

NAME:	SCIENCE TEACHER:	10BC
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SCIENCE

Year 10 Examination 2014

10BC – 120 marks

Time allowed: 2 hours

Answer all questions in the spaces provided on the paper.

Show all your working in calculations.

Give units for all answers (eg kg or m) unless they are already provided.

Check you have pages 1-31.

For Teacher Use

Question	m/c	Short answers 1-17	18	19	20	21	22	23	24	25	26	27	28	Total
Marks gained														
Marks available	30	50	3	4	3	4	4	2	3	5	5	4	3	120

Thinking with evidence in Science - Multiple Choice Questions

- Use a **blue or black pen**
- For each answer **completely fill in the circle** as shown. A ○ B ● C ○ D ○
- Do **not** extend beyond the circles.
- If you want to change your answer **you must** cross out your original answer as shown. A ○ B ✗ C ○ D ●
- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown. A ○ B ⊗ C ○ D ✗

1 A ○ B ○ C ○ D ○

2 A ○ B ○ C ○ D ○

3 A ○ B ○ C ○ D ○

4 A ○ B ○ C ○ D ○

5 A ○ B ○ C ○ D ○

16 A ○ B ○ C ○ D ○

17 A ○ B ○ C ○ D ○

18 A ○ B ○ C ○ D ○

19 A ○ B ○ C ○ D ○

20 A ○ B ○ C ○ D ○

6 A ○ B ○ C ○ D ○

7 A ○ B ○ C ○ D ○

8 A ○ B ○ C ○ D ○

9 A ○ B ○ C ○ D ○

10 A ○ B ○ C ○ D ○

21 A ○ B ○ C ○ D ○

22 A ○ B ○ C ○ D ○

23 A ○ B ○ C ○ D ○

24 A ○ B ○ C ○ D ○

25 A ○ B ○ C ○ D ○

11 A ○ B ○ C ○ D ○

12 A ○ B ○ C ○ D ○

13 A ○ B ○ C ○ D ○

14 A ○ B ○ C ○ D ○

15 A ○ B ○ C ○ D ○

26 A ○ B ○ C ○ D ○

27 A ○ B ○ C ○ D ○

28 A ○ B ○ C ○ D ○

29 A ○ B ○ C ○ D ○

30 A ○ B ○ C ○ D ○

**Do NOT answer questions
31-40 from the booklet.**

Question 1 [3 marks]

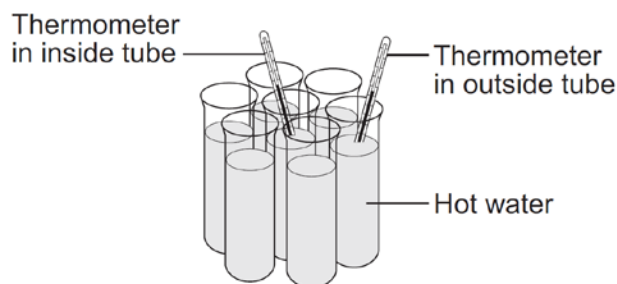
Penguins are often seen huddling together. A group of students did an investigation to find out if huddling helps to keep animals warm. The students put hot water into each of seven large test tubes.

The students recorded the temperature of the water in two of the tubes every minute for 10 minutes.



- (a) Which would be the best experimental control for this investigation? (circle your answer)

- A repeating the investigation to check the results
- B recording the temperature of water in a tube left on its own
- C measuring the temperature of real penguins in a huddle
- D moving the tubes around every two minutes



The table shows the data collected by the students.

Time (minutes)	Temperature of water in inside tube ($^{\circ}\text{C}$)	Temperature of water in outside tube ($^{\circ}\text{C}$)
0	75	74
10	68	49

- (b) To collect data for a line graph, the students should... (circle your answer)
- A collect results for more than 10 minutes.
 - B make sure that the water in the tubes was at the same temperature at the start.
 - C collect results more often during the 10 minutes.
 - D use a thermometer that measures to greater precision.

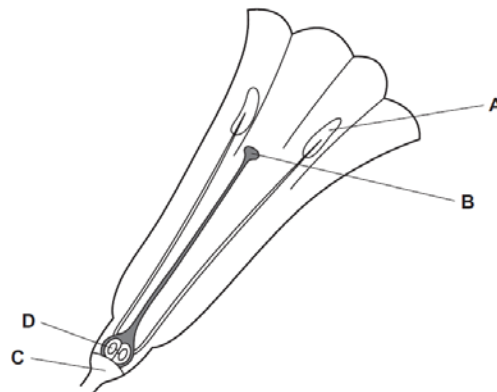
- (c) The students looked at their results and wrote a conclusion.

Write down conclusion for the experiment based on the results given in the table.

Q1:

Question 2 [4 marks]

Flowers are organs in which sexual reproduction takes place. The diagram shows a section through a flower.



- (a) State the letter of the part in which
- (i) the pollen is produced _____
 - (ii) the fertilised egg is produced _____

- (b) Explain how the structure of the flower indicates that it is pollinated by insects. (2 ideas needed).

After pollination and seed formation, the ovary of a flower develops into a fruit. Fruits contain seeds. Most plants produce fruits that are adapted for dispersing seeds. Seeds are dispersed so that young plants do not grow near their parents.

- (c) Explain the advantage to plants of dispersing their seeds.

The photograph shows a cocklebur fruit. The photograph is magnified.

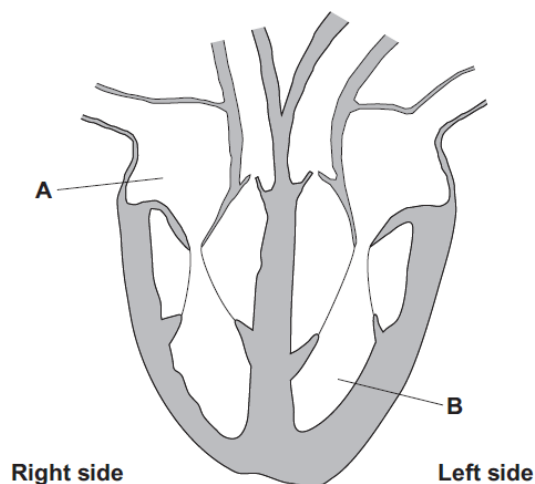
- (d) Suggest how cocklebur fruits are adapted for dispersing their seeds. Explain your choice.



Question 3 [5 marks]

A sports physiologist must have a detailed understanding of the heart system.

The diagram shows the structure of the heart.

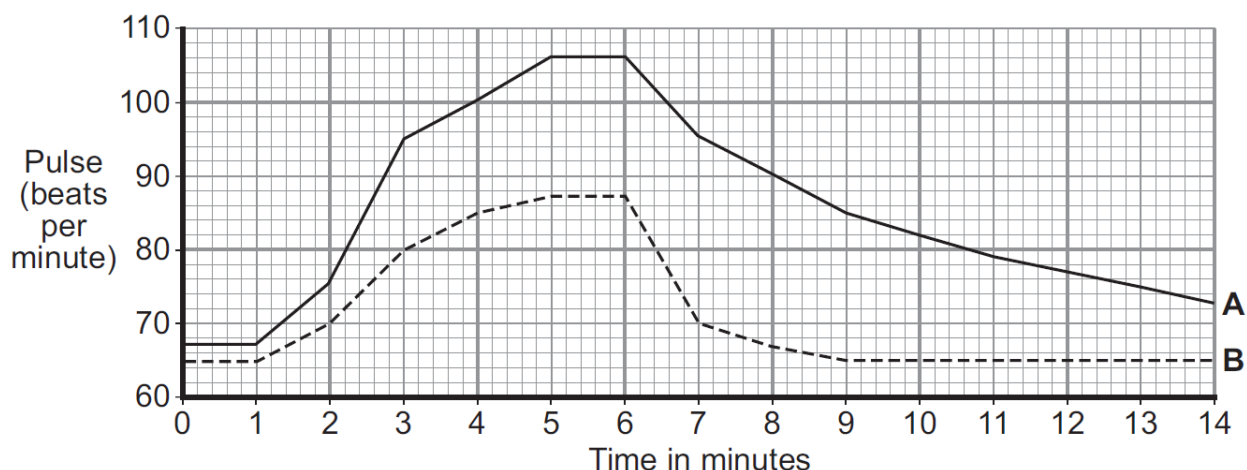


- (a) Draw arrows on the diagram to show how the blood circulates through the heart.

- (b) Name the parts of the heart labelled A and B.

A	B
---	---

An athlete and an office worker monitored their heart rate by taking their pulse before, during and after exercise. The graph shows their results.



- (c) Why does the heart rate increase during exercise?

- (d) Suggest which line, A or B, shows the results for the athlete.

Line _____

Give two reasons for your answer.

1

2

Q3:

Question 4 [2 marks]

The table shows the amounts of energy, sugar and salt in 100 mL of some sports drinks.

Drink	Energy in kJ	Sugar in g	Salt in mg
A	361	20	0
B	378	22	63
C	427	23	153
D	230	13	5

Which drink

- (a) contains least energy _____
- (b) contains 220 g of sugar per litre _____
- (c) is most likely to cause increased body mass _____
- (d) is least likely to cause an increase in blood pressure _____

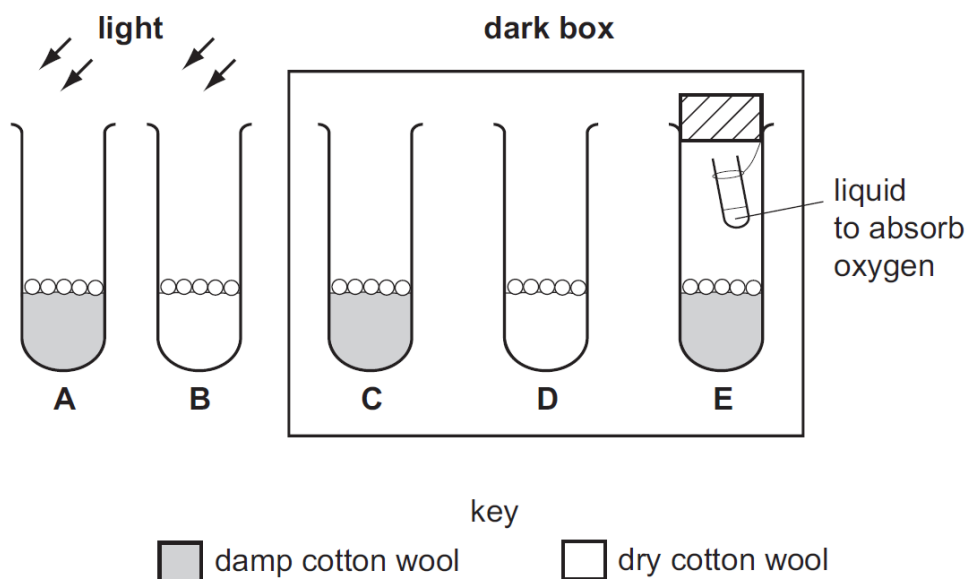


Q4:

Question 5 [3 marks]

A student set up an experiment to investigate the conditions needed for the germination of lettuce seeds.

He placed five lettuce seeds on cotton wool in each of five test-tubes. The diagram shows the conditions present in each tube.



The table shows his results.

Tube	conditions			Number of seeds that germinated
A	Water	Oxygen	Light	5
B	No water	Oxygen	Light	0
C				5
D				0
E				0

- (a) Complete the table to show the conditions present in each tube. Tubes A and B have been done for you.
- (b) What conclusions can the student make from these results? Explain.

Q5:

Question 6 [3 marks]

The table below shows the atomic numbers and mass numbers for six elements.

Element	carbon	nitrogen	oxygen	fluorine	neon	sodium
Atomic number	6	7	8	9	10	11
Mass number	12	14	16	19	20	23

The electrons in atoms are arranged in shells or energy levels.

- (a) What is the largest number of electrons that can fit into the first shell of each of the atoms in the table?

- (b) Which element in the table has 8 protons in the nucleus of its atoms?

- (c) What is the electron arrangement of a sodium atom?

- (d) Explain why the sodium atom has no electrical charge.

Question 7 [3 marks]

The picture shows a fire fighter putting out a forest fire.

The fire fighter's clothing has thick thermal padding inside and a light coloured, fire proof, shiny layer outside.



- (a) What is the main way that heat is transferred through the air from the fire to the fire fighter?

- (b) Why is the outside layer of the clothing shiny?

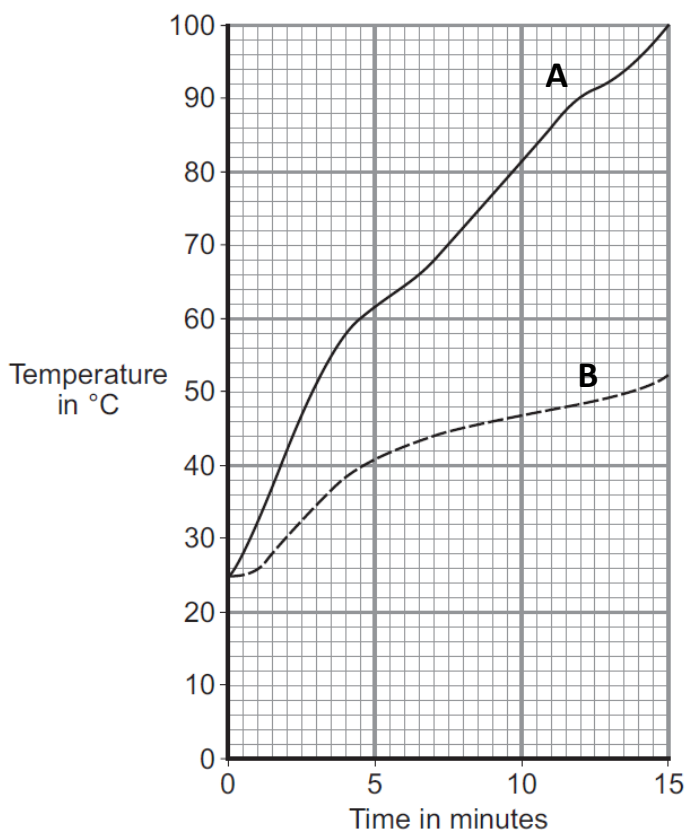
The graph shows the result of a laboratory test on two types of thermal padding.

Each type of padding was put onto a very hot metal surface and the temperature inside the padding was taken every minute.

- (c) Which type of padding, A or B, would it be best to use inside the fire fighter's clothing? Give a reason for your answer.

Padding _____

Reason:



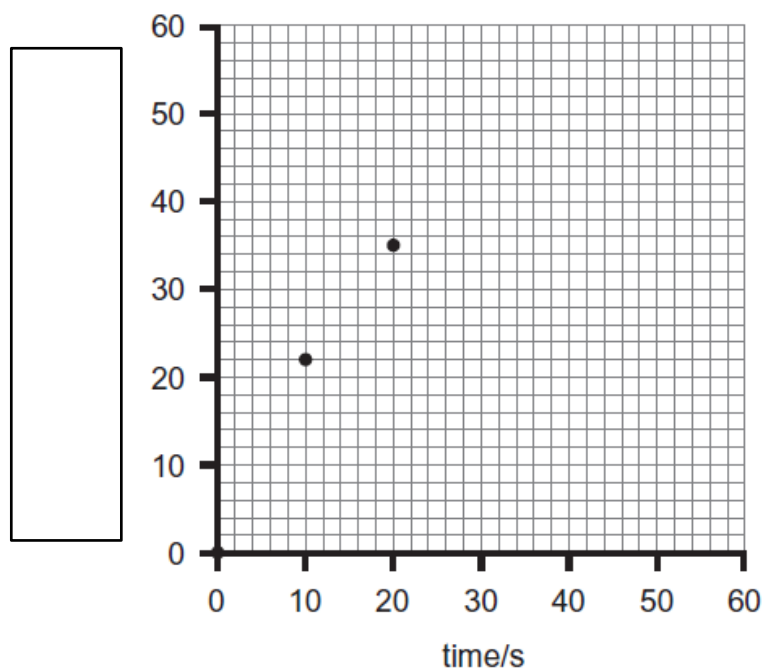
Q7:

Question 8 [3 marks]

Ashley carried out an investigation into the volume of carbon dioxide given off when baking powder is added to acid. Her results are shown below.

Time (s)	0	10	20	30	40	50	60
Volume (mL)	0	22	35	42	48	50	50

- (a) On the grid below plot the rest of the points and draw a curve of best fit.



- (b) Label the y-axis.
(c) Use your graph to find how long it took to produce 30 mL of gas.

Question 9 [3 marks]

Indicators can change colour in acid and alkaline solutions. Indicators can be made from plant material such as red cabbage. Use this information in the table to answer the questions that follow.

Substance	Colour of universal indicator paper	Colour of red litmus paper	Colour of red cabbage solution	pH range
Hydrochloric acid	Red	Red	Red	1-2
Sodium hydroxide	Dark blue	Blue	Yellow	12-14
Water	Green	Red	Purple	7
Ethanoic acid	orange	red	red	3-6

Q8:

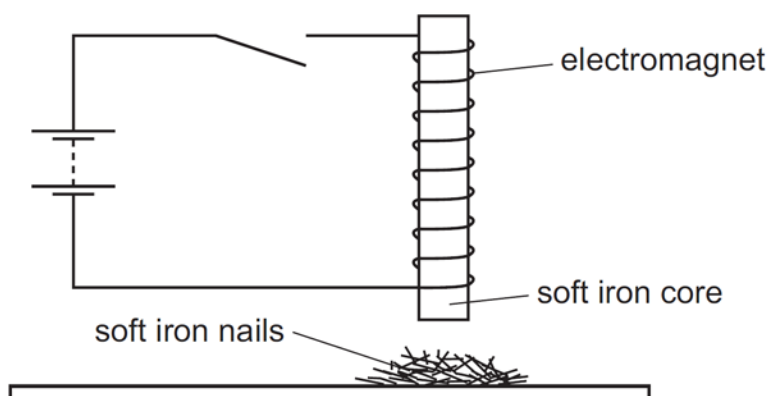
(a) Why is red litmus paper not a suitable indicator for testing pH?

(b) Explain why red cabbage solution can be described as an indicator.

(c) Why is universal indicator a better indicator than red cabbage solution for testing acids?

Question 10 [2 marks]

An electromagnet with a soft iron core is connected to battery through an open switch. The soft iron core lies just above some small soft iron nails.



The switch is now closed, left closed for a few seconds, and then opened.

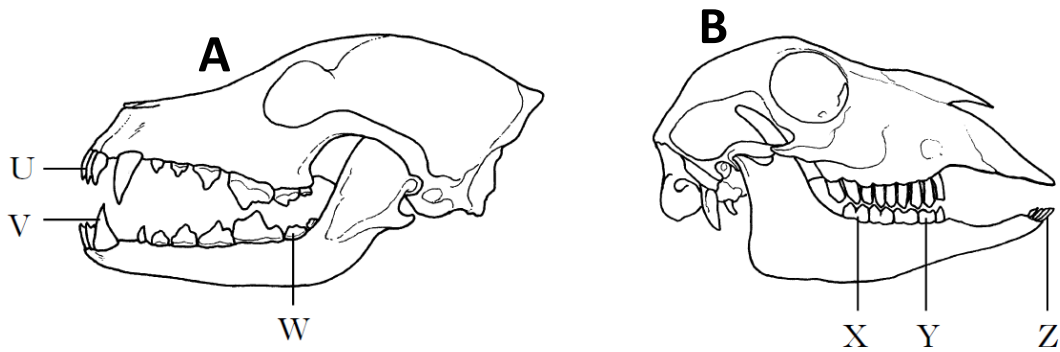
What do the soft iron nails do:

(a) (i) as the switch is closed?

(ii) as the switch is then opened?

(b) Why does the student use a soft iron core?

Question 11 [4 marks]



The diagram shows the skulls of two mammals.

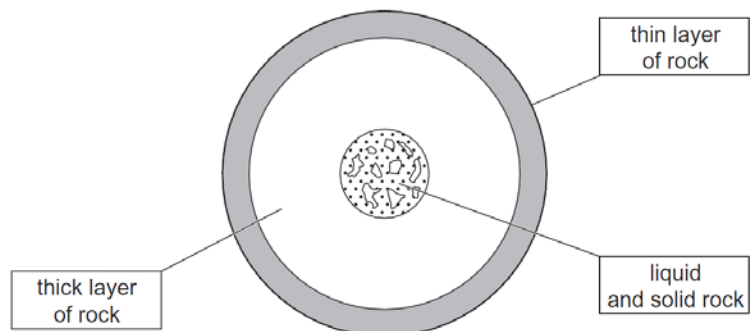
(a) Use letters (U to Z) from the diagram to identify the following teeth.

- (i) Incisors _____ and _____
- (ii) A tooth used for piercing and holding prey _____
- (iii) A tooth used for crushing and grinding plant material _____

(b) Which skull belongs to a herbivore; Explain in detail why you chose this skull.

Question 12 [1 mark]

(a) Use the diagram to describe what the mantle is made from.

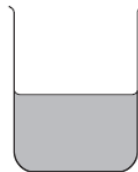


(b) What name is given to the outer layer?

Q11: Q12:

Question 13 [3 marks]

A forensic scientist mixed some soil from a crime scene with water to carry out some tests.



- (a) How would the forensic scientist produce a clear solution?

- (b) How would the forensic scientist measure the pH of this solution?

A bag of powder was found in the car at the crime scene.

- (c) Describe how the forensic scientist would test a sample of the powder to see if it was soluble.

- (d) When the powder was mixed with an acid, a gas was given off. How could you tell if the gas is carbon dioxide?

Tick one box.

- ☐ When the gas is added to limewater, the limewater turns cloudy.
- ☐ When a glowing splint is put in the gas, the splint lights up.
- ☐ When a burning splint is placed in the gas there is a popping sound.

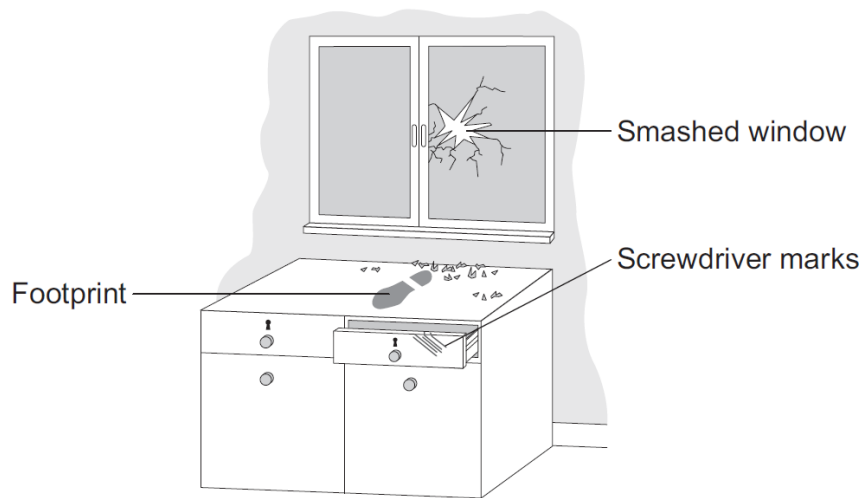


Q13:

Question 14 [1 marks]

A Scenes of Crime Officer (SOCO) took a photograph of a crime scene.

The drawer had been forced open using a screwdriver and marks were left in the wood. A shoeprint was left on the top of the cupboard.

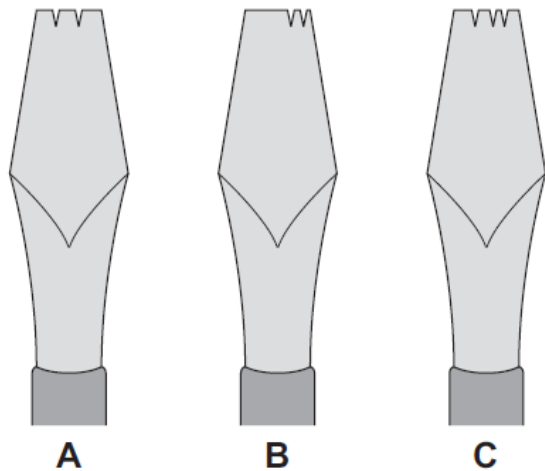


- (a) How would the SOCO collect evidence of the marks left by the screwdriver at the crime scene?

The marks made by the screwdriver were analysed by a forensic scientist.

Three screwdrivers were collected, one from each of three possible suspects.

The diagram below shows the marks on the drawer at the crime scene



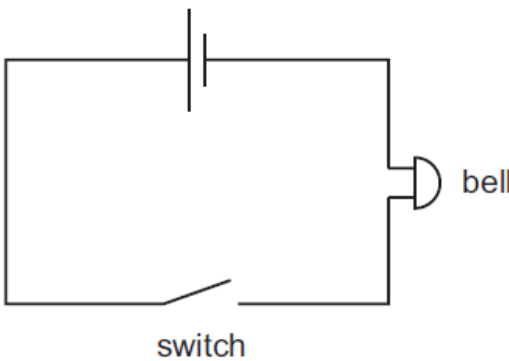
- (b) Which screwdriver, A, B or C, caused the marks on the drawer?

Q14:

Question 15 [3 marks]

A house has a door bell which is operated by a switch at the door. The switch is closed when the bell push is operated.

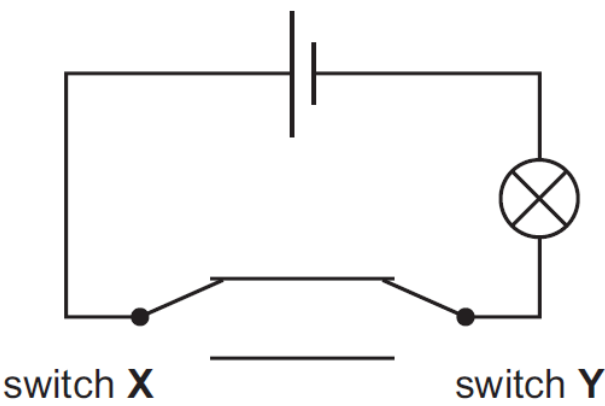
The diagram shows the electrical circuit for this.



- (a) **On the diagram above**, add another switch and connecting wires to enable the bell to work from another door as well.

The diagram opposite shows a circuit for a two-way switch to operate a lamp.

- (b) Use the circuit diagram to complete the table below.
State the position of the switch and whether the lamp is off or on.

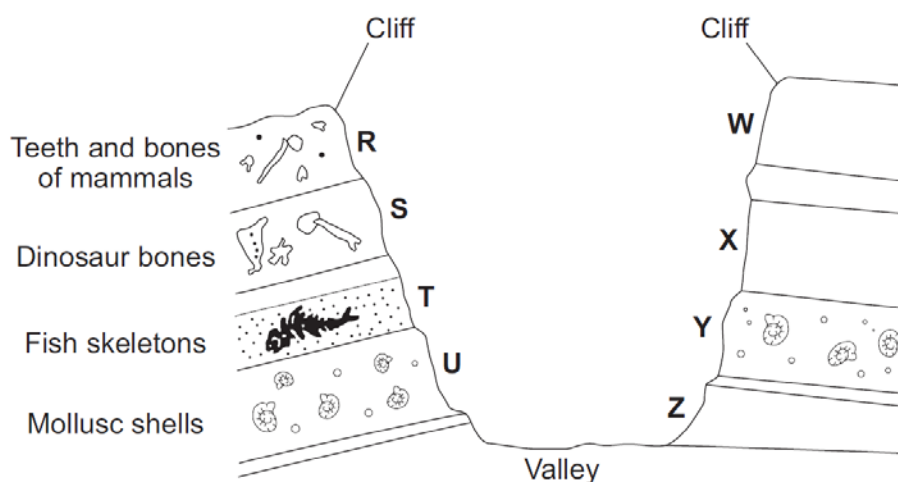


Switch X	Switch Y	Lamp on or off
up	up	
up	down	
down		off
	down	on

Q15:

Question 16 [3 marks]

The diagram shows a section through rock layers containing fossils.

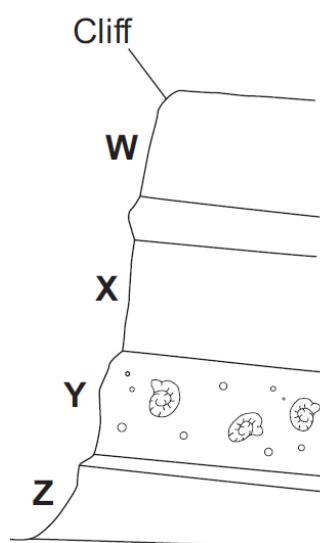


- (a) Which layers of rock are probably the same age? Give a reason for your answer.

- (b) Which of these statements about rocks and fossils is true? Tick your answer(s)

- ☐ Older fossils are usually found in deeper rocks.
- ☐ Rocks of the same age in a particular area will contain fossils of totally different life forms.
- ☐ The deeper the rock, the more different types of fossil are found.
- ☐ Fossils are never found in igneous rocks.

- (c) On the diagram, draw the fossils that would be found in layer W.



Q16:

Question 17 [4 marks]

Polymers

Polymers are materials made of giant molecules. Polymer molecules can be linear, branched or cross-linked. Linear and branched molecules form thermoplastic polymers such as polythene, polystyrene and nylon.

Thermoplastic polymers soften when heated. Cross-linked molecules form thermosetting polymers. These polymers do not soften when heated.

Urea-formaldehyde is a thermosetting polymer used to make electrical plugs and sockets. Bakelite, the first commercially produced man-made polymer, is also thermosetting.

Polymers have a wide range of applications due to their useful properties, including strength, good electrical and thermal insulation and resistance to attack by corrosive chemicals. Low density polythene or LDPE is widely used in the packaging industry as a tough, transparent film. High density polythene or HDPE is used where greater strength is required. HDPE is used to make heavy duty bottles and traffic cones. HDPE is also used in the construction industry to make pipes and gutters.

Polymer properties can be changed by using additives, such as plasticisers, lubricants, pigments and anti-oxidants. Plasticisers give the polymer more flexibility and lubricants reduce friction. Pigments are used to make final products of different colours. To protect polymers against attack by oxidising agents, anti-oxidants are added.

Use the information above to answer the following questions:

(a) What happens to nylon when it is heated?

(b) What type of molecules is present in Bakelite?

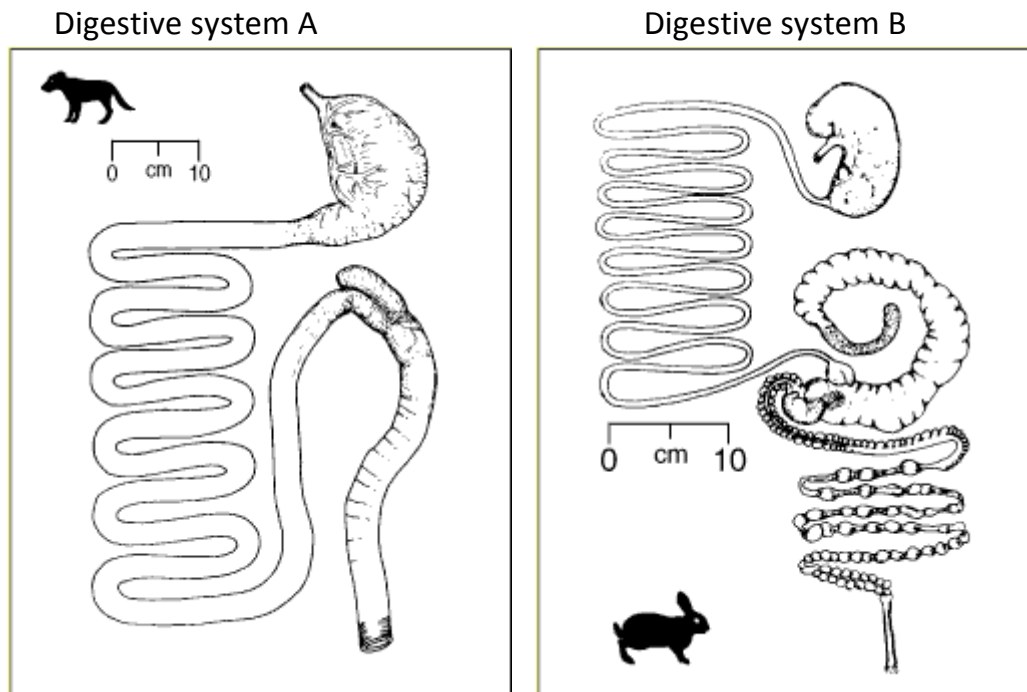
(c) Why are traffic cones made from HDPE and not LDPE?

(d) What type of additive can be used to make HDPE bright orange in colour?

Q17:

Question 18 [3 marks]

The two diagrams below show two different digestive systems. Use these diagrams to answer the following questions.



- (a) State which digestive system above represents the digestive system of a herbivore.

- (b) Describe two differences between the digestive systems of the dog and rabbit and discuss why they have these differences in terms of their diet.

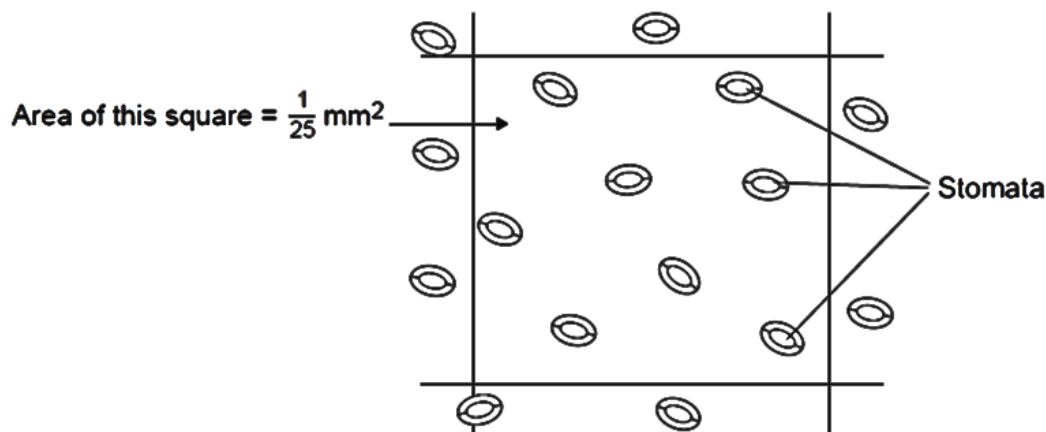
Question 19 [3 marks]

A class of students investigated the number of stomata per mm² on the upper surface and on the lower surface of the leaves of three species of plant, P, Q and R.

The students placed samples of the surface cells onto a grid on a microscope.

Student X counted the stomata on the lower surface of a leaf from one of the plant species.

The diagram shows part of the grid that student X saw under the microscope.



(a) Complete the calculation to estimate the number of stomata per mm^2 on the lower surface of this leaf.

- Number of stomata in $\frac{1}{25} \text{ mm}^2 =$
- Number of stomata in $1 \text{ mm}^2 =$

The table shows the average results for the class.

Plant species	Average number of stomata per mm^2 of leaf	
	Upper surface of leaf	Lower surface of leaf
P	40	304
Q	0	11
R	85	195

Student X had counted the stomata on the lower surface of a leaf from one of the plant species. Use your answer to part (a) and information in the table, to help you to answer this question.

(b) From which plant species, P, Q or R, was student X's leaf most likely to have been taken?

(c) Species Q is normally found growing in hot, dry conditions. Explain one way in which species Q is adapted for living in hot, dry conditions. Use information from the table.

Question 20 [3 marks]

A student investigated three different insulating materials.

- She took four identical ice cubes.
- She wrapped three of the ice cubes in different materials.
- All of the ice cubes started at the same temperature.
- The student put the ice cubes in direct sunlight.
- She measured the time each ice cube took to melt.

Her results are shown in the table.

Ice cube	Insulating material	Time taken for the ice cube to melt (s)
A	aluminium foil	540
B	black paper	120
C	newspaper	300
D	no insulation	180

(a) Why did the student use one ice cube with no insulation?

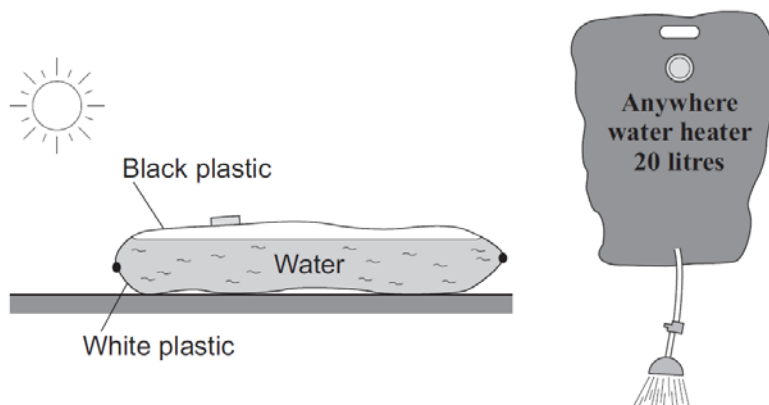
(b) What conclusion about the performance of the insulating materials can be made from the investigation?

(c) In terms of energy, why do each of the different materials give different results?

Q20:

Question 21 [4 marks]

The diagram shows a simple type of portable shower. The water container is a strong plastic bag that is black on one side and white on the other. To warm the water, the bag is placed on the ground in direct sunlight, with the black side facing the Sun.



- (a) Circle the process by which heat is transferred from the Sun to the outside of the bag.

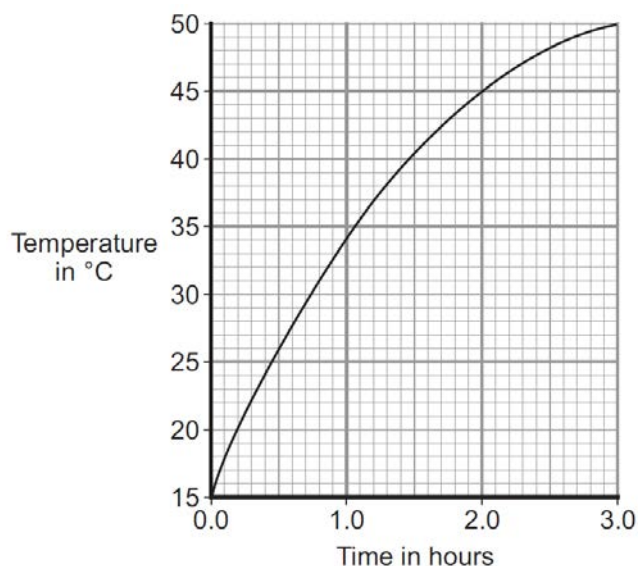
conduction convection radiation

- (b) Explain why the black side of the bag and not the white side should face the Sun.

The graph shows how the temperature of the water inside a full bag increases after the bag is placed outside on a sunny day.

- (c) How long does it take for the water to reach 37°C ?

- (d) Describe how the temperature of the water changes during the three hours.



A different manufacturer makes the same type of portable shower but uses a bag with a larger surface area.

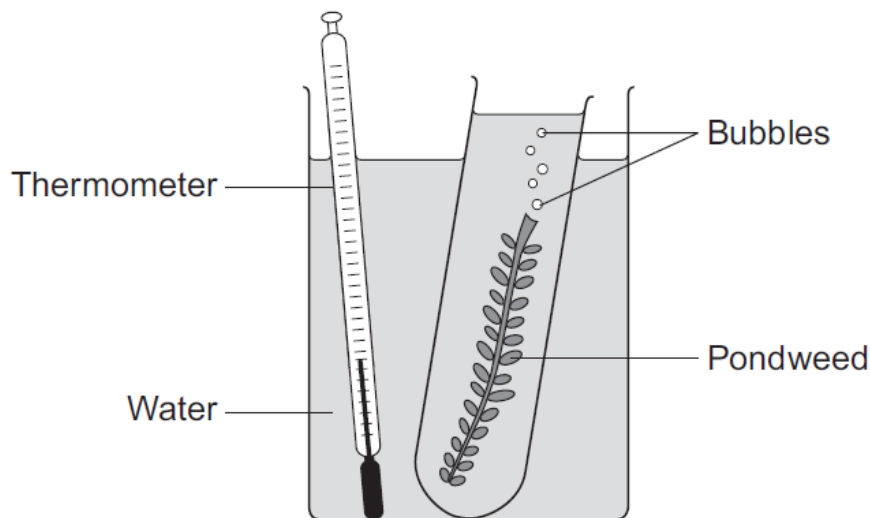
The bag is made from the same coloured plastics and holds the same amount of water. The second bag has a larger surface area. Assume that the two bags are tested in exactly the same way.

- (e) Draw a line **on the graph** to show how the temperature of the water inside the second bag would change over the first hour.

Question 22 [3 marks]

A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

The diagram shows the way the experiment was set up.

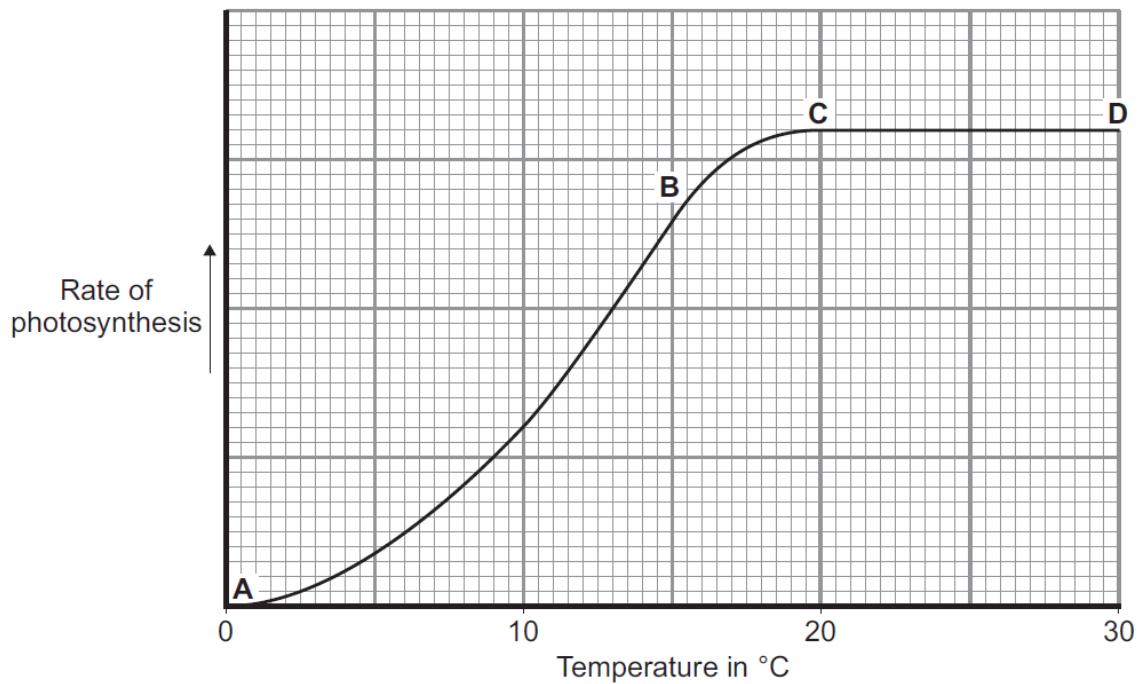


- (a) The student needed to control some variables to make the investigation fair. State two of these variables.

- (b) The bubbles of gas are produced only while photosynthesis is taking place. What two measurements would the student make to calculate the rate of photosynthesis?

Q21:

The graph below shows the effect of temperature on the rate of photosynthesis.

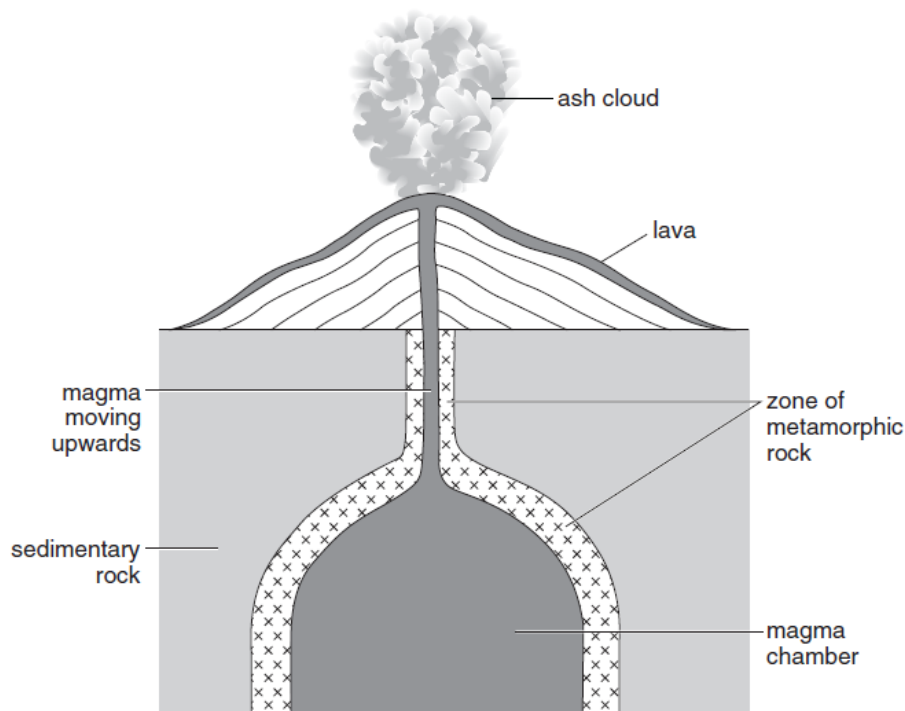


- (c) Name the factor that limits the rate of photosynthesis between the points labelled A and B on the graph.

- (d) Discuss which factor, carbon dioxide, oxygen or water, might limit the rate of photosynthesis between the points labelled C and D on the graph.

Question 23 [4 marks]

The diagram below shows a section through a volcano. Magma is moving up from a magma chamber. Some of the magma erupts to form lava. The liquid lava cools and becomes solid rock.



- (a) Which one stays liquid longer, magma underground or lava on the surface?

As the magma cools underground, it solidifies and crystals are formed.

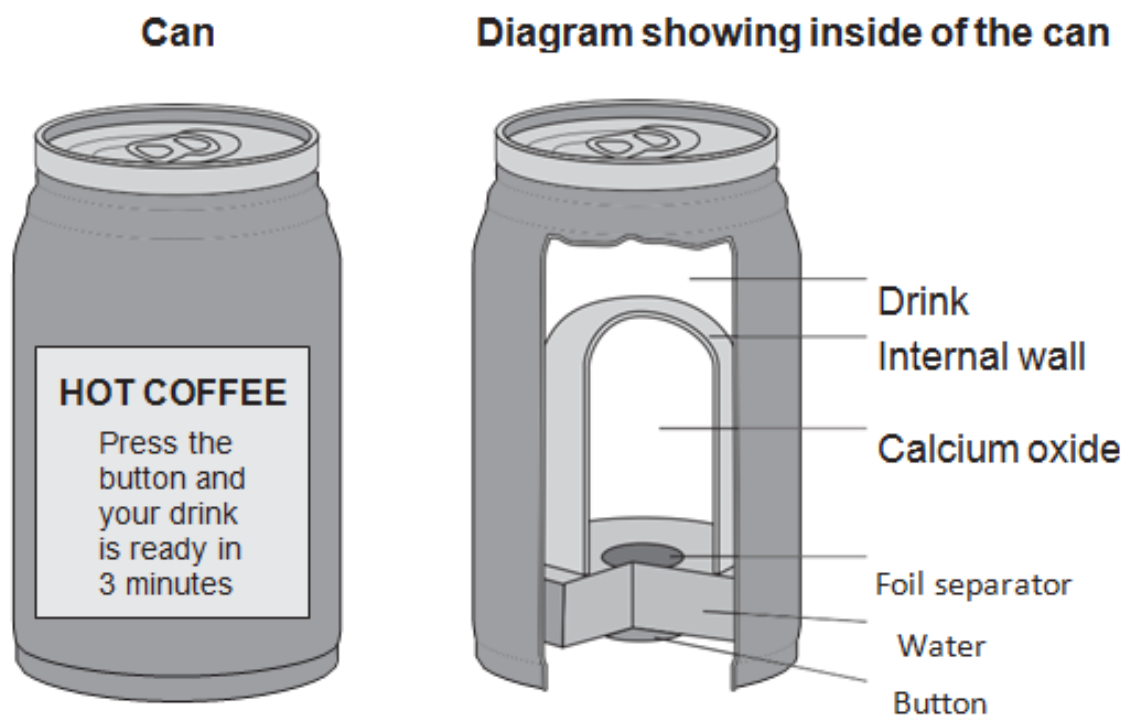
- (b) In what way will these crystals be different from the crystals formed when lava solidifies above ground? Give the reason for your answer.

- (c) A zone of rock surrounding the magma has become a metamorphic rock. What conditions would cause this to happen?

Question 24 [3 marks]

Read the information in the box.

A self-heating can is used to make a coffee drink hot.



- To heat the drink, the button is pressed.
- Pressing the button breaks the foil separator.
- The water and calcium oxide mix and react.
- Calcium hydroxide is produced.
- The reaction gives out heat energy.
- The heat is used to warm the drink to 60°C.

The walls of the can are insulated.

The insulation stops the outside of the can becoming hot.

The drink is added to the can in one factory.

Calcium oxide and water are added to the can at a different factory.

- (a) Complete the word equation for the reaction that takes place between calcium oxide and water. Use information from the box.

calcium oxide + _____ → _____

- (b) Give two safety features in the way the can is designed and manufactured. Use the information in the box to help you.

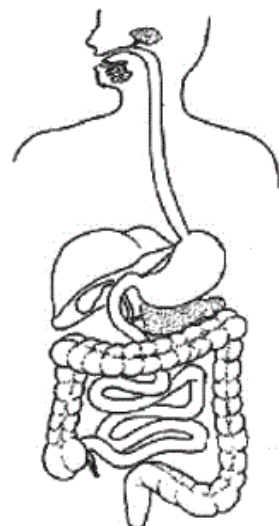
Question 25 [5 marks]

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe how the different parts of the human digestive system help to break down molecules of fat so that they can be absorbed into the body.

To gain full marks you should refer to:

- the enzyme and where the enzyme is produced
- the products of digestion
- any other chemicals involved

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Question 26 [5 marks]

Many people suffer from medical conditions which affect what they can eat.
The table below gives information about some of these conditions.

Condition	Symptoms	Dietary advice
coeliac disease	diarrhoea, malnutrition, tiredness	wheat free diet
diabetes (type 2)	increased thirst, loss of weight, blurred vision	low fat and low sugar diet
heart disease	pain in chest and arms, heart attacks	low fat and low sugar diet
lactose intolerance	bloating, nausea, abdominal pain	lactose free diet

A menu from a restaurant is shown,

Starters		KEY	
Garlic bread	V	♥	low in fat and sugar
Sweet potato soup	L V W	L	lactose free
Red pepper soup	♥ W	V	vegetarian
Vegetable tartlets	♥ V	W	wheat free
Main courses			
Bean and green pepper salad	♥ V		
Chicken and melon shells	♥		
Chicken with grapefruit glaze	L		
Thai beef salad	♥ W		
Tomato and feta tarts	V W		
Desserts			
Chocolate and pear tart	L V W		
Fig and apricot crunch	♥ V		
Strawberry ice cream	V W		
Summer fruit mousse	L V W		

Use the table and the menu to answer the questions below.

(a) Mr Thomson has to eat a wheat free diet.

(i) From which condition does he suffer?

(ii) Which two main courses can he eat?

(b) Mr Davidson has diabetes. Which dessert should he choose?

(c) Mr Smith should only choose chicken with grapefruit glaze as his main course.
Give two symptoms of the condition from which he suffers.

(d) Mrs Herd has heart disease. She is also a vegetarian.
Complete her menu order card.

<i>Order card</i>	
Starter	<hr/>
Main course	<hr/>
Dessert	<hr/>

Q26:

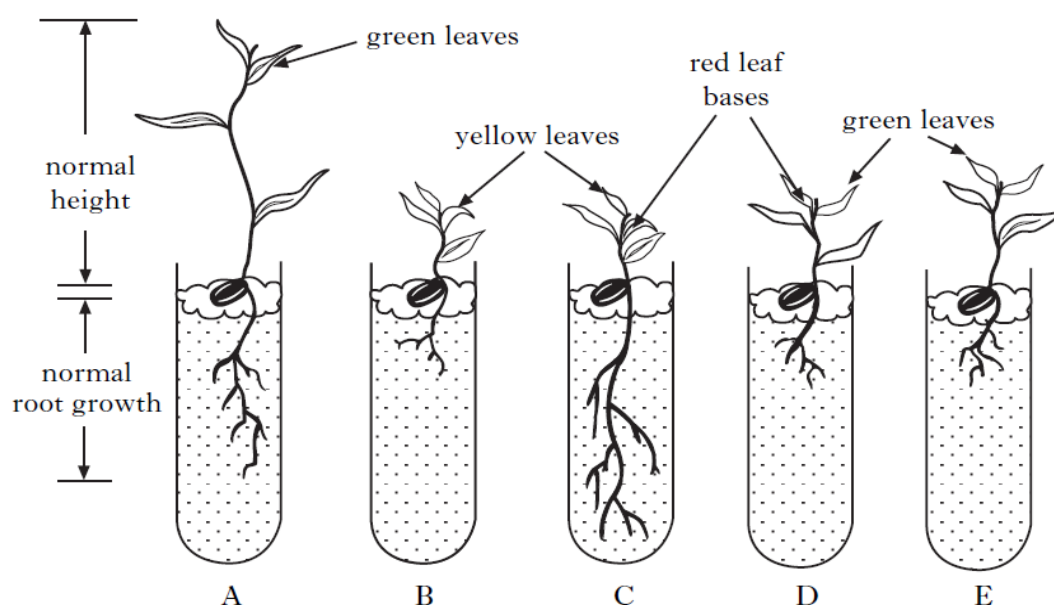
Question 27 [4 marks]

The effect of some minerals on plant growth was investigated. When a mineral is missing, the plant will not grow properly.

In experiment A, a plant was grown in a solution containing nitrogen, phosphorus, potassium and magnesium. These minerals are all needed for healthy growth.

In experiments B, C, D and E, each solution had one of these minerals missing.

The results are shown below.



The table shows the effect on a growing plant if a mineral is missing from the solution.

Mineral missing from solution	Effect on growing plant	
nitrogen	<ul style="list-style-type: none">• smaller height• yellow leaves	<ul style="list-style-type: none">• red leaf bases• longer roots
phosphorus	<ul style="list-style-type: none">• smaller height• green leaves	<ul style="list-style-type: none">• red leaf bases• shorter roots
potassium	<ul style="list-style-type: none">• smaller height• green leaves	<ul style="list-style-type: none">• shorter roots
magnesium	<ul style="list-style-type: none">• smaller height• yellow leaves	<ul style="list-style-type: none">• shorter roots

(a) What colour are the leaves of a plant growing in a solution with all the minerals?

(b) Give two pieces of information about the leaves of a plant growing in a solution with no nitrogen.

(c) Which mineral is missing from the solution in experiment B?

(d) Which experiment has no phosphorus in the solution?

Question 28 [3 marks]

Architects need to know how well different materials insulate buildings. This can be determined using **U-values**.

The **U-value** is defined as the rate at which heat energy is transferred through one square metre of building material when the temperature difference is one degree Celsius.

The rate of heat transfer through a material can be determined using:

$$\text{rate of heat transfer} = \text{U-value} \times \text{area} \times \text{difference in temperature}$$

The tables below give information for two houses.



House P

House P	<i>U-value</i> (W m ⁻² °C ⁻¹)	<i>Total area</i> (m ²)
Uninsulated roof	2.0	150
Cavity walls	1.9	300
Single glazed windows	5.6	50



House Q

House Q	<i>U-value</i> (W m ⁻² °C ⁻¹)	<i>Total area</i> (m ²)
Insulated roof	0.5	150
Filled cavity walls	0.6	500
Double glazed windows	2.8	80

- (a) Complete the sentence below by circling the correct answer.

The { **higher** / **lower** } the U-value, the better the material is as a heat insulator.

The rate of heat transfer through a material can be determined using:

rate of heat transfer = U-value × area × difference in temperature

When the temperature outside is 2°C and the inside temperature is 22°C the rate of heat transfer through the roof for **house Q** is:

$$\begin{aligned}\text{rate of heat transfer} &= 0.5 \times 150 \times 20 \\ &= 1500\end{aligned}$$

- (b) Show, by calculation, that house P has the highest rate of heat transfer through the roof when the outside temperature is 2 °C and the inside temperature is also 22 °C.

Q28:

THE END