Sc

KEY STAGE
3

TIER
5–7

2009

Science test

# Paper 2

First name _____

Last name _____

School _____

## Remember

- The test is 1 hour long.
- You will need: pen, pencil, rubber, ruler, protractor and calculator.
- The test starts with easier questions.
- Try to answer all of the questions.
- The number of marks available for each question is given below the mark boxes in the margin. You should not write in this margin.
- Do not use any rough paper.
- Check your work carefully.
- Ask your teacher if you are not sure what to do.

| TOTAL MARKS | |
|---|---|

1. Nancy is a dancer.



(a) When Nancy dances her arms and legs are moved by pairs of antagonistic muscles.

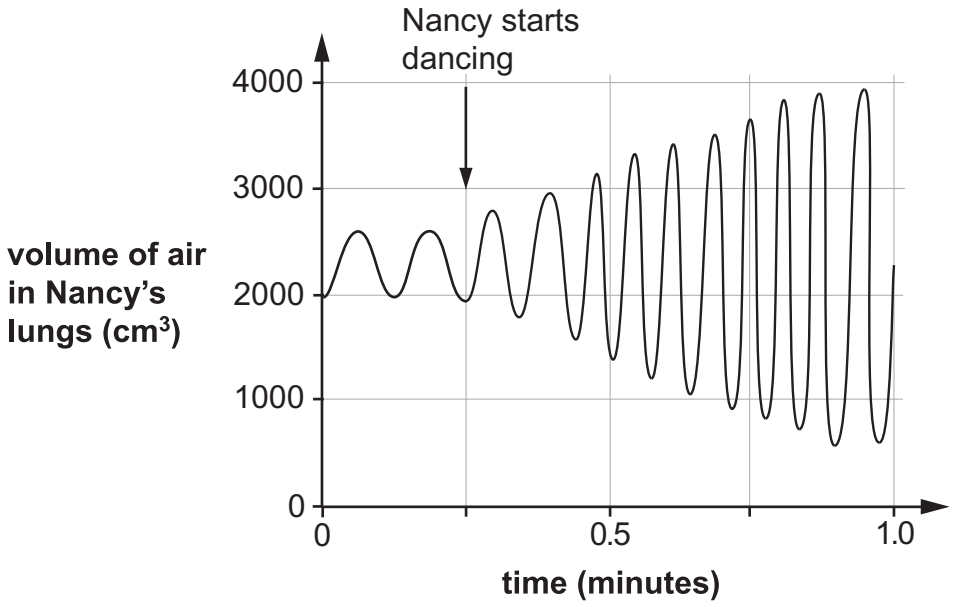
How do antagonistic muscle pairs work?
Tick the correct box.

| | |
|---|---|
| Both muscles contract at the same time. | ☐ |
| One muscle is big and the other is small. | ☐ |
| As one muscle contracts, the other relaxes. | ☐ |
| One muscle is strong and the other is weak. | ☐ |
| Both muscles relax at the same time. | ☐ |

☐ 1a

1 mark

(b) As Nancy dances her breathing changes because she needs more oxygen. The graph below shows how the volume of air in her lungs changes when she dances.




From the graph, give **two** ways her breathing changes when she dances.

1. _____

2. _____

1b
1 mark

1b
1 mark

(c) Nancy's muscle cells produce carbon dioxide as she dances.

Which of the following shows how the carbon dioxide is removed from Nancy's body?
Tick the correct box.

muscle cells → bloodstream → windpipe → lungs → nose ☐

muscle cells → windpipe → lungs → bloodstream → nose ☐

muscle cells → bloodstream → lungs → windpipe → nose ☐

muscle cells → windpipe → bloodstream → lungs → nose ☐

1c
1 mark

*maximum 4 marks*

Total
4

2. (a) The table below shows the pH of four acidic liquids.

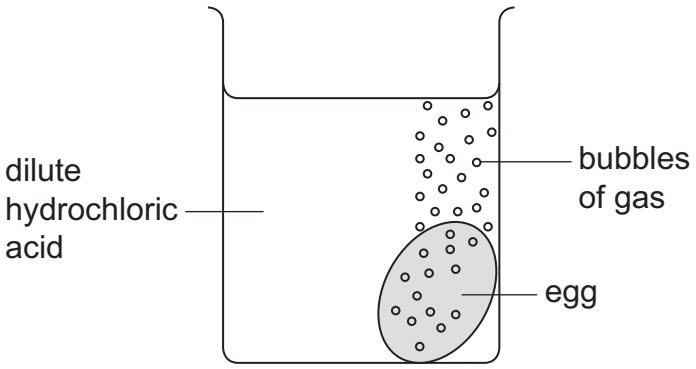
| acidic liquid | pH |
|---|---|
| grapefruit juice | 3.1 |
| ethanoic acid | 3.0 |
| lemonade | 4.4 |
| dilute hydrochloric acid | 1.0 |

Which of these liquids is the **least** acidic?

2a

1 mark

(b) Emilio cooked an egg until it was hard-boiled.
He put the egg in a beaker of dilute hydrochloric acid as shown.




(i) The egg shell reacted completely with the acid.
After two days the pH of the liquid in the beaker was 2.5.

How did the **acidity** of the liquid in the beaker change?
Use the table above to help you.

2bi

1 mark

(ii) Emilio put another hard-boiled egg in some ethanoic acid.
It took longer for the shell to react completely.

Use the table opposite to suggest a reason for this.

_____

_____

2bii
1 mark

(c) The chemical formulae for four acids are shown in the table below.

| sulphuric acid | hydrochloric acid | nitric acid | ethanoic acid |
|---|---|---|---|
| $H_2SO_4$ | HCl | $HNO_3$ | $CH_3COOH$ |

(i) Give the **name** of the element that is present in all four acids.

_____

2ci
1 mark

(ii) Give the **names** of the two **other** elements present in sulphuric acid.

1. _____

2. _____

2cii
1 mark

2cii
1 mark

(iii) How many atoms are there in the formula $HNO_3$ (nitric acid)?

_____

2ciii
1 mark

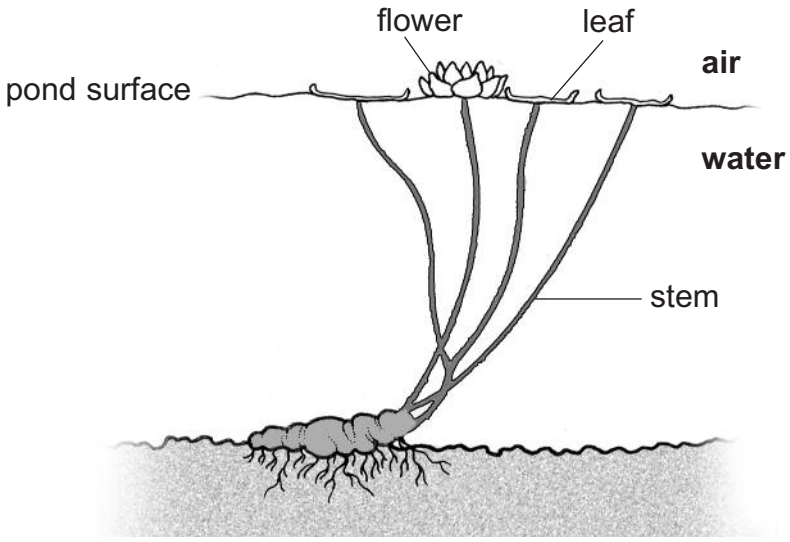
*maximum 7 marks*

Total
7

3. The photograph below shows some water lilies in early summer.




This diagram shows a water lily plant.




(a) Water lilies do **not** grow well in moving water.

Suggest a reason for this.

_____

_____

3a

1 mark

(b) During the winter, many water lily plants do **not** grow new leaves.

Suggest **one** reason why the plants do **not** grow new leaves in the winter.

_____

3b

1 mark

(c) (i) Give **one** way water lily plants are adapted to live in water.

_____

3ci
1 mark

(ii) Explain how this adaptation helps the water lily to grow in water.

_____

_____

3cii
1 mark

(d) In the summer, water lilies produce large yellow flowers.
The flowers float on the surface of the pond.



Suggest **one** way these colourful floating flowers help the water lily to reproduce.

_____

_____

3d
1 mark

(e) When water lilies cover the pond surface with leaves, the pond does not get as hot during the day.

Explain why the pond does **not** get as hot.

_____

_____

3e
1 mark

*maximum 6 marks*

Total
6

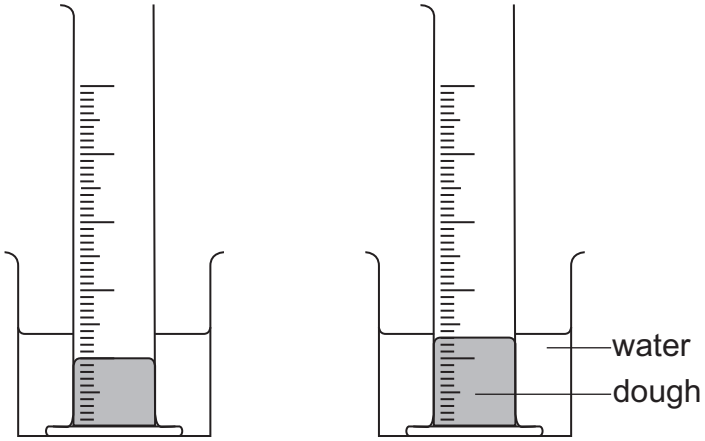
4. Sara investigated making bread.
She described what she did below.

I mixed flour, water, sugar and yeast to make bread dough.

I put 50 $cm^3$ of dough into a measuring cylinder.

I put the measuring cylinder into a water bath at 30°C.

I measured the volume of the dough after 30 minutes.




Sara repeated the experiment with the water bath at different temperatures.
Her results are shown below.

| temperature of water bath (°C) | volume of dough ($cm^3$) | |
|---|---|---|
| | at the start | after 30 minutes |
| 30 | 50 | 66 |
| 45 | 50 | 73 |
| 60 | 50 | 77 |
| 75 | 50 | 71 |
| 90 | 50 | 60 |

(a) Use the table of results.
What question did Sara investigate?

_____

_____

4a

1 mark

(b) At each temperature Sara used dough from the same mixture.

(i) Give **one** other way Sara made her experiment fair.

_____

4bi
1 mark

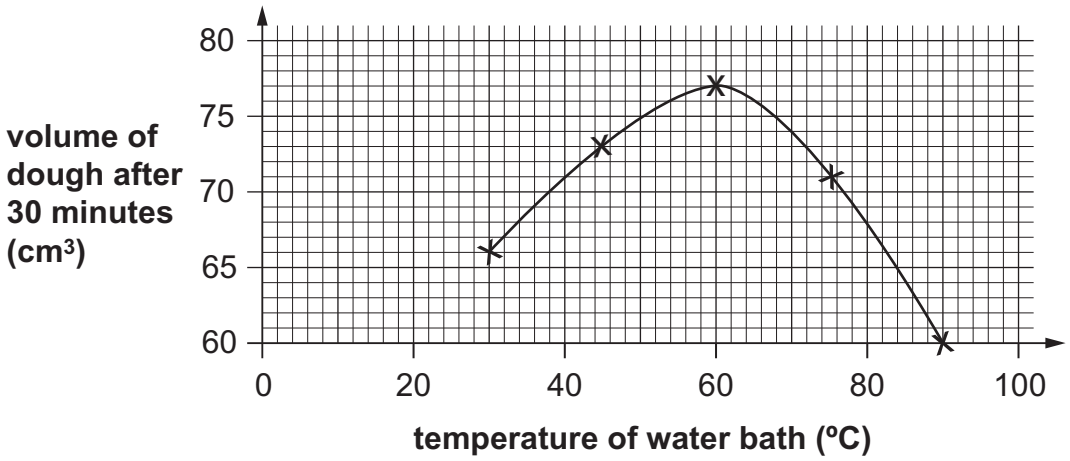
(ii) Why would using dough from a different mixture make Sara's experiment **unfair**?

_____

_____

4bii
1 mark

(c) Sara plotted her results on the graph below.




Describe the relationship between the variables on the graph from 30°C to 90°C.

_____

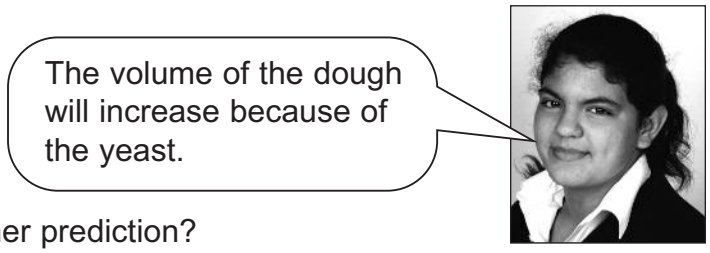
_____

_____

4c
1 mark

4c
1 mark

(d) Sara made a prediction.




What could she do to test her prediction?

_____

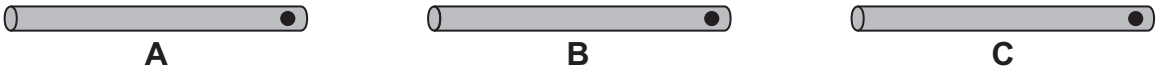
_____

4d
1 mark

*maximum 6 marks*

Total
6

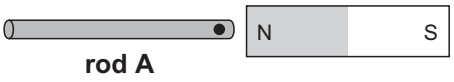
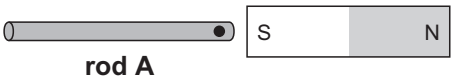
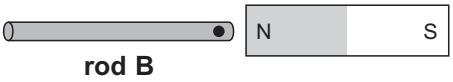
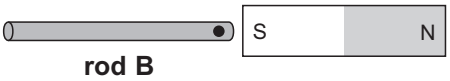
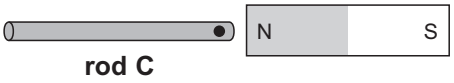
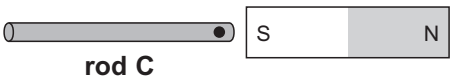
5. Hannah has three rods (A, B and C) made from different metals.
One rod is a **magnet**; one is made of **copper**; and one is made of **iron**.
She does not know which rod is which.




Each rod has a dot at one end.

(a) Hannah uses **only** a bar magnet to identify each rod.
She puts each pole of the bar magnet next to the dotted end of each rod.

Complete Hannah's observations in the table below.
Write if each rod is **copper**, **iron** or a **magnet**.

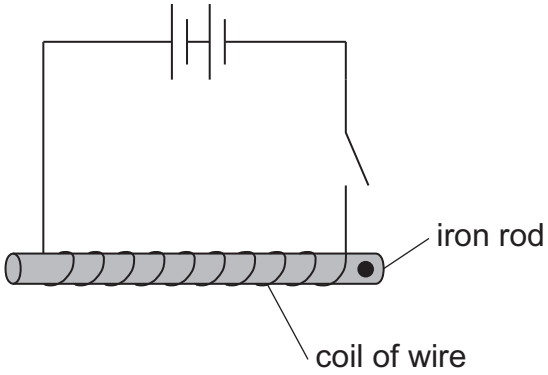
| test | observations | type of rod |
|---|---|---|
|     | attract<br>attract | Rod *A* is _____. |
|     | nothing happens<br>_____ | Rod *B* is _____. |
|     | attract<br>_____ | Rod *C* is _____. |

5a
1 mark

5a
1 mark

5a
1 mark

(b) Hannah uses the iron rod to make an electromagnet.




When the switch is closed the iron rod becomes an electromagnet.
Give **two** ways Hannah could make the electromagnet stronger.

1. _____

2. _____

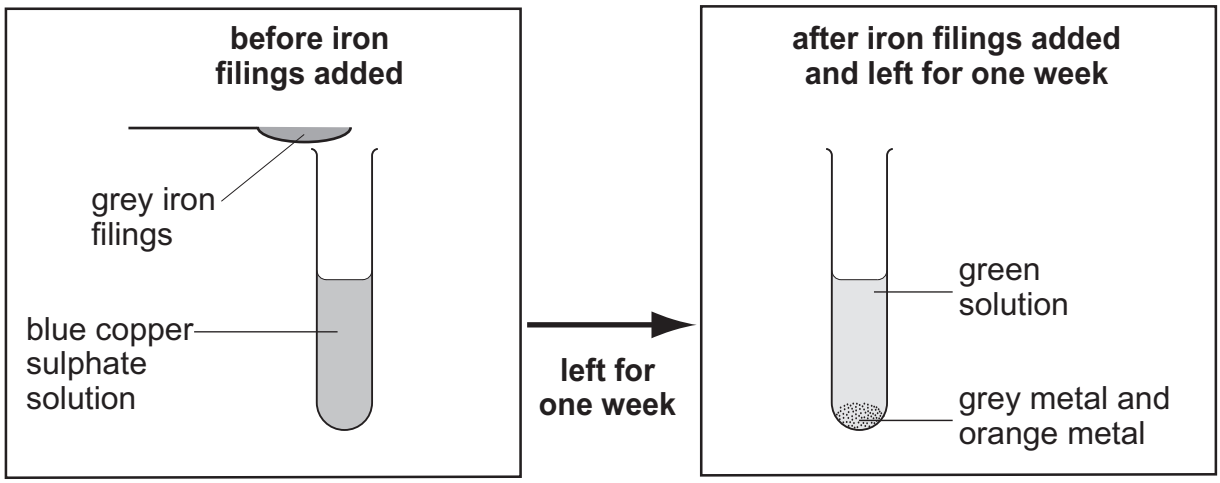
5b
1 mark

5b
1 mark

*maximum 5 marks*

Total
5

6. Joanne added iron filings to copper sulphate solution.
She observed the reaction after one week.




(a) What evidence in the diagrams shows that a chemical reaction has taken place?

_____

6a
1 mark

(b) The reaction between iron and copper sulphate is a **displacement** reaction.

(i) Give the name of the orange metal visible after one week.

_____

6bi
1 mark

(ii) What is the name of the compound formed in this reaction?

_____

6bii
1 mark

(iii) Joanne poured the green solution into another test tube. She added some copper pieces to the solution.

Will a displacement reaction occur?

yes ☐ no ☐

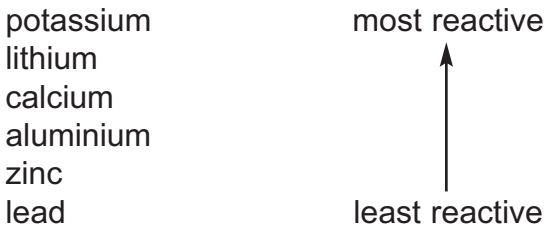
Explain your answer.

_____

_____

6biii
1 mark

(c) Part of the reactivity series of metals is shown below.




Use the information above.
Which **two** metals would react with aluminium nitrate in a displacement reaction?

Tick the **two** correct boxes.

calcium ☐ potassium ☐

zinc ☐ lead ☐

☐ 6c
1 mark

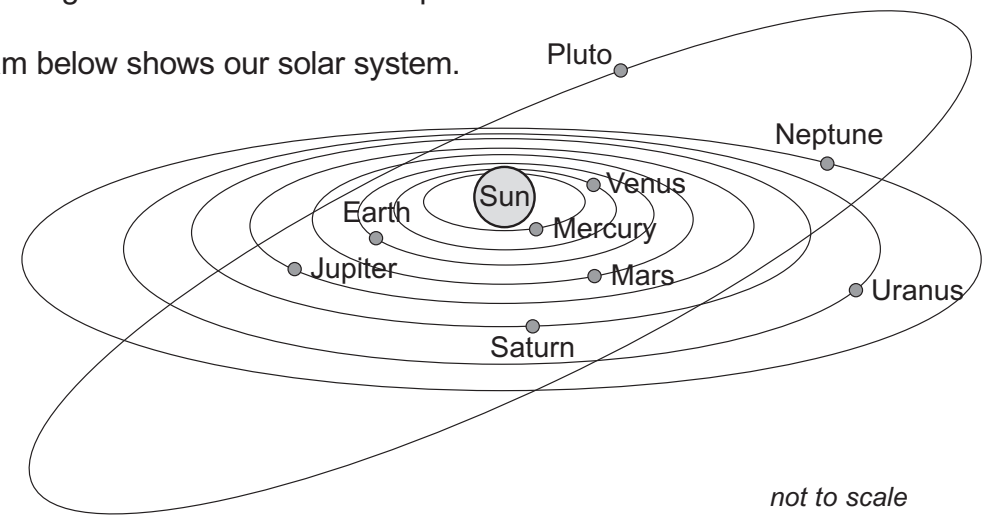
*maximum 5 marks*



Total
☐
5

7. Pluto was discovered in 1930. It was classified as a planet.
In 2006, scientists agreed that Pluto is **not** a planet.

(a) The diagram below shows our solar system.




*not to scale*

(i) **From the diagram**, what supports the idea that Pluto is a planet?

_____

7ai
1 mark

(ii) **From the diagram**, what supports the idea that Pluto is **not** a planet?

_____

7aii
1 mark

(b) The table below shows information about planets in our solar system.

| planet | diameter (km) |
|---|---|
| Mercury | 4800 |
| Venus | 12200 |
| Earth | 12800 |
| Mars | 6800 |
| Jupiter | 142600 |
| Saturn | 120200 |
| Uranus | 49000 |
| Neptune | 50000 |

Pluto has a diameter of 2 300 km.
How does this information suggest to scientists that Pluto is **not** a planet?

_____

7b
1 mark

(c) An object called Charon orbits Pluto.

How does the presence of Charon support the idea that Pluto is a planet?

_____

7c

1 mark

(d) The table below shows the composition of the atmosphere of some of the objects in our solar system.

| object | atmosphere |
|---|---|
| Mercury | none |
| Venus | mainly carbon dioxide |
| Earth | mainly nitrogen and oxygen |
| Neptune | hydrogen, helium and methane |
| Earth's moon | none |
| Titan (a moon) | nitrogen and methane |
| Pluto | nitrogen and methane |

Atmosphere is **not** used to classify objects as moons or planets.
Use the information above to suggest a reason for this.

_____

_____

7d

1 mark

(e) Why do you think scientists found it difficult to decide how Pluto should be classified?

_____

_____

7e

1 mark

*maximum 6 marks*

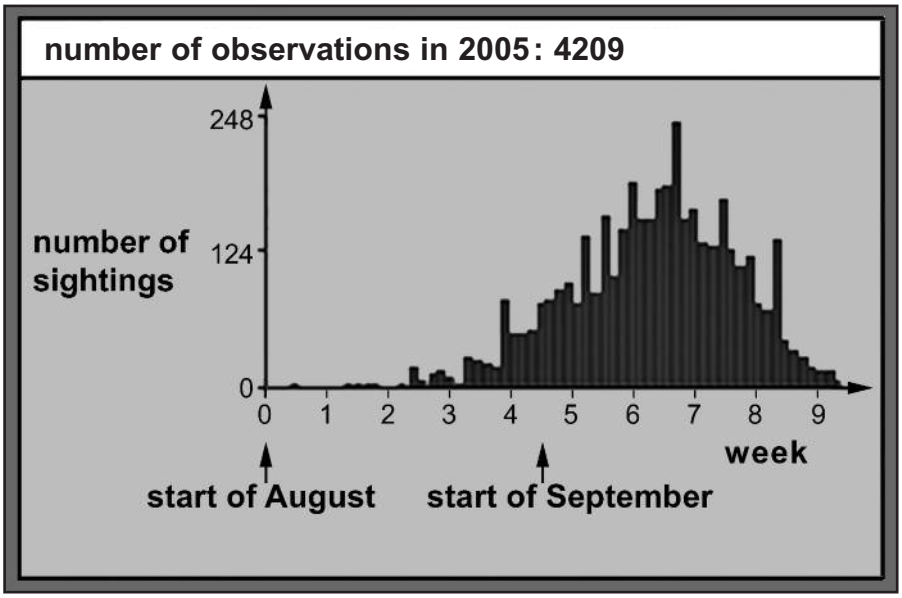
Total

6

8. Every autumn the BBC asks people all over the UK to record when and where they see the first ripe conkers. The results are shown on a website.

Conkers only ripen in the autumn.




(a) Some pupils discussed these results and made some conclusions.

Tick a box in each row to say whether the conclusion is **true** or **false** or whether you **cannot tell** based on the results.

| | **true** | **false** | **cannot tell** |
|---|---|---|---|
| There are more conkers in 2005 than there have been in other years. | ☐ | ☐ | ☐ |
| There are only 248 conker trees in the UK. | ☐ | ☐ | ☐ |
| The most common time for the first ripe conkers was in September. | ☐ | ☐ | ☐ |
| The number of sightings decreased between August and September. | ☐ | ☐ | ☐ |

☐ 8a
1 mark

☐ 8a
1 mark



Information from *http://www.bbc.co.uk/nature/animals/wildbritain/autumnwatch/results/conkers.html* (December 2005)

(b) The map shows where members of the public saw ripe conkers in the UK.



(i) Suggest **one** reason why it is a good idea to collect data by asking the public to observe when conkers ripen.

_____

_____

8bi

1 mark

(ii) Suggest **one** reason why it is **not** a good idea to collect data by asking the public to observe when conkers ripen.

_____

_____

8bii

1 mark

(c) The data was collected in one year.

What data would the BBC need to collect to find out if the time of year in which conkers ripen was changing?

_____

8c

1 mark

(d) Conkers ripen earlier in the south of the country than in the north.

Suggest why conkers ripen earlier in the south.

_____

8d

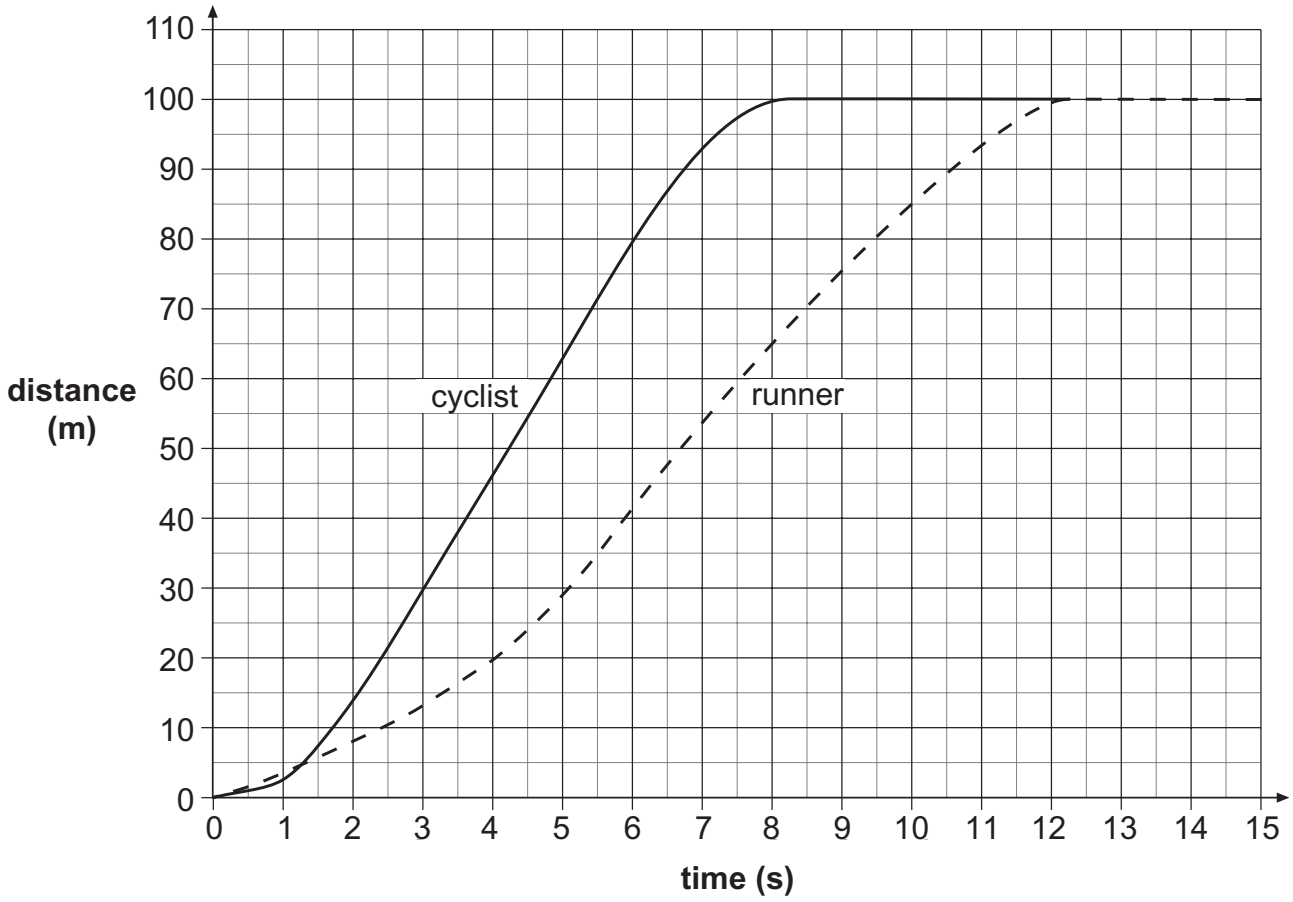
1 mark

*maximum 6 marks*

Total

6

9. A cyclist and a runner have a race.
The distance-time graph for the race is shown below.




Use the graph to answer the following questions.

(a) (i) How much time did it take the cyclist to travel 100 m?

_____ s

9ai
1 mark

(ii) When the cyclist finished the race how far behind was the runner?

_____ m

9aii
1 mark

(iii) How much more time did the runner take compared with the cyclist to complete the race?

_____ s

9aiii
1 mark

(b) The cyclist is travelling at a constant speed between 3 seconds and 6 seconds.

How does the graph show this?

_____

_____

9b

1 mark

(c) (i) When the race started, a walker set off at a steady speed of 2 m/s.

**Draw a line on the graph** on the opposite page to show the distance covered by the walker in the first 15 seconds. Use a ruler.

9ci

1 mark

(ii) Calculate how much time it will take for the walker to walk 100 m.

_____

_____ s

9cii

1 mark

*maximum 6 marks*

Total

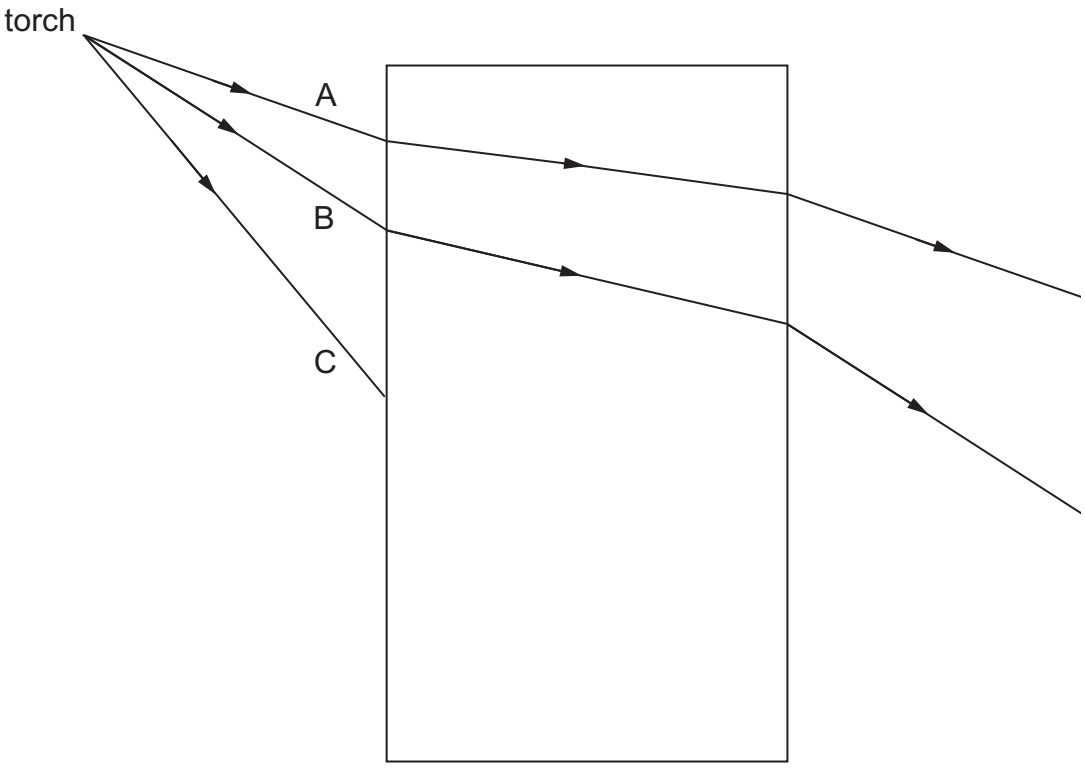
6

10. (a) When light travels from air to glass, it changes direction.
What is the name of this effect?

10a
1 mark

_____

(b) The diagram below shows three rays of light A, B and C striking a glass block.




The paths of A and B have been drawn.

10b
1 mark

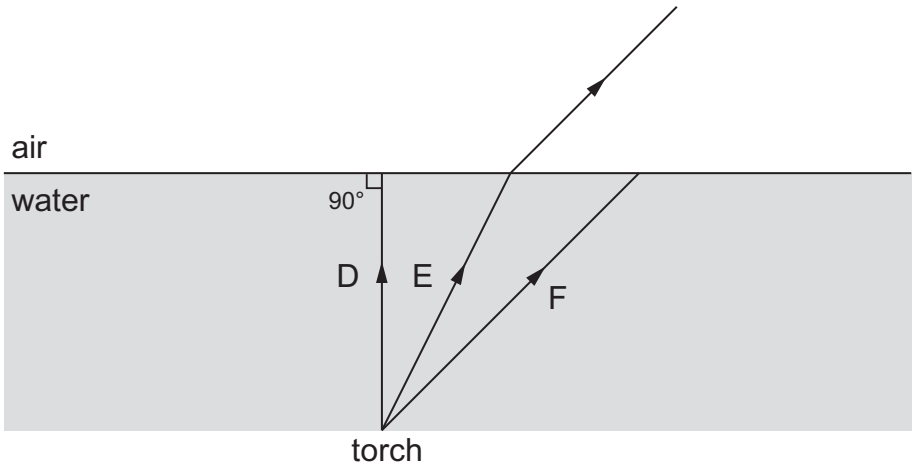
Continue ray C to show its path through the block and out the other side.
Use a ruler.

10b
1 mark

(c) The diagram below shows three rays of light, D, E and F, from a torch placed under water.

The path of ray E is shown as it leaves the water and enters the air.

Continue the paths of D and F as they pass through the air.
Use a ruler.




10c
1 mark

10c
1 mark

*maximum 5 marks*

Total
5

11. During pregnancy a woman's body increases in mass.
The table shows the average increase in mass in some parts of the body during pregnancy.

| part | increase in mass during pregnancy (kg) |
|---|---|
| foetus | 3.6 |
| uterus | 0.9 |
| placenta | 0.7 |
| red blood cells | 0.2 |
| amniotic fluid | 0.9 |
| breast tissue | 0.4 |
| fat | 3.9 |

(a) Explain why the mass of the placenta increases as the foetus develops.

11a
1 mark

11a
1 mark

(b) Pregnant women need to make sure they have plenty of iron in their diet.
Use information in the table to explain why they need extra iron.

11b
1 mark

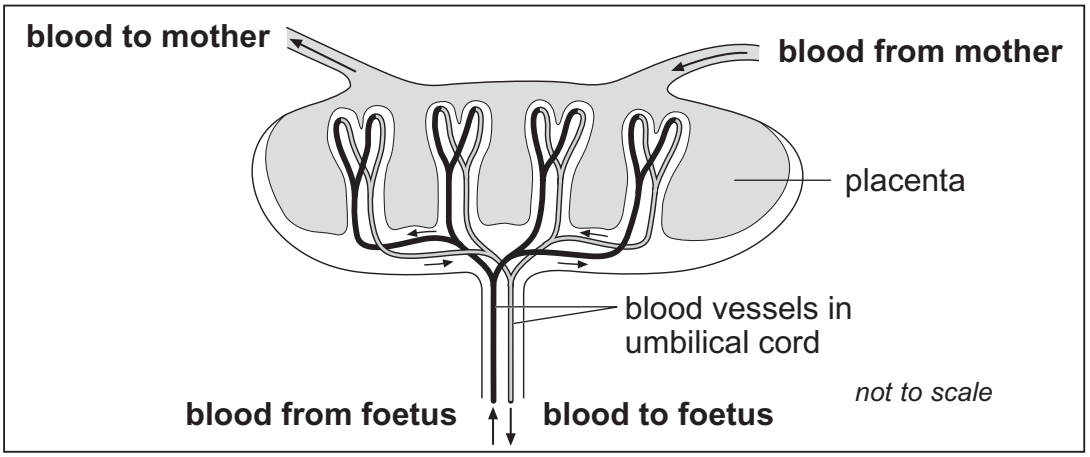
(c) The foetus is **not** part of a woman's body before she becomes pregnant.

Which **two** other parts from the table are **not** present in her body before she becomes pregnant?

11c
1 mark

_____ and _____

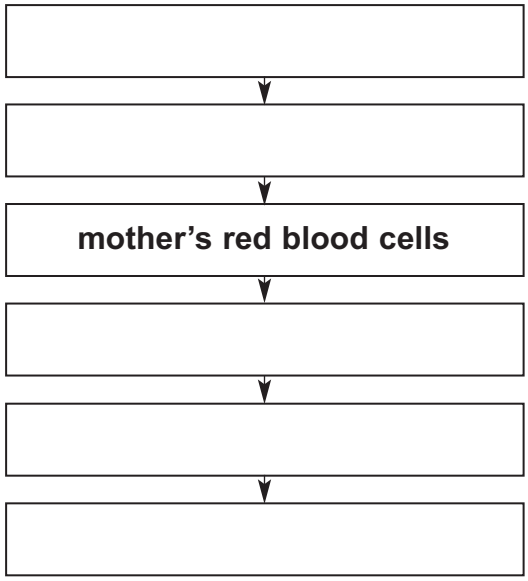
(d) (i) The diagram shows the blood supply in the placenta and umbilical cord.




When the mother breathes, oxygen and other gases pass to the foetus.

Complete the flow diagram below to show how oxygen passes from the mother to the foetus. Use **all** the words from the list below.

| | | | | |
|---|---|---|---|---|
| **lungs** | **umbilical cord** | **blood of foetus** | **windpipe** | **placenta** |




11di
1 mark

11di
1 mark

(ii) When a pregnant woman breathes in cigarette smoke, carbon monoxide gas combines with some of her red blood cells.

How could this harm the foetus?

_____

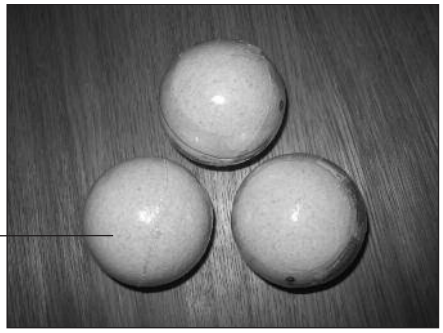
_____

11dii
1 mark

*maximum 7 marks*

Total
7

12. When bath 'bombs' are dropped into bath water they colour the water and make the water smell of perfume.



bath bomb

(a) Bath bombs contain citric acid and sodium carbonate. When they react a gas is produced.

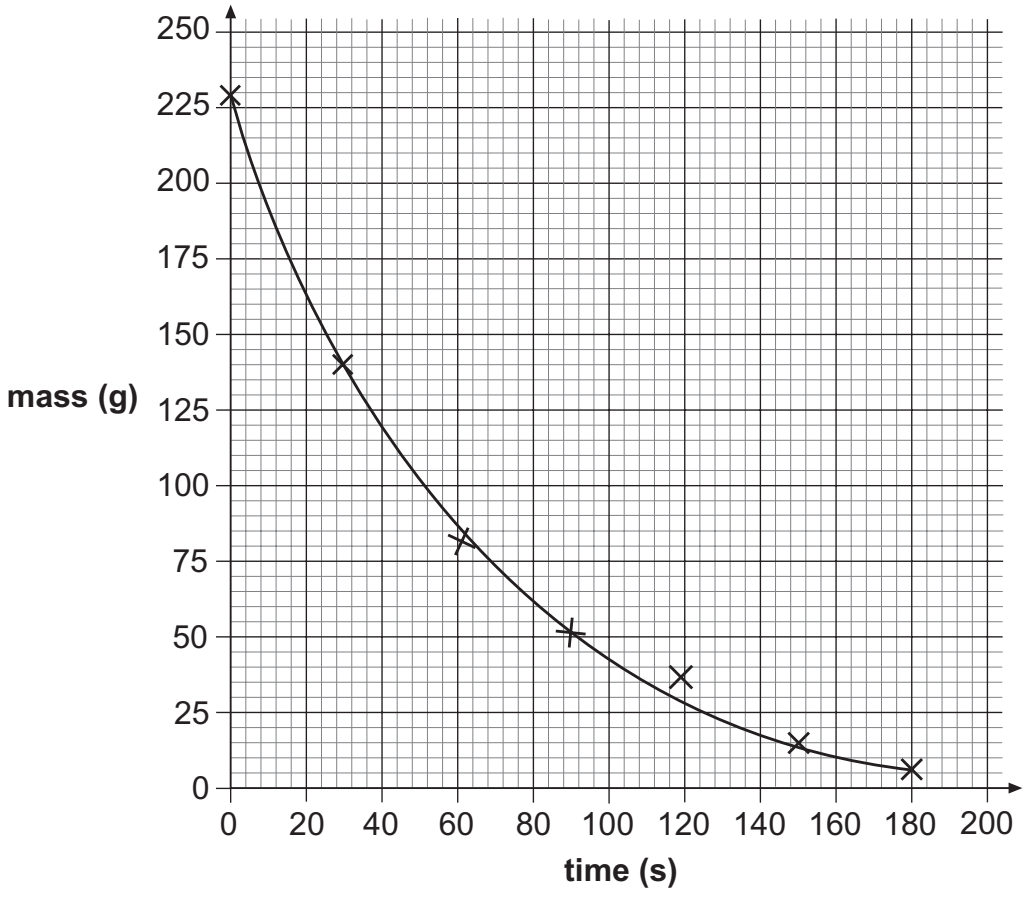
Complete the word equation for the reaction that takes place.

12a

1 mark

citric acid + sodium carbonate → sodium citrate + water + _____

(b) A bath bomb was dropped into hot water and its mass was measured every thirty seconds, for three minutes.
The graph below shows the results.



Between which two times on the graph does the mass of the bath bomb decrease fastest?
Tick the correct box.

between 0 s and 30 s ☐

between 30 s and 60 s ☐

between 90 s and 120 s ☐

between 150 s and 180 s ☐

☐ 12b
1 mark

(c) (i) The bath bomb was 230 g at the start.
How long does it take for the mass of the bath bomb to decrease by a half?

_____ s

☐ 12ci
1 mark

(ii) The reactants in a bath bomb were 176 g at the start.
129 g of sodium citrate and 14 g of water are produced in the reaction.
Calculate the mass of gas produced in the reaction.

_____

_____ g

☐ 12cii
1 mark

(d) Some people on cruise ships practise golf. They hit golf balls into the sea. Turtles can swallow the golf balls. A new type of golf ball has been made from a bath bomb covered in hardened paper to use on cruise ships.

Suggest **one** reason why this type of golf ball might be better for the environment than a normal golf ball.

_____

_____

☐ 12d
1 mark

(e) Complete the word equation for the reaction between citric acid and calcium carbonate. Use the equation in part (a) to help you.

citric acid + calcium carbonate → water + _____ + _____

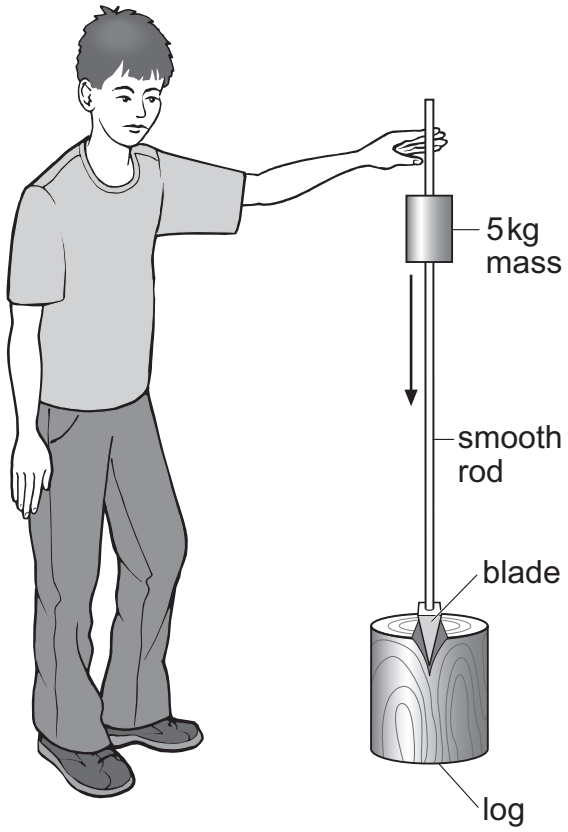
☐ 12e
1 mark

*maximum 6 marks*

Total
☐
6

13. David uses a falling mass to split wooden logs.

The 5 kg mass slides down the rod and hits the metal blade.
The force on the blade splits the log.




(a) To lift the mass David uses energy stored in his muscles.

What energy transfer occurs when David's muscles lift the mass?

from _____ energy in his muscles to

gravitational potential energy of the mass

13a

1 mark

(b) David lifts the mass. The mass gains 50 J of gravitational potential energy. The falling mass changes this energy into kinetic energy.

(i) As it falls, what is the maximum amount of energy the mass can change from gravitational potential energy to kinetic energy?

_____ J

13bi

1 mark

(ii) Not all the gravitational potential energy is transferred to kinetic energy as the mass falls.
Give one reason for this.

_____

_____

13bii
1 mark

(c) Give **two** ways David can increase the kinetic energy of the mass just before it hits the blade.

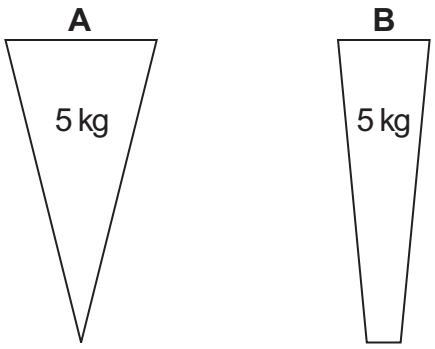
1. _____

2. _____

13c
1 mark

13c
1 mark

(d) David can use a different blade to split the logs.
The diagram below shows two different blades **A** and **B**.




The formula for pressure is: $\text{pressure} = \frac{\text{force}}{\text{area}}$

Which blade puts more pressure on the log?
Write the letter.

_____

Explain your answer in terms of area. Use the formula to help you.

_____

_____

13d
1 mark

**END OF TEST**

*maximum 6 marks*

Total
6

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QCA/09/3802 (Pupil pack)
QCA/09/3798 (Mark scheme pack)