



# Coimisiún na Scrúduithe Stáit State Examinations Commission

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**JUNIOR CERTIFICATE EXAMINATION, 2015**

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**SCIENCE – HIGHER LEVEL**

**THURSDAY, 11 JUNE – MORNING, 9.30 to 11.30**

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## INSTRUCTIONS

1. Write your **examination number** in the box provided on this page.
2. Answer **all** questions.
3. Answer the questions in the spaces provided in this booklet. If you require extra space, there is a blank page provided at the back of this booklet.
4. The use of the *Formulae and Tables* booklet approved for use in the State Examinations is permitted. A copy may be obtained from the examination superintendent.

<p><b>Centre Number</b></p>
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<p><b>Examination Number</b></p> <hr style="width: 20%; margin: 10px auto;"/>
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For examiner use only	
Section / Question	Mark
<b>Biology</b>	
Q.1 (52)	
Q.2 (39)	
Q.3 (39)	
<b>Chemistry</b>	
Q.4 (52)	
Q.5 (39)	
Q.6 (39)	
<b>Physics</b>	
Q.7 (52)	
Q.8 (39)	
Q.9 (39)	
<b>Total (Paper)</b>	
Bonus for Irish	
<b>Grand Total (Paper) (390)</b>	
<b>Coursework A (60)</b>	
<b>Coursework B (150)</b>	
<b>Grand Total (600)</b>	

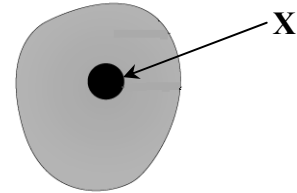
# Biology

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## Question 1

(52)

- (a) All living things are made of cells.  
The diagram is of an animal cell.



- (i) Name the part labelled X. \_\_\_\_\_  
(ii) Name one substance that is able to pass through the membrane of an animal cell.

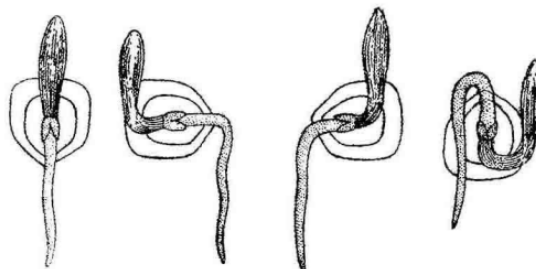
\_\_\_\_\_

- (b) Plant cells are grouped into tissues.

- (i) Name one example of a plant tissue. \_\_\_\_\_  
(ii) State the function of the plant tissue you have named. \_\_\_\_\_

\_\_\_\_\_

- (c) In germinating seeds, the radicle always grows downwards, as in the diagrams.



- (i) What name is given to this growth response? \_\_\_\_\_  
(ii) What is the advantage to the plant of the radicle always growing downwards?

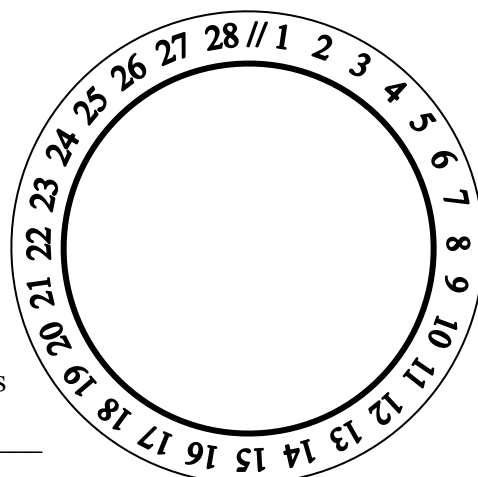
\_\_\_\_\_

- (d) The diagram shows the 28 days of the human female menstrual cycle.

- (i) What is meant by the *fertile period* of the menstrual cycle? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

- (ii) During what range of days (between 1 and 28) is menstruation most likely to occur? \_\_\_\_\_



(1) (2)

(e) Mammals, including humans, use some of the energy they release from food to keep their bodies at a higher temperature than that of their surroundings.

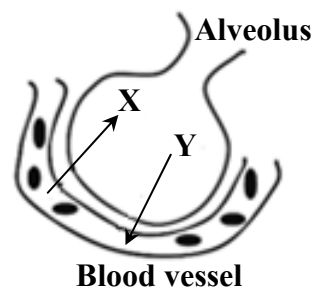
(i) What is the normal temperature of the adult human body? (Give your answer in °C.)

\_\_\_\_\_

(ii) What is the name of the process by which mammals release energy from food?

\_\_\_\_\_

(f) During gaseous exchange in the lungs, gas X leaves the blood vessel and enters the alveolus. At the same time, gas Y leaves the alveolus and enters the blood vessel.



(i) Name gas Y. \_\_\_\_\_

(ii) Name the type of blood vessel shown in the diagram.

\_\_\_\_\_

(g) The skin is an excretory organ, and is the largest organ in the human body.

Name two substances excreted by the skin.

1. \_\_\_\_\_

2. \_\_\_\_\_

(h)



The diagram shows chromosomes in the nucleus of a cell taken from the lining inside a person's mouth.

(i) How many different pairs of chromosomes are usually found in the nucleus of a human cell? \_\_\_\_\_

(ii) What name is given to the parts of chromosomes that control inheritable characteristics? \_\_\_\_\_

(iii) Name one human inheritable characteristic. \_\_\_\_\_

(iv) Name the two substances from which chromosomes are made.

1. \_\_\_\_\_

2. \_\_\_\_\_

(7 × 6 + 1 × 10)

**Question 2**

(39)

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(a) Many foods that we eat contain a lot of starch, which is a form of carbohydrate. (6)

(1) (2)

Name two other forms of carbohydrate that are important in a balanced diet.

1. \_\_\_\_\_

2. \_\_\_\_\_

(b) When we eat starchy foods, the starch must be broken down in our digestive systems using enzymes. (18)

(i) Why do we need to eat starchy foods?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(ii) What is an enzyme?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(iii) Name the enzyme which begins to break down starch in our digestive systems.

\_\_\_\_\_

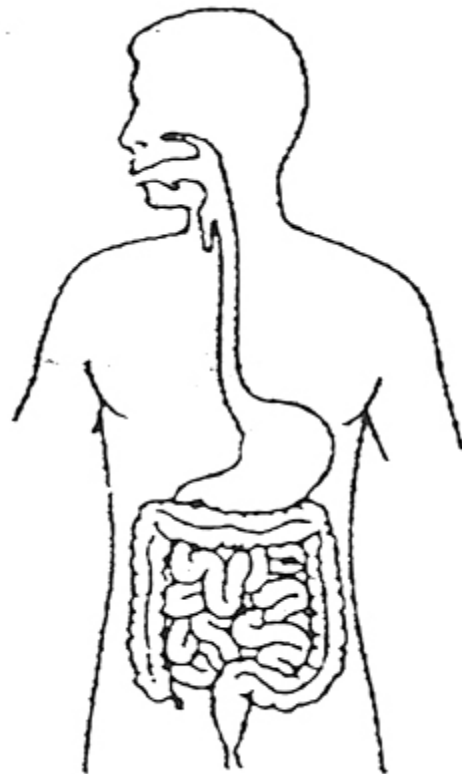
(iv) Name the product of the breakdown of starch by this enzyme.

\_\_\_\_\_

(v) Name two parts of our digestive system where the breakdown of starch takes place.

1. \_\_\_\_\_

2. \_\_\_\_\_

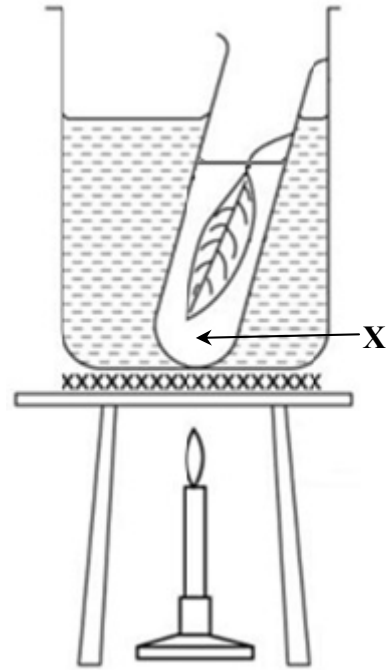


(c) Starch is produced as a result of photosynthesis in a plant.

(15)

The diagram shows one of the steps involved in testing a leaf for the presence of starch.

The purpose of this step is to remove chlorophyll from the leaf.



(i) Why is it necessary to remove the chlorophyll from the leaf? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(ii) Name liquid X. \_\_\_\_\_

(iii) Give a detailed description of the next steps that the student would take when testing the leaf for the presence of starch. Include in your description an account of how the student would know that there was starch present in the leaf.

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For examiner use only	
(1)	(2)

**Question 3**

(39)

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(a) The photograph is of beehives in the middle of an apple orchard. Apple trees help bees and bees help apple trees. (12)



(i) What is the name for this sort of relationship between two species?

\_\_\_\_\_

(ii) How do apple trees help bees?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(iii) How do bees help apple trees? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

(iv) What effect might the decline in bee numbers have on the number of apples produced in orchards? Explain your answer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

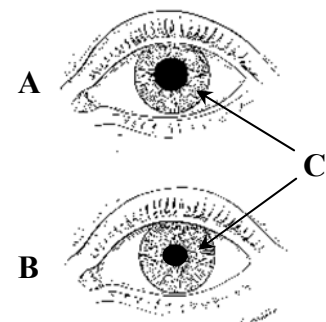
(b) The diagrams are of the human eye, as seen under different conditions of light intensity. (9)

(i) Name the part of the eye labelled C. \_\_\_\_\_

(ii) Which diagram (A or B) shows how the eye would appear under a low level of light intensity? \_\_\_\_\_

Explain your answer. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_



(1) (2)

(c) The diagram shows the bones in a human leg. (18)

(i) Name the bones labelled X and Y.

X \_\_\_\_\_

Y \_\_\_\_\_

(ii) In the diagram, label the location of a ball and socket joint with the letter B.

(iii) In the diagram, label with the letter A the arrow which shows the direction in which blood flows through *arteries* in the human leg.

(iv) Describe two differences between the physical structure of arteries and the physical structure of veins. Drawing a labelled diagram may help your answer.

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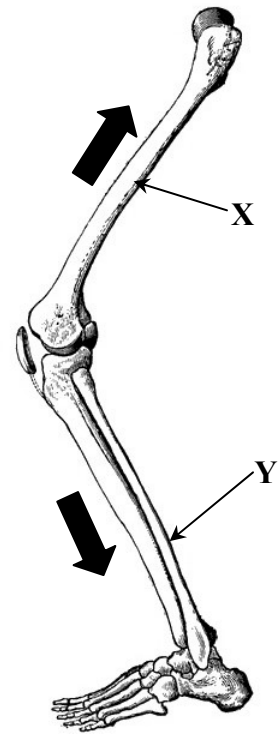
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(1) (2)

Labelled diagram

# Chemistry

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## Question 4

(52)

(1) (2)

(a) Natural gas is used as a fuel in many Irish homes.

(i) Name the hydrocarbon compound that is the main component of natural gas.

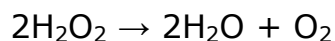
\_\_\_\_\_

(ii) When natural gas is burned completely, carbon dioxide and one other compound are formed.

Name the other compound. \_\_\_\_\_



(b) The balanced chemical equation for the preparation of oxygen in the laboratory is as follows:



(i) Explain the meaning of the large number “2” at the start of “ $2\text{H}_2\text{O}_2$ ”.

\_\_\_\_\_  
\_\_\_\_\_

(ii) Explain the meaning of the small number “2” at the end of “ $2\text{H}_2\text{O}_2$ ”.

\_\_\_\_\_  
\_\_\_\_\_

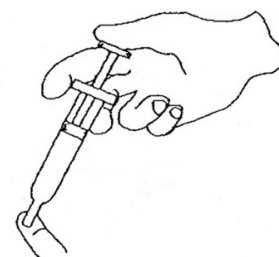
(c)  $20\text{ cm}^3$  of air is drawn into a syringe. The tip is covered, as in the diagram, and the piston is pushed in to the  $10\text{ cm}^3$  mark.

(i) What property of gases is being demonstrated here?

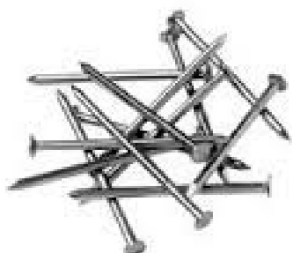
\_\_\_\_\_

(ii) Explain why the piston could not be pushed in if the syringe had been filled with water instead of air. \_\_\_\_\_

\_\_\_\_\_



(d)



Iron nails rust easily.

Name two methods of rust prevention.

1. \_\_\_\_\_

2. \_\_\_\_\_

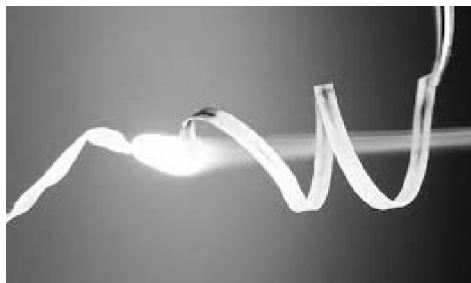


- (e) Write a balanced chemical equation for the reaction between hydrochloric acid (HCl) and calcium carbonate (CaCO<sub>3</sub>).

\_\_\_\_\_

(1) (2)

- (f) Magnesium ribbon burns in air to produce an intense white light. The compound magnesium oxide is formed in the reaction.

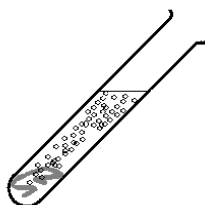


- (i) What type of bonding is present in magnesium oxide? \_\_\_\_\_

- (ii) What colour does moist litmus paper turn in the presence of magnesium oxide?

\_\_\_\_\_

- (g) (i) Name the gas produced when zinc is placed in a solution of hydrochloric acid. \_\_\_\_\_



- (ii) Name one metal which is less reactive than zinc when placed in hydrochloric acid. \_\_\_\_\_

- (h) A science student set up the equipment shown in the diagram to carry out a titration of an acid against a base.

- (i) What name is given to the reaction between an acid and a base?

\_\_\_\_\_

- (ii) Name the two products generally formed in the reaction between an acid and a base.

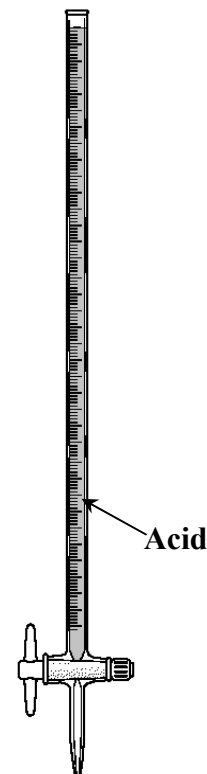
1. \_\_\_\_\_

2. \_\_\_\_\_

- (iii) Examine the diagram and state one experimental error which the student has made.

\_\_\_\_\_

\_\_\_\_\_



Base +  
Indicator

(7 × 6 + 1 × 10)

**Question 5**

(39)

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- (a) From 2015, many domestic consumers will have to pay for the supply and treatment of water. A number of processes are needed so that domestic water is suitable for household uses.

The diagram below shows some of the processes involved in water treatment. (24)

- (i) Name the first process in water treatment, labelled **A**.

\_\_\_\_\_

\_\_\_\_\_

Name one item that might be removed from the water during process **A**.

\_\_\_\_\_

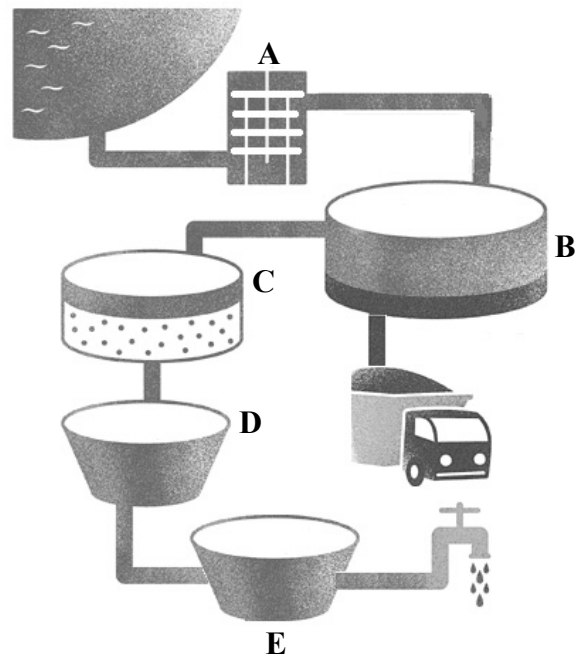
\_\_\_\_\_

- (ii) Explain why water is taken from the *top* of the container labelled **B**.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



- (iii) Why, during process **C**, is the water passed through a filtration bed?

\_\_\_\_\_

- (iv) During process **D** micro-organisms in the water are killed when a certain chemical is added. Name the chemical. \_\_\_\_\_

- (v) Name the final process in water treatment, labelled **E**.

\_\_\_\_\_

- (vi) Explain why it is important that the water supplied to our homes is treated.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- (vii) A lot of the water treated for domestic use is lost due to leaking pipes. Explain why water pipes may get damaged during very cold winters.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(b) Many people living in limestone areas in Ireland have hard water. (6)

(i) Name a metal ion that causes water to be hard. \_\_\_\_\_

(ii) Describe one way to remove the hardness from water.

\_\_\_\_\_  
\_\_\_\_\_

(c) Water may be decomposed into its elements by means of electrolysis, as in the diagram. (9)

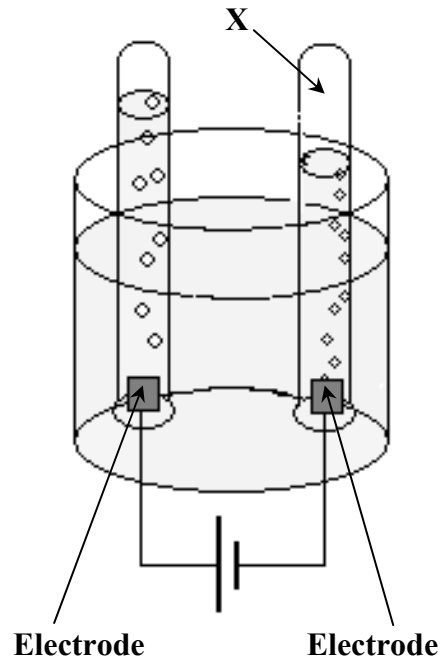
(i) Name the gas labelled X. \_\_\_\_\_

(ii) The electrodes must be made from a material which will not react with the water during the electrolysis.

Name a material from which the electrodes might be made. \_\_\_\_\_

(iii) A chemical must be added to the water so that electrolysis can take place.

Name a chemical suitable for this purpose.  
\_\_\_\_\_



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use only

(1) (2)

**Question 6**

(39)

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(a) The element sodium is given the chemical symbol Na and can be found in the Periodic Table on page 79 of the *Formulae and Tables* booklet. (15)

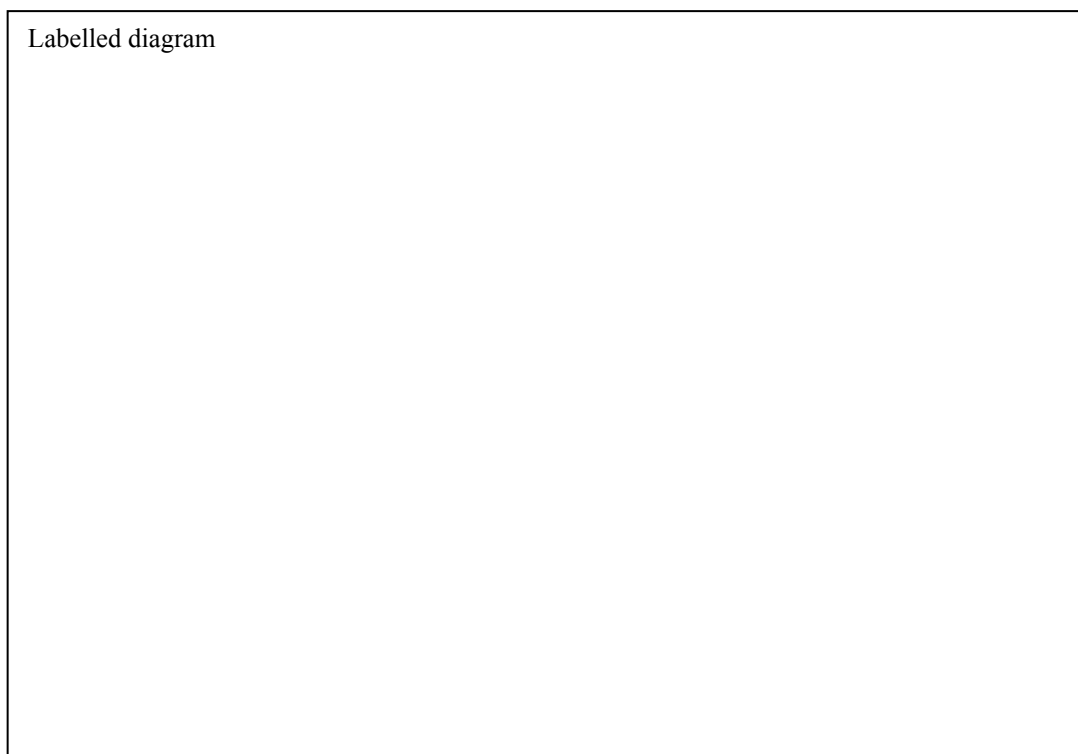
(1) (2)

(i) Sodium is in Group 1 of the Periodic Table.

What is the other name given to this group? \_\_\_\_\_

(ii) Sodium-23 is the most common isotope of sodium. Draw a model of the structure of an atom of sodium-23 in the box below. Your labelled diagram should show the location of all of the sub-atomic particles in the atom.

Labelled diagram



(b) Potassium is also located in Group 1 of the Periodic Table. Many of the chemical properties of potassium are similar to those of sodium. (6)

(i) Explain why sodium and potassium have many similar chemical properties.

\_\_\_\_\_  
\_\_\_\_\_

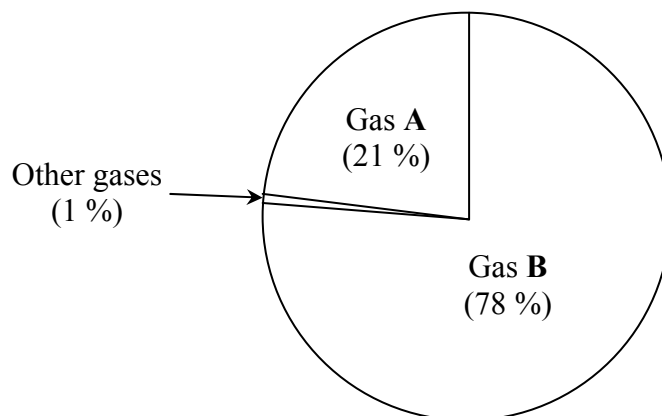
(ii) One chemical property of both sodium and potassium is that they react vigorously in water.

Complete the following word equation for the reaction between potassium and water.

**Potassium + Water** → \_\_\_\_\_ + \_\_\_\_\_

(c) The pie-chart below shows the composition of gases in the air.

(18)



For  
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use only

(1) (2)

(i) Name gas A. \_\_\_\_\_

(ii) Name gas B. \_\_\_\_\_

(iii) Carbon dioxide is one of the other gases found in air.

Describe an experiment to show that carbon dioxide is found in air. Drawing a labelled diagram may help your answer.

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Labelled diagram

A large empty rectangular box intended for drawing a labelled diagram to illustrate an experiment for detecting carbon dioxide in air.

(iv) Outline one piece of experimental evidence which shows that air is a mixture, rather than a compound.

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# Physics

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## Question 7

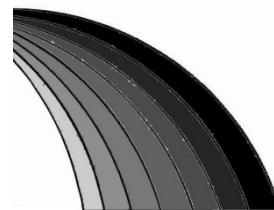
(52)

(1) (2)

(a) A rainbow is seen when white light is separated into its colours.

(i) Name the process that happens when white light is separated into its colours. \_\_\_\_\_

(ii) Name a piece of laboratory apparatus which can be used to separate white light into its colours. \_\_\_\_\_



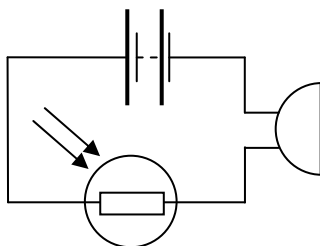
(b) Does heat have to be added to or removed from solid ice at  $0\text{ }^{\circ}\text{C}$  in order to change its state to liquid water at the same temperature? Explain your answer.

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(c)



The circuit diagram shown includes a battery, a light-dependent resistor (LDR) and a buzzer. When a student covers the LDR with his hand, the noise from the buzzer becomes fainter. Explain why this happens.

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(d) A cylindrical block of wood has radius 2 cm, height 7 cm and mass 66 g.

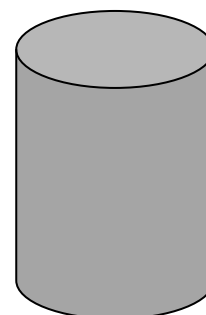
(i) Calculate the volume of the block.

(You may need to refer to page 10 of the *Formulae and Tables* booklet.)

Calculation

(ii) Calculate the density of the wood.

Calculation



(e) Cracks may appear in the surface of a road on a very hot and sunny day.



(i) Explain why this happens.

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(ii) How does heat travel from the Sun to the Earth? \_\_\_\_\_

(f) A metre stick, suspended from its mid-point, has a weight of 1.8 N hanging from the 20 cm mark. Calculate where a student must hang a weight of 2.7 N so that the metre stick will be balanced horizontally.



Calculation

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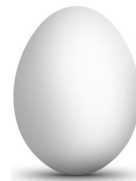


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(g) At sea-level, an egg will be fully cooked when placed in boiling water for three minutes. At higher altitudes, an egg needs to be in boiling water for six minutes before it is fully cooked. Explain this phenomenon.




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(h) France produces most of its electricity using nuclear sources, such as uranium.

(i) Are nuclear energy sources considered to be *renewable* or *non-renewable* sources of energy?




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Explain your answer. \_\_\_\_\_

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(ii) State one advantage of producing electricity using nuclear energy sources.

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(7 × 6 + 1 × 10)

**Question 8**

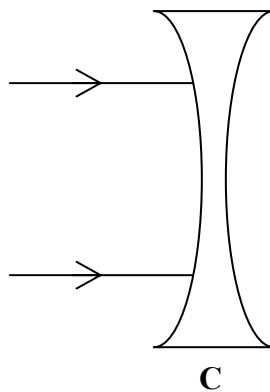
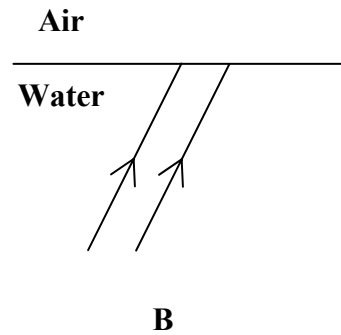
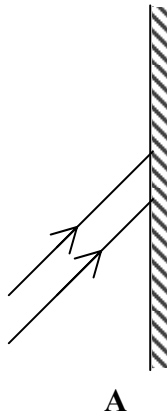
(39)

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- (a) Diagram **A** shows two rays of light hitting a plane mirror.  
Diagram **B** shows two rays of light travelling from water into air.  
Diagram **C** shows two rays of light hitting a concave lens.

(1) (2)

- (i) Complete the ray diagrams below. (9)



- (ii) Name the process that occurs when rays of light pass from water into air. (3)

\_\_\_\_\_

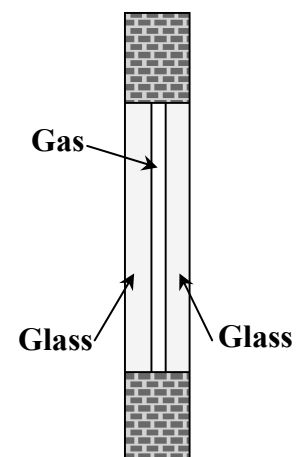
- (b) In order to conserve energy in our homes we must try to prevent heat loss. Double-glazed windows reduce heat loss. Explain how they do this. (6)

\_\_\_\_\_

\_\_\_\_\_

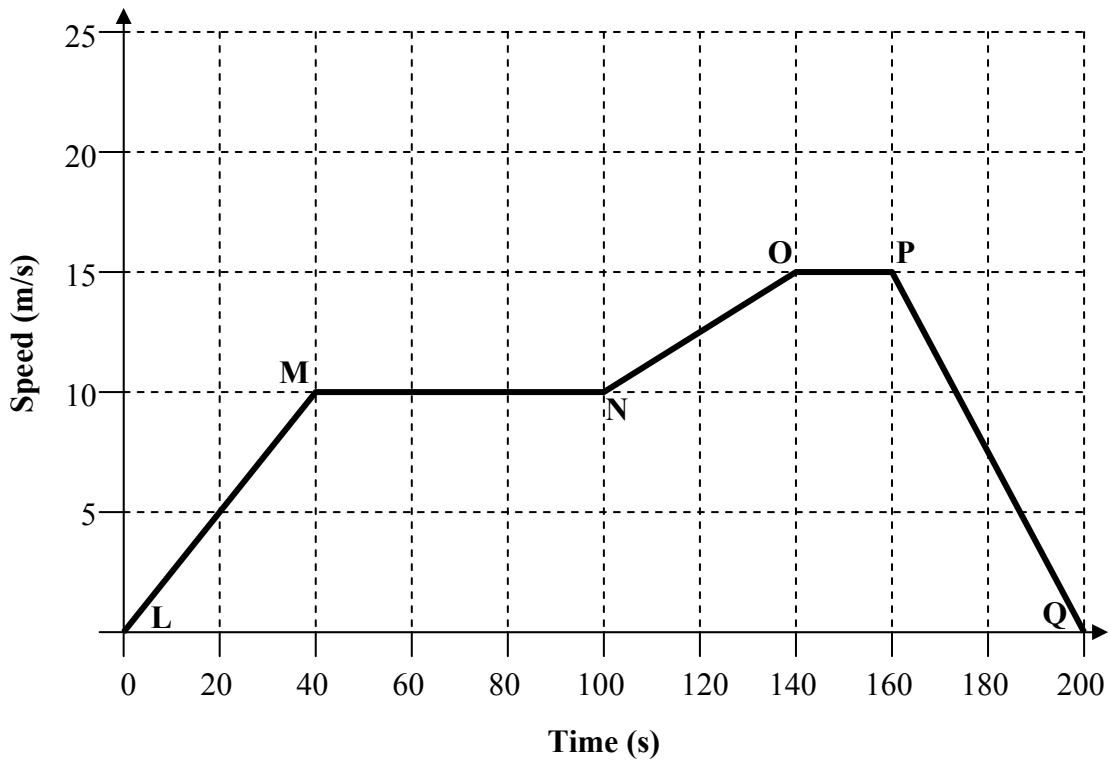
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(c) The graph shows the speed of a Luas tram as it travels from Stop L to Stop Q. (21)



For  
examiner  
use only

(1) (2)

- (i) What is the maximum speed of the tram during its journey? \_\_\_\_\_
- (ii) Calculate the distance travelled by the tram between position M and position N.

Calculation

- (iii) Calculate the acceleration of the tram between position N and position O.

Calculation

- (iv) What are the units of acceleration? \_\_\_\_\_
- (v) Describe the motion of the tram between positions P and Q.

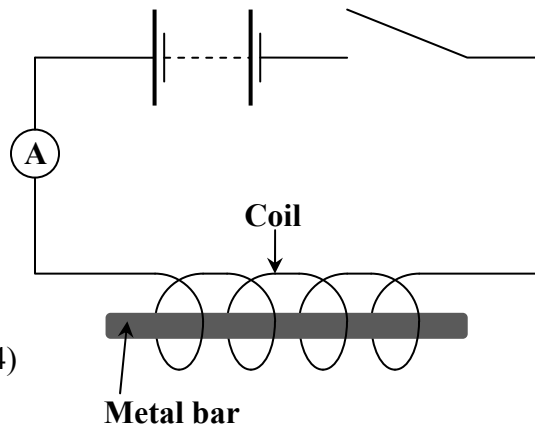
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**Question 9**

(39)

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- (a) A student set up the circuit shown to investigate the magnetic effect of a constant electric current. She varied the number of turns of wire in the coil and counted how many paper-clips were picked up by the metal bar each time. (24)  
Her results are given in the table below.



(1) (2)

<b>Number of turns of wire in the coil</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>80</b>	<b>100</b>
<b>Number of paper-clips picked up</b>	<b>5</b>	<b>11</b>	<b>16</b>	<b>20</b>	<b>26</b>

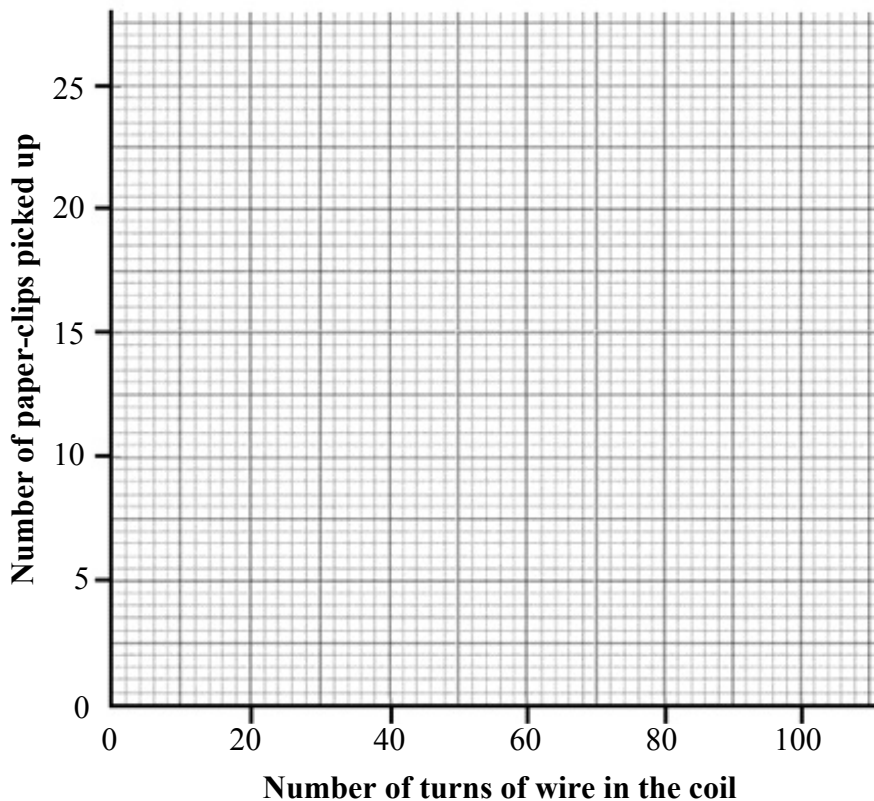
- (i) Name a suitable material from which the bar and the paper-clips should be made.

\_\_\_\_\_

- (ii) Name the instrument labelled A in the circuit diagram. \_\_\_\_\_

What does this instrument measure? \_\_\_\_\_

- (iii) Draw a graph in the grid below of the number of paper-clips picked up *versus* the number of turns of wire in the coil.



(iv) Use your graph to estimate how many paper-clips would be picked up if there were 30 turns of wire in the coil. \_\_\_\_\_

(v) State one way in which the student might have made sure that this investigation was a fair one. \_\_\_\_\_  
\_\_\_\_\_

(1) (2)

(b) A battery, such as the one in a mobile phone, uses chemical reactions to make electricity and is a source of *direct current* (d.c.). (9)

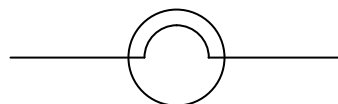
(i) What is direct current? \_\_\_\_\_  
\_\_\_\_\_

(ii) The other type of electric current is supplied to our homes by electricity suppliers. Name this type of electric current. \_\_\_\_\_

(iii) What is the main energy conversion that is happening when a mobile phone is being recharged? \_\_\_\_\_  
\_\_\_\_\_

(c) The symbol shown on the right is that of a light bulb.

In each of the spaces provided, draw two bulbs so that they are arranged (i) in series and (ii) in parallel. (6)



(i) Two bulbs in series

(ii) Two bulbs in parallel

