

BENENDEN

Lower School Scholarship 2023

SCIENCE

13+

1 Hour

Full Name: _____

Current school: _____

Date: _____

Instructions to Candidates:

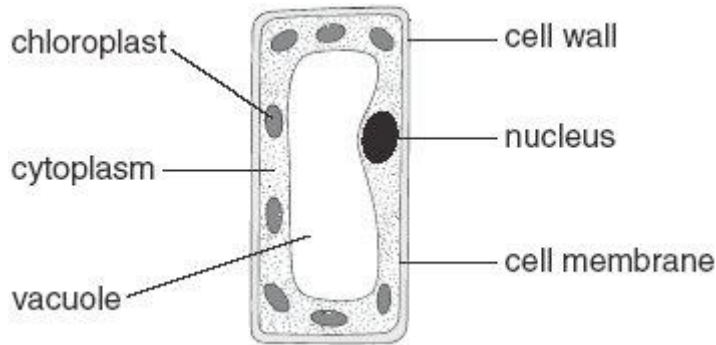
- Write your answers in the space provided in this booklet.
(total marks for paper 100)
- There are questions that cover Biology, Chemistry, and Physics topics, make sure you answer all of them
- Marks available are indicated in brackets

Equipment needed:

- Calculators are allowed
- Make sure you have ruler and a sharp pencil

Q1.

The diagram below shows a plant cell.



(a) In which part of a plant would you find this type of cell?

.....

1 mark

(b) (i) Give the function of the nucleus.

.....
.....

1 mark

(ii) Give the function of the chloroplasts.

.....
.....

1 mark

(iii) Give the function of the cell wall.

.....
.....

1 mark

(c) Give the names of **two** labelled parts that are **not** present in animal cells.

1.

2.

2 marks

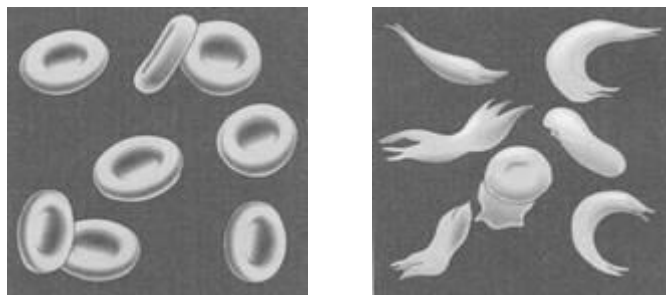
(d) Tick **one** box in each row to show whether the statement is true for photosynthesis **or** for respiration.

statement	photosynthesis	respiration
carbon dioxide is produced		
light is needed		
it occurs in plants and animals		
oxygen is produced		

2 marks
maximum 8 marks

Q2.

Sickle-cell anaemia is an inherited disease which can be fatal. People with sickle-cell anaemia have sickle-shaped red blood cells.



(a) Sickle-shaped red blood cells can become tangled together. Suggest **one** consequence of this.

.....
.....

1 mark

(b) Red blood cells contain a chemical called haemoglobin. People with sickle-cell anaemia produce an abnormal form of haemoglobin which crystallises at low oxygen concentrations. Explain why the abnormal haemoglobin is likely to crystallise as the blood flows through the tissues, such as muscle.

.....
.....

1 mark

- (c) Malaria is another disease which can be fatal. The micro-organism which causes malaria spends part of its life cycle inside human red blood cells. The table shows how a person's type of haemoglobin affects their chances of getting malaria.

Person's type of haemoglobin produced	does the person suffer from sickle-cell anaemia	will the person catch malaria easily?
normal only	no	yes
a mixture of normal and abnormal	only slightly	no
abnormal only	yes	no

The type of haemoglobin a person makes is an inherited characteristic. In areas where malaria is common, there are more people in each successive generation with a mixture of both normal and abnormal haemoglobin. Explain why.

.....

.....

.....

.....

.....

2 marks
Maximum 4 marks

Q3.

- (a) Tom watched birds feeding in his garden. He spotted the birds shown below.



not to scale

Tom recorded what the birds in his garden ate. His results are shown below.

bird	type of food			
	fruit	nuts	worms	seeds
blackbird	✓		✓	
blue tit		✓		✓
bullfinch				✓
dove				✓
sparrow		✓		✓
robin	✓		✓	✓

Use the information in the table to answer the following questions.

- (i) Tom put some pieces of fruit in his garden. Which **two** birds will eat this food?

..... and

1 mark

- (ii) How many types of bird eat nuts?

.....

1 mark

- (iii) Which food from the table opposite will attract the **most types of bird**?

.....

1 mark

(iv) Which bird from the table eats the most types of **food**?

.....

1 mark

(b) What are birds covered with to keep them warm?

.....

1 mark

(c) Many birds reproduce in the spring.



Suggest why birds need extra food in the spring.

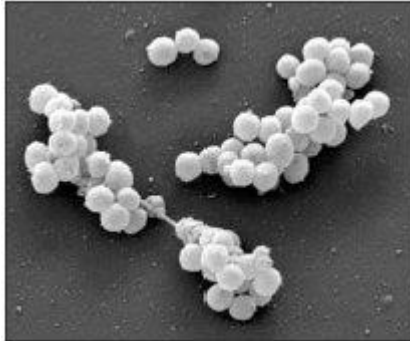
.....

.....

1 mark
maximum 6 marks

Q4.

The photograph below shows bacteria that have developed resistance to antibiotics.
They are called MRSA bacteria.



- (a) When MRSA bacteria reproduce, they pass on their resistance to antibiotics to the next generation.

What part of a cell passes on information?

.....

1 mark

- (b) MRSA bacteria can cause serious infections in people who are ill in hospital.
The bacteria can live on a healthy person's **skin** or in their **lungs** without causing any harm.

Use this information to fill in the table below.

Suggest **two** ways MRSA bacteria can be spread from person to person.
Suggest how the spread of the bacteria can be prevented for each method.

	method of spread	method of prevention
1		
2		

2 marks

(c) People can be vaccinated against some diseases caused by bacteria or viruses.

Describe how vaccination prevents a person getting a disease.

.....

.....

.....

.....

.....

3 marks
maximum 6 marks

Q5.

A garden centre has two types of the same plant for sale.

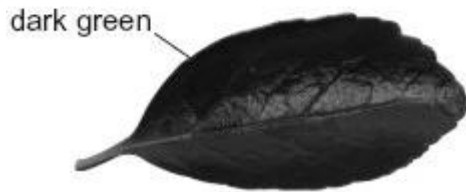
normal type



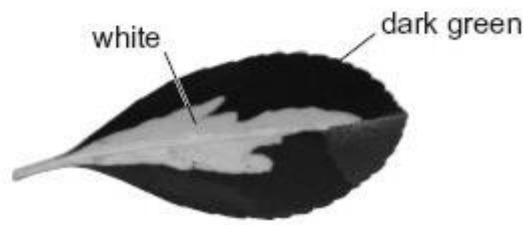
variegated type



normal leaf



variegated leaf



Chlorophyll makes a plant leaf green.

(a) At the end of the summer, the normal plants had grown more than those with variegated leaves. All the plants had been grown in the same conditions.

(i) Explain why plants with normal leaves grow more than plants with variegated leaves.

.....
.....
.....

2 marks

(ii) Describe an investigation you could do to show how much more a normal plant grows **compared** with a variegated plant over a six-week period.

In your answer, you must clearly identify:

- the independent variable (IV)
- the dependent variable (DV)
- the variables to control (CV)
- how you will calculate the end result.

.....

.....

.....

.....

.....

.....

.....

.....

4 marks

(b) What process do plants carry out in the light and in the dark to release energy?

Tick the correct box.

photosynthesis

respiration

absorption

dispersal

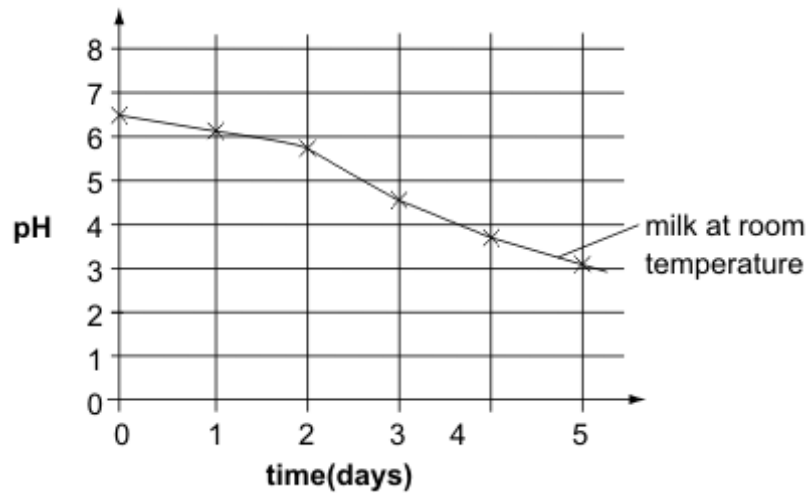
1 mark
maximum 7 marks

Q6.

Jane stored some milk at room temperature for five days in a sealed container. She used a pH sensor and data logger to record the pH of the milk for 5 days.

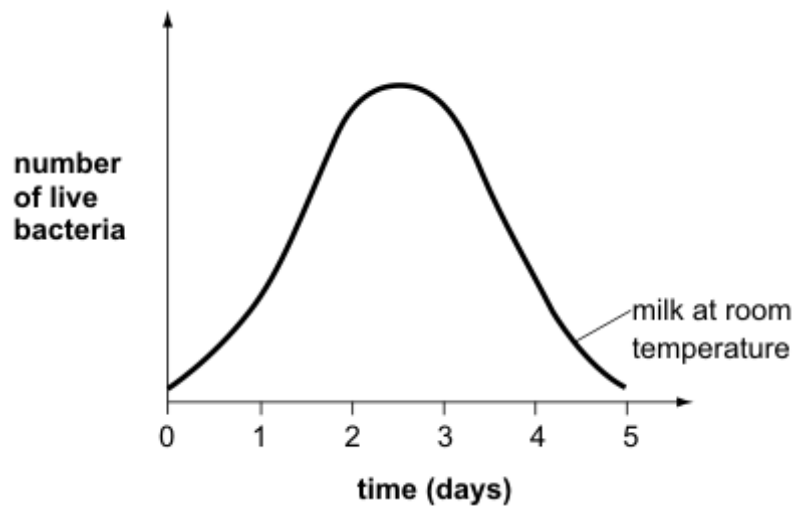
Her results are shown below.

graph 1



- (a) Jane predicted that the number of live bacteria in the milk would change as shown below.

graph 2



- (i) Suggest one reason why the number of live bacteria would start to decrease after 3 days.

.....
.....

1 mark

(ii) What evidence from **graph 1** suggests that there were still some live bacteria in the milk on day 5?

.....

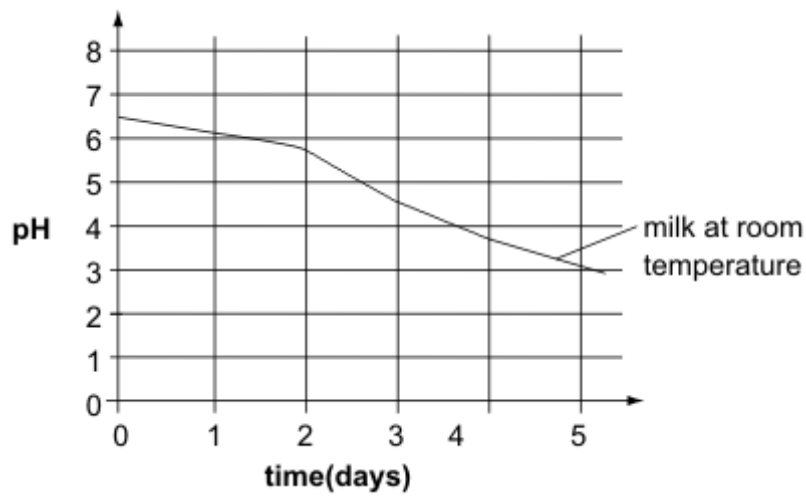
.....

1 mark

(b) Jane put some fresh milk in a sealed container in the fridge. She measured the pH of the milk every day for five days.

(i) On **graph 3** below, draw a line to show the pH of the **refrigerated milk** for five days.

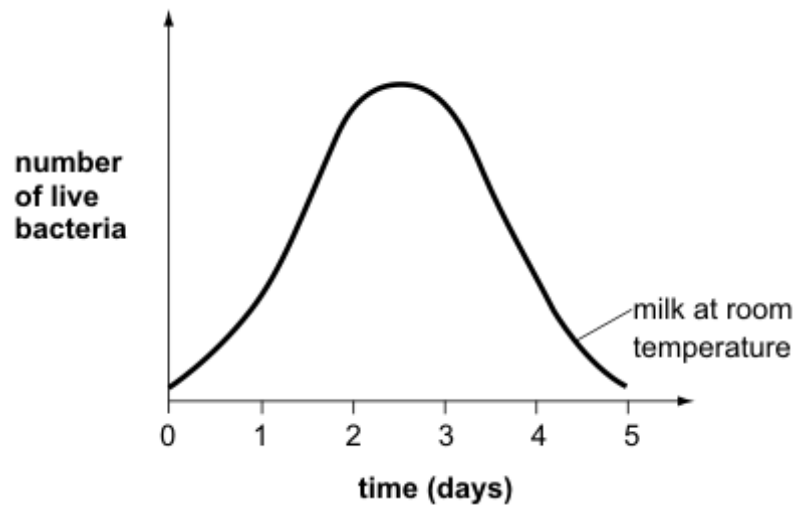
graph 3



2 marks

(ii) On **graph 4** below, draw a line to predict how the number of live bacteria in **refrigerated milk** will change over five days.

graph 4



1 mark
maximum 5 marks

Q7.

(a) The table below shows information about five elements.

element	melting point (°C)	boiling point (°C)	conducts electricity	colour
A	-7	59	no	brown
B	-218	-183	no	colourless
C	1535	2750	yes	silvery
D	113	445	no	yellow
E	1083	2567	yes	orange

(i) Which **two** of these elements are likely to be metals?

Write the letters.

..... and

1 mark

(ii) Which element in the table is liquid at room temperature?

Write the letter.

.....

1 mark

(b) What is the chemical symbol for copper?

Tick the correct box.

Cr Cu C Co Ca

1 mark

(c) How many atoms of iron and oxygen are there shown in the formulas for FeO and Fe₂O₃?

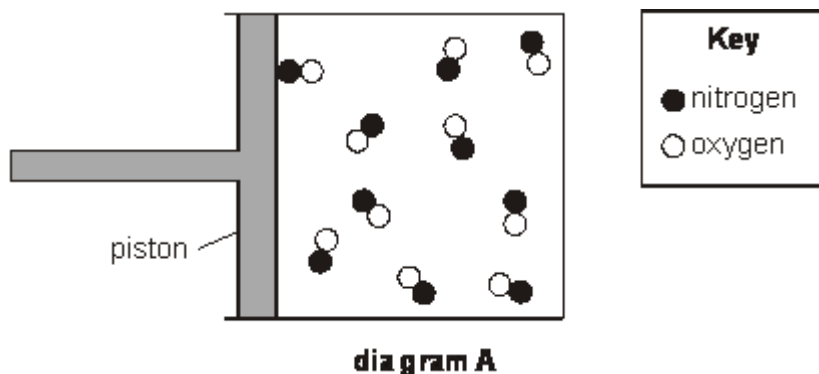
Complete the table below.

compound	number of atoms of iron	number of atoms of oxygen
FeO		
Fe ₂ O ₃		

2 marks
maximum 5 marks

Q8.

Diagram **A** represents a gas in a container.
The gas can be compressed by moving the piston to the right.



(a) (i) How can you tell that the substance in the container is a gas?

.....

.....

1 mark

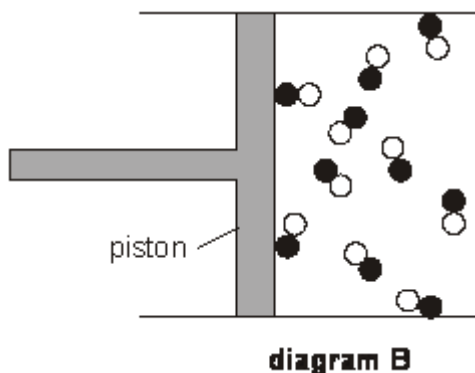
(ii) How can you tell from the diagram that the gas is pure?

.....

.....

1 mark

(b) The piston is moved to the right as shown in diagram **B**.



How can you tell, from diagram **B**, that the pressure of the gas has increased?

.....

.....

1 mark

- (c) Diagram **C** shows what happened to the molecules after the gas was compressed more.

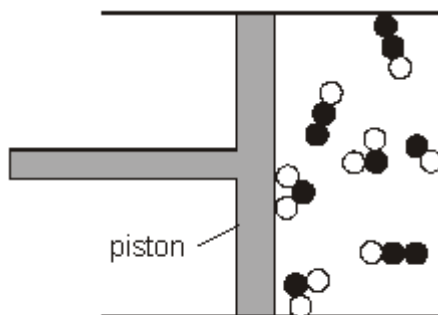


diagram C

- (i) How can you tell that a chemical reaction happened when the gas was compressed?

.....

1 mark

- (ii) The mass of the gas in both diagrams **B** and **C** was 0.3 g.
 Why did the mass of the gas **not** change when it was compressed?

.....

1 mark

- (iii) Complete the table below with the correct chemical formula of each substance. Use the key to help you.

substance	formula

Key	
	nitrogen
	oxygen

1 mark

(iv) What is the **name** of the substance represented by the symbol $\bullet\circ$?

.....

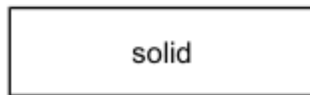
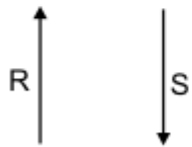
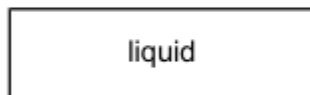
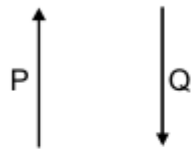
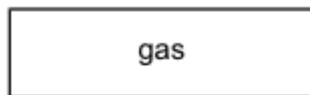
1 mark
maximum 7 marks

Q9.

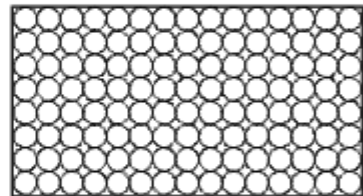
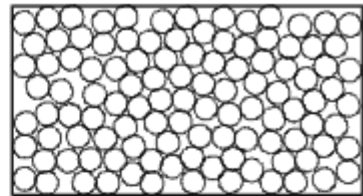
(a) Methane can be a gas, a liquid or a solid. In the diagram below, arrows P, Q, R and S represent changes of state.

The boxes on the right show the arrangement of particles of methane in the three different physical states.
Each circle represents a particle of methane.

physical state of methane



arrangement of particles



(i) Draw a line from each physical state of methane to the arrangement of particles in that physical state.
Draw only **three** lines.

1 mark

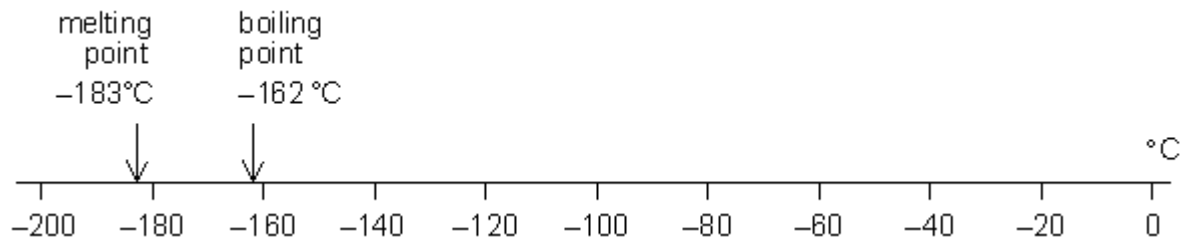
- (ii) Arrows P, Q, R and S represent changes of state.
Which arrow represents:

evaporation?

melting?

2 marks

- (b) Methane is the main compound in natural gas. The scale below shows the melting point and the boiling point of methane.



Methane has three physical states: solid, liquid and gas.

- (i) What is the physical state of methane at -170°C ?

.....

1 mark

- (ii) The formula of methane is CH_4 . The symbols for the two elements in methane are C and H.

Give the names of these two elements.

element C

element H

2 marks

- (iii) When methane burns, it reacts with oxygen.
One of the products is water, H_2O .

Give the name of the other product.

.....

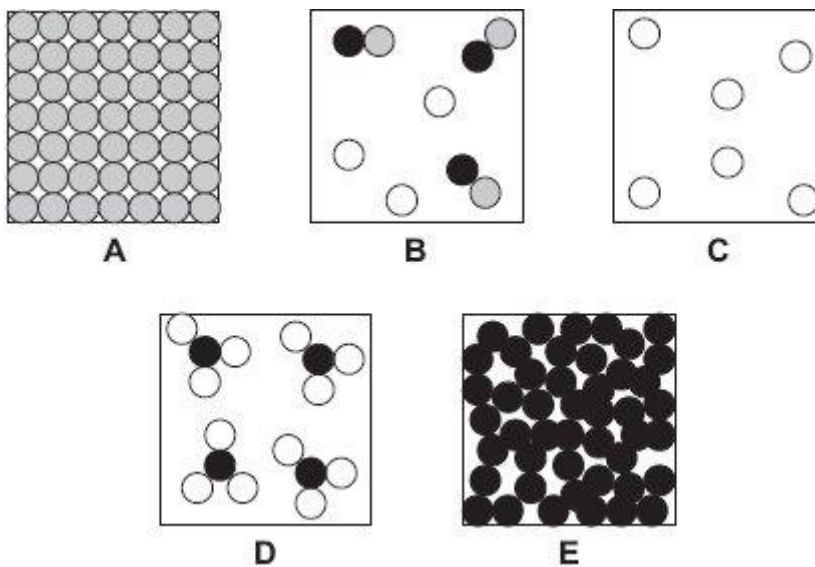
1 mark

Maximum 7 marks

Q10.

(a) The diagrams below show the arrangement of atoms or molecules in five different substances A, B, C, D and E.

Each of the circles ,  and  represents an atom of a different element.



Give the letter of the diagram which represents:

(i) a mixture of gases;

.....

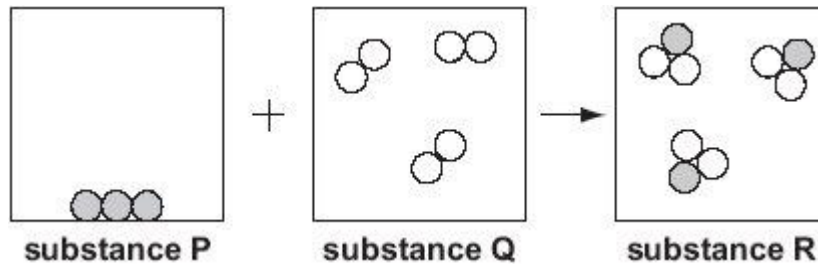
1 mark

(ii) a single compound.

.....

1 mark

- (b) The diagram below shows a model of a chemical reaction between two substances.



- (i) How can you tell from the diagram that a chemical reaction took place between substance P and substance Q?

.....

1 mark

- (ii) Substance P is carbon.

Suggest what substances Q and R could be.

substance Q

substance R

1 mark

- (iii) How does the diagram show that mass has been conserved in this reaction?

.....

1 mark
 maximum 5 marks

Q11.

Table 1 below shows the colour of universal indicator in acidic, neutral and alkaline solutions.

	acidic			neutral	alkaline		
	←				→		
colour of indicator	red	orange	yellow	green	blue	dark blue	purple

table 1

Ramy tested different liquids with the indicator solution. His results are shown in table 2 below.

liquid	colour of indicator solution
Milk	green
lemonade	orange
water	green
fruit juice	red
washing-up liquid	blue

table 2

(a) Use Ramy's results to answer the following questions.

(i) Give the name of **one** acidic liquid in **table 2**.

.....
1 mark

(ii) Give the name of **one** neutral liquid in **table 2**.

.....
1 mark

(b) Ramy dissolved some bicarbonate of soda in distilled water. This produced an alkaline solution.

(i) Ramy added the indicator to the alkaline solution.

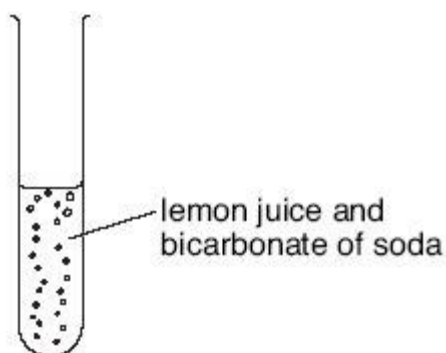
Suggest what colour the indicator became.

Use **table 1** to help you.

.....

1 mark

(ii) Ramy added lemon juice to the solution of bicarbonate of soda.



How could he tell that a gas was produced?

.....

1 mark

(c) Ramy mixed an acid with an alkali and tested the mixture with the indicator solution.

The indicator solution turned green.

What is the name of the reaction between an acid and an alkali?

Tick the correct box.

condensation

crystallisation

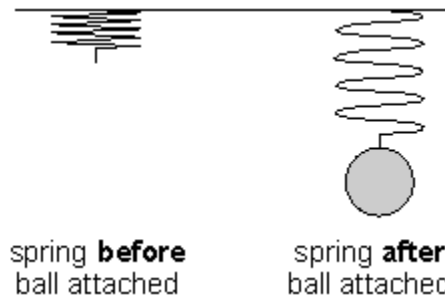
evaporation

neutralisation

1 mark
maximum 5 marks

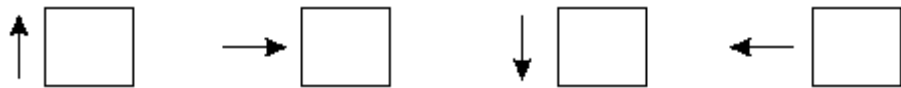
Q12.

(a) John attaches a ball to a spring. The diagram below shows what happens.



(i) Which arrow shows the direction of the **force of the ball on the spring?**

Tick the correct box.



1 mark

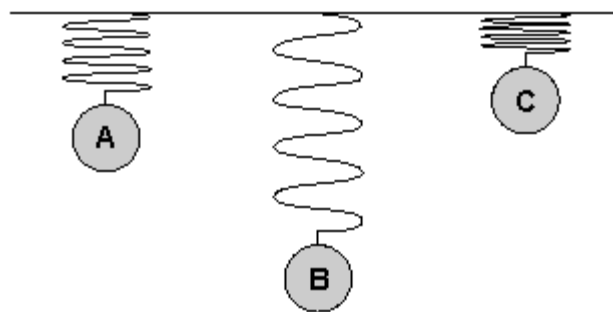
(ii) Which arrow shows the direction of the **force of the spring on the ball?**

Tick the correct box.



1 mark

(b) The diagram below shows three metal balls attached to **identical** springs.



Which ball is the heaviest?
Write the letter.

.....

1 mark

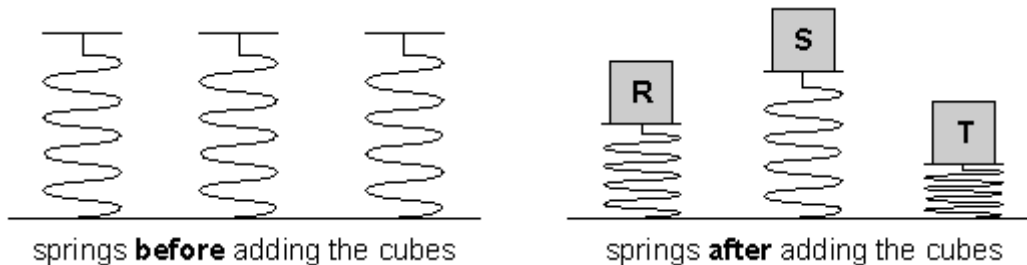
Explain your answer.

.....
.....

1 mark

- (c) John has another three **identical** springs. He puts a cube on each spring. Each cube has a different mass.

The diagrams below show the springs before and after John added the cubes.



Which cube is the heaviest?
Write the letter.

.....

1 mark

Explain your answer.

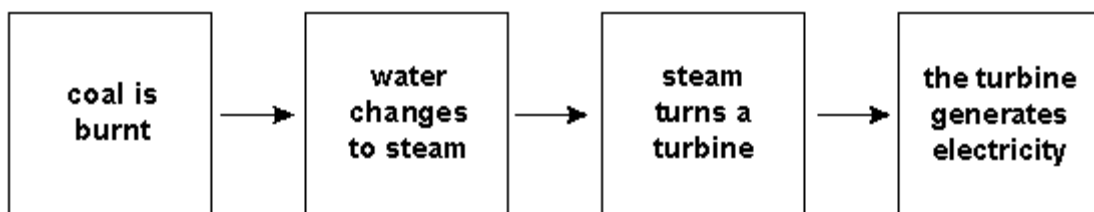
.....

.....

1 mark
maximum 6 marks

Q13.

In a power station, coal can be used to generate electricity.



(a) Use words from the box to answer the questions below.

chemical	electrical	gravitational potential	
kinetic	light	sound	thermal

1 mark

(i) What is the useful energy transfer when coal is burnt?

..... energy is transferred to
energy

1 mark

(ii) Some of the energy stored in coal is wasted when it is burnt.
Give the name of **one** type of energy released that is **not** useful.

.....

1 mark

- (b) Wind turbines are also used to generate electricity. The wind turns the turbine blades and the turbine blades turn a generator.



Use words from the **box opposite**. Complete the sentence to show the useful energy transfer in a wind turbine and generator.

..... energy is transferred to energy

1 mark

- (c) Suggest **one** disadvantage of using wind to generate electricity.

.....

1 mark

- (d) Sugar cane is a plant.
 The sugar from the cane is used to make alcohol.
 Alcohol is a fuel.



- (i) Which energy source do plants use to produce sugar?

.....

1 mark

- (ii) Is sugar cane a renewable **or** non-renewable source of energy?
 Tick one box.

renewable source non-renewable source

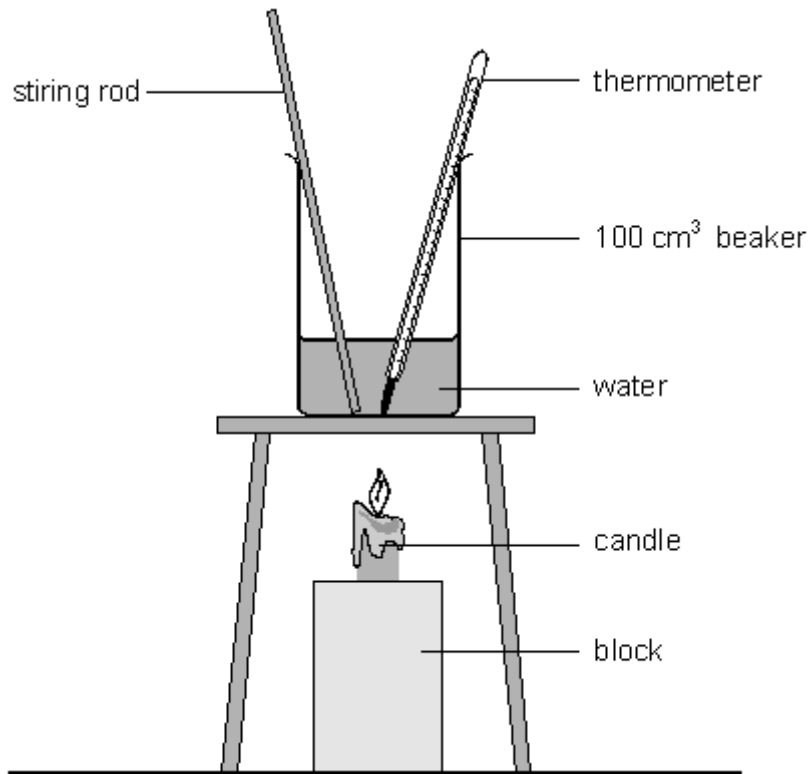
Give a reason for your answer.

.....

1 mark
 maximum 7 marks

Q14.

Luke investigated the heating of water. He predicted that the rise in temperature would depend on the volume of water. The diagram shows the apparatus he used.



Luke recorded his results in a table as shown below.

beaker	volume of water, in cm ³	temperature at start, in °C	temperature after 2 minutes, in °C
A	25	18	30
B	50	18	24
C	75	18	22

(a) Why did Luke need to know the temperature of the water at the beginning and at the end of the experiment?

.....
.....

1 mark

(b) Did Luke's results support his prediction? Explain your answer.

.....
.....

1 mark

(c) Luke stirred the water during the experiment. How did this make his results more reliable?

.....
.....

1 mark

(d) Which of the following statements about the energy transferred to the beakers is correct?
Tick the correct box.

Much more energy went into beaker 'A' because its temperature increased the most.

The same amount of energy went into all three beakers.

Beaker 'C' received the most energy because there was more water to heat.

1 mark

(e) After a time, all three beakers cooled down to room temperature. What happened to the thermal energy in the beakers as they cooled down?

.....
.....

1 mark

Maximum 5 marks

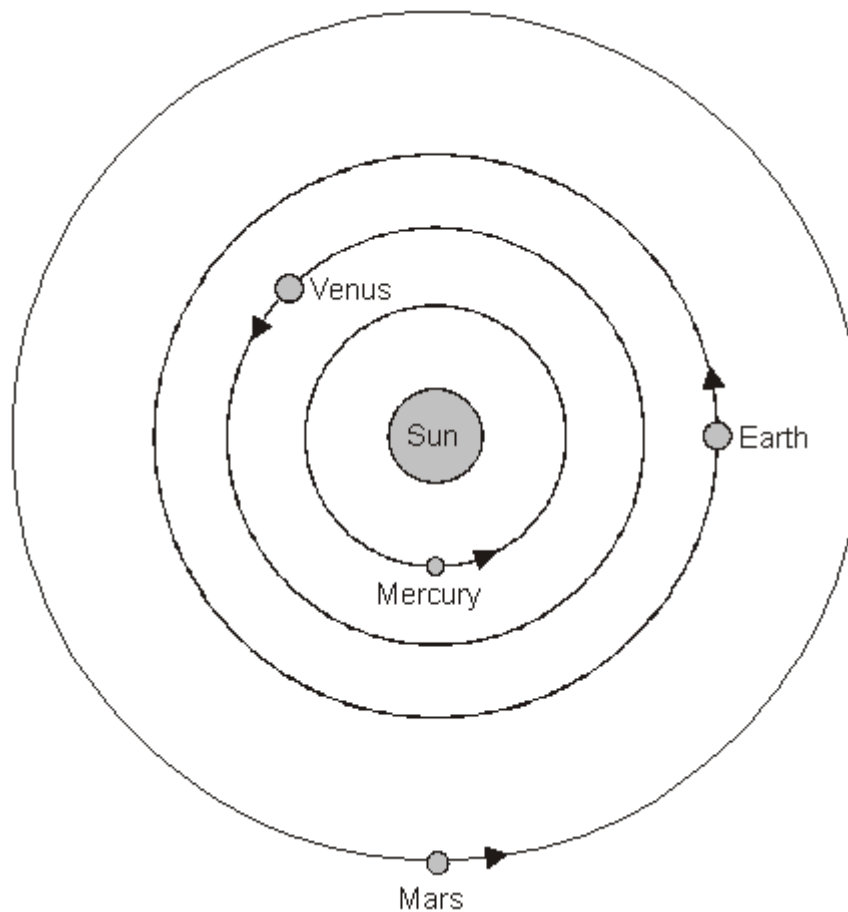
Q15.

The table below shows information about four planets.

planet	time taken to orbit the Sun (Earth years)	distance from the Sun (million km)
Mercury	0.25	60
Venus	0.5	108
Earth	1.0	150
Mars	2.0	228

The diagram below shows the orbits of the Earth, Mercury, Venus and Mars, and their position at one particular time.

The arrows show the direction in which the planets move.



not to scale

- (a) Show the position of each planet six months later by drawing a letter X on the orbit of each planet.

2 marks

- (b) Use the information in the table to calculate the largest and smallest distance between the Earth and Venus.

closest million km

1 mark

furthest million km

1 mark

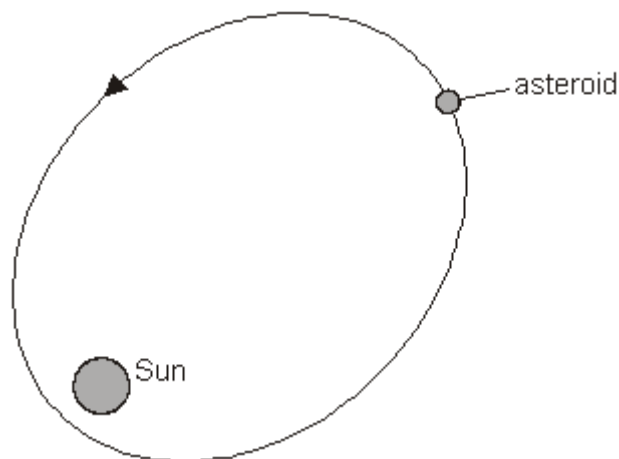
- (c) The speed of light is 300 000 km/second.
Calculate how long light takes to reach the Earth from the Sun.

.....

..... S

1 mark

- (d) The diagram below shows the path of an asteroid around the Sun.



not to scale

- (i) **On the path of the asteroid**, draw a letter S to show the position where the asteroid is travelling the slowest.

On the path of the asteroid, draw a letter F to show the position where the asteroid is travelling the fastest.

1 mark

- (ii) Explain why the speed of the asteroid changes.

.....

.....

1 mark
 maximum 7 marks

Q16.

The table shows information about three planets in our solar system.

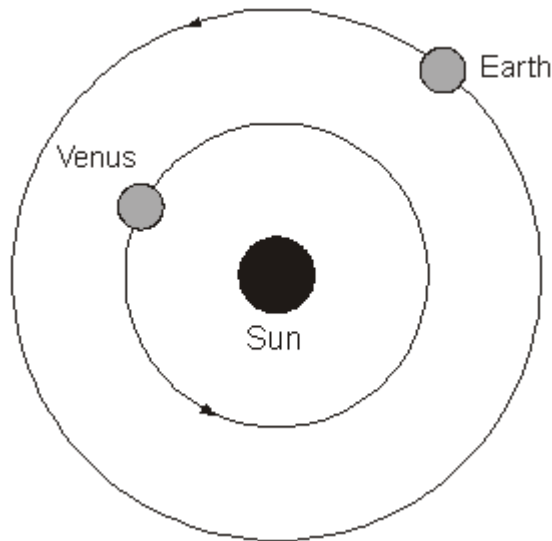
planet	time taken to orbit the Sun (Earth-years)
Mars	2.0
Venus	0.6
Earth	1.0

(a) Give **one** reason why Venus takes less time than Earth to orbit the Sun.

.....
.....

1 mark

(b) The diagram below shows the orbits of Venus and Earth. The Sun is a source of light. Venus does **not** produce its own light.



not to scale

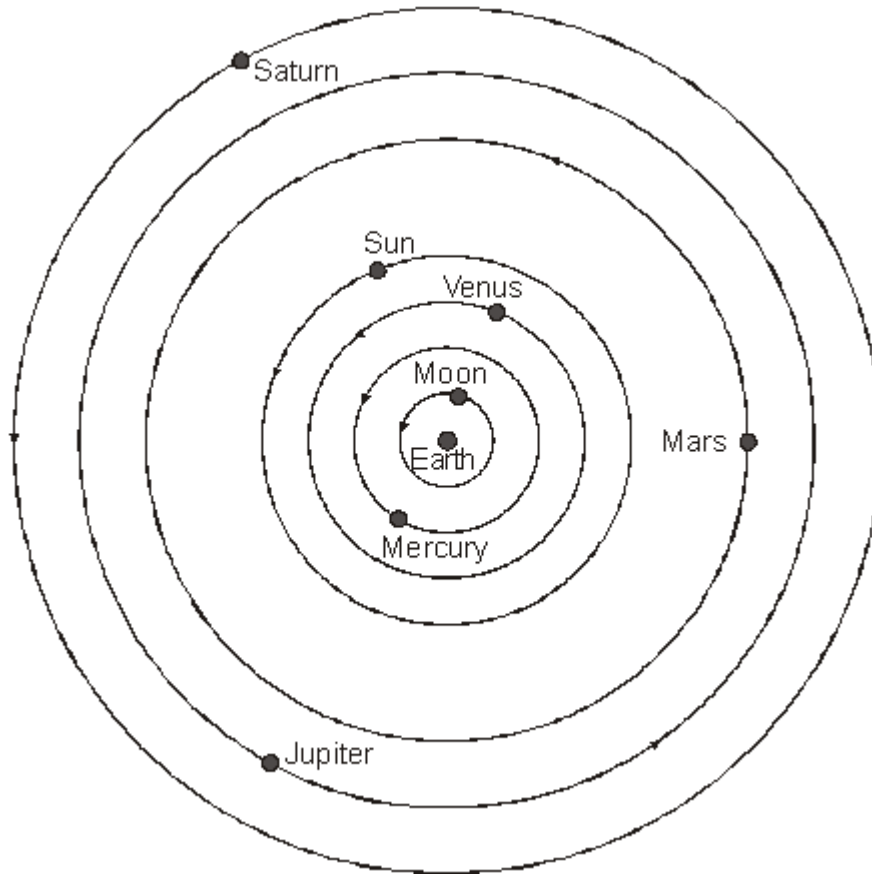
On the diagram above, draw rays of light to show how Venus can be seen from Earth. Use a ruler.

1 mark

Draw an arrow **on each** ray to show the direction of light.

1 mark

- (c) The diagram below shows how the astronomer Ptolemy drew the solar system 2000 years ago.



not to scale

- (i) The planets Uranus and Neptune are missing from his diagram.
Suggest why Ptolemy did **not** include these planets in his diagram.

.....

1 mark

- (ii) Today we know the correct arrangement of the planets in our solar system.

Give **one** way the diagram above is incorrect.
Complete the sentence below.

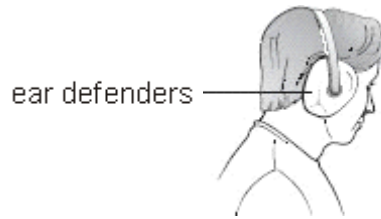
In the correct arrangement

1 mark
maximum 5 marks

Q17.

Three pupils watched a firework display.

- (a) A man lit the fireworks. He wore ear defenders.



Why should he wear ear defenders when he is close to loud fireworks?

.....
.....

1 mark

- (b) A rocket exploded making a loud sound and a bright flash.
Peter, Sabrina and Jan were standing at different distances from the rocket.



Jan



Sabrina



Peter



When the rocket exploded, Jan heard the quietest sound.
Why did Jan hear the quietest sound?

.....
.....

1 mark

(c) Jan saw the flash before she heard the sound.

What does this tell you about the speed of light and the speed of sound?

.....
.....

1 mark

(d) Complete the sentences below using words from the list.

chemical electrical heat light sound

(i) Jan, Sabrina and Peter could **see** the rocket explode because it gave out energy.

1 mark

(ii) They could **hear** the rocket explode because it gave out energy.

1 mark
maximum 5 marks

End of paper 100 marks