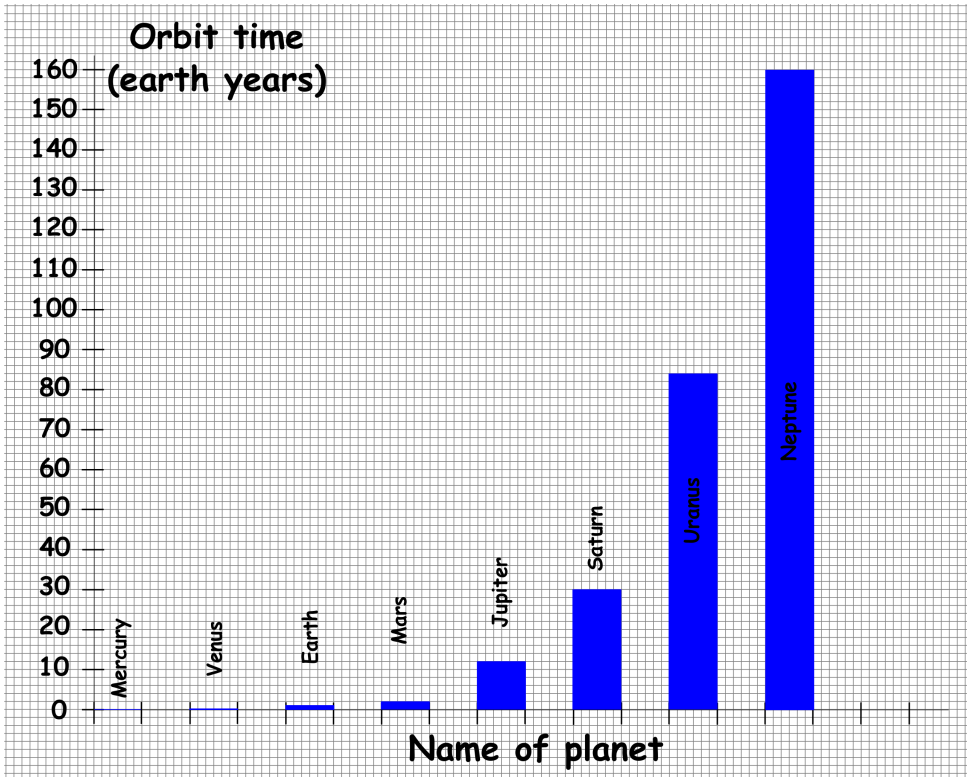
Questions on Our Solar System, Galaxies and the Universe: Answers

Comprehension

1. At the centre of our solar system is a star called the sun.
2. The sun's gravity is strong enough to keep the planets in their orbits because it is so massive.
3. The shape of the planets' orbits are elliptical.
4. A satellite is a smaller object in orbit around a larger object.
5. As you move further away from the sun it takes longer to orbit.
6. My very easy method just speeds up naming planets. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.
7. The galaxy we are in is called the Milky Way.
8. Our galaxy gets its name from the milky band of light we can see across the night sky.
9. There are around 250 billion stars in the Milky Way.
10. A light year is how far light travels in one year. It is a measure of distance.
11. Our nearest major galaxy is called Andromeda.
12. The universe is all known space and matter.

Additional tasks

1.



2. Put the following objects in order of size starting with smallest first.

INTERNATIONAL SPACE STATION, THE MOON, THE EARTH, JUPITER, THE SUN, OUR SOLAR SYSTEM, THE MILKYWAY GALAXY, THE UNIVERSE

3. Write **true** or **false** next to the following statements to do with space.

A light year is a measurement of speed (**false**) The milky way doesn't rotate (**false**)
There are only a few manmade satellites orbiting earth (**false**) The sun is a star (**true**)
There has been a manned mission to Mars (**false**) No one lives in the space station (**false**)
Our nearest star is Alpha Centauri (**true**) The moon has no air on it (**true**)
Andromeda's our nearest galaxy (**true**) There are billions of galaxies in the universe (**true**)
Pluto is classed as a dwarf planet (**true**) An ellipse is like a squashed circle (**true**)
It takes 365 days for earth to orbit the sun (**false**) Venus is closest to the sun (**false**)
Scientists don't know what most of the universe is made from (**true**)