Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

GCSE Physics

Unit 1

Foundation Tier

[GPY11]

GPY11

THURSDAY 25 MAY, MORNING

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all** questions.

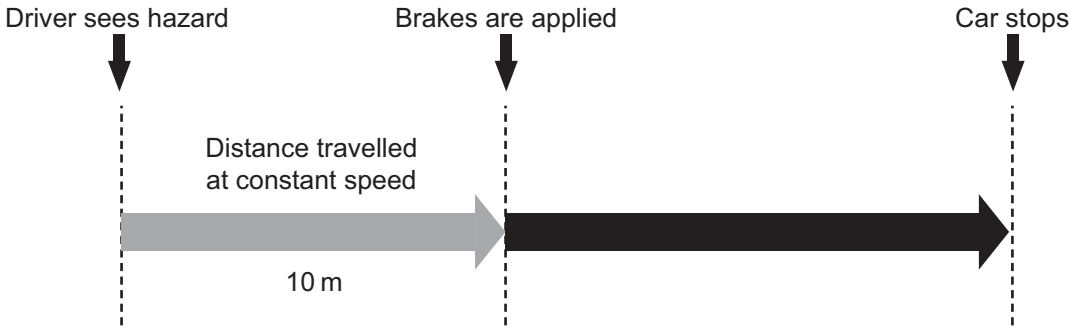
INFORMATION FOR CANDIDATES

The total mark for this paper is 80.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **4(d)**.

13456

1 (a) (i) The driver of a car takes a short time to react to a hazard on the road.
During this time the car travels at a constant speed.

The diagram below shows the distance the car travels before the driver applies the brakes.
Once the brakes are applied the car eventually stops.



Source: Chief Examiner

The constant speed of the car is 20 m/s.
Calculate the time between the driver seeing the hazard and applying the brakes.
Show clearly how you get your answer, starting with the equation you plan to use.

Time = _____ s [3]

(ii) Calculate the average speed of the car from the moment the driver applies the brakes until the car stops.
Show clearly how you get your answer, starting with the equation you plan to use.

Average speed = _____ m/s [3]

(iii) From the moment the brakes are applied it takes the car 4.0 s to stop.
Using the equation below, calculate the rate of change of speed of the car during this time.
Include the unit for rate of change of speed with your answer.

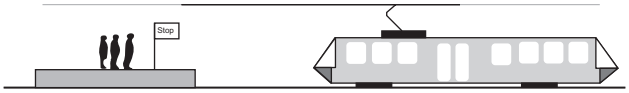
$$\textit{rate of change of speed} = \frac{\textit{final speed} - \textit{initial speed}}{\textit{time taken}}$$

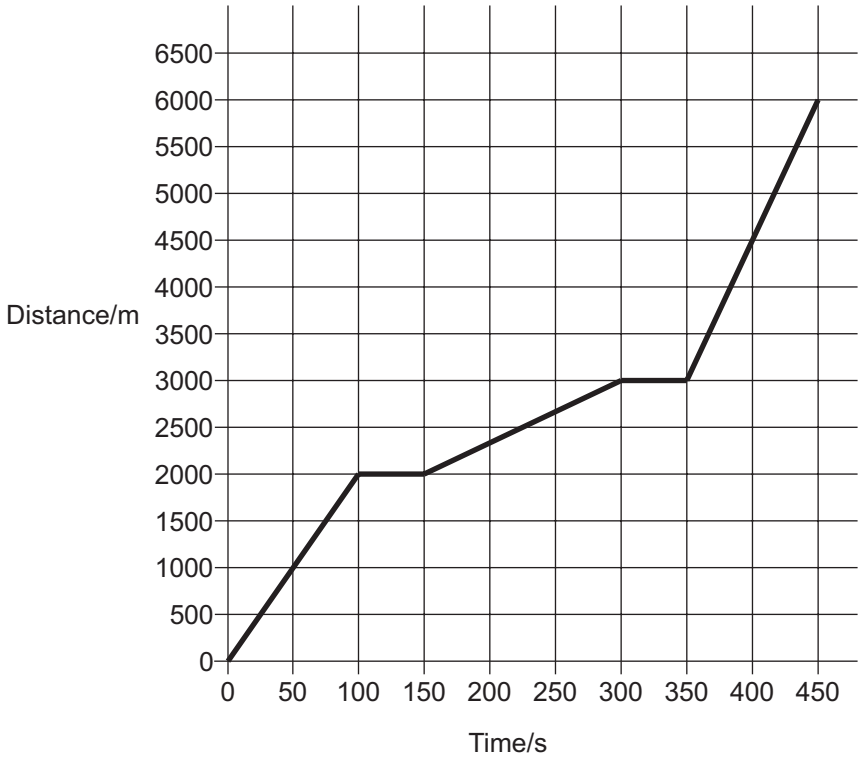
Rate of change of speed = _____

Unit of rate of change of speed = _____ [3]

[Turn over

(b) The distance–time graph below shows the journey of a train as it moves from one stop to the next.





Source: Chief Examiner

(i) Calculate the **average speed** of the train for the complete journey shown. **Show clearly how you get your answer, starting with the equation you plan to use.**

Average speed = _____ m/s [3]

(ii) Between which two times is the train **moving with the slowest speed**? What feature of the graph shows this?

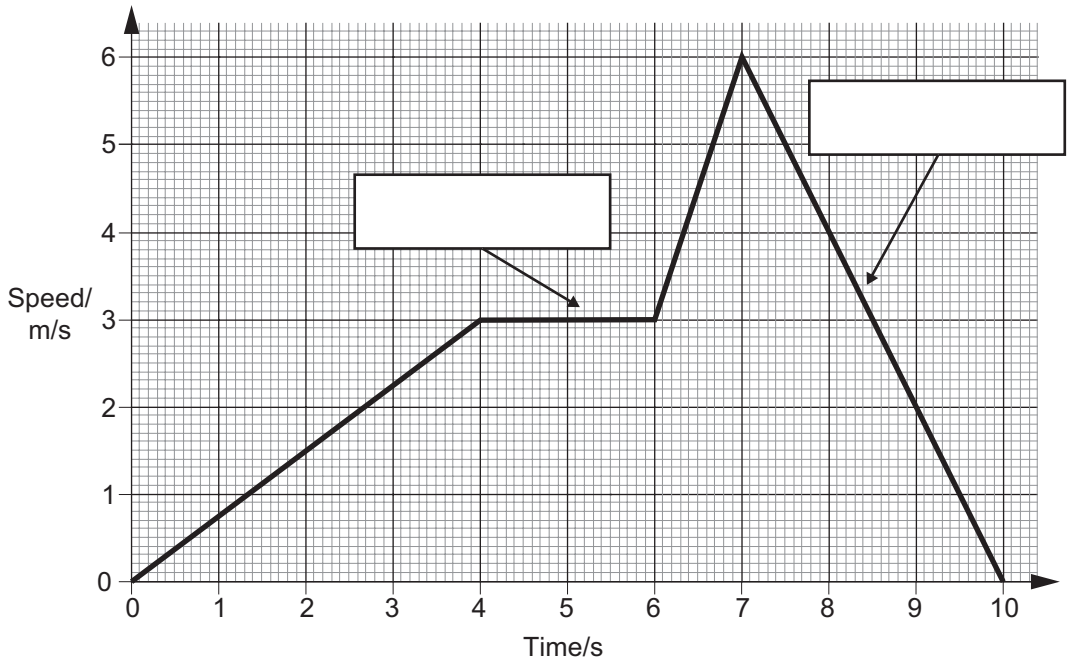
Times between _____ s and _____ s

Feature _____

_____ [2]

(c) A speed–time graph is shown below.

(i) In the boxes provided, describe the motion represented by that part of the graph.



Source: Chief Examiner

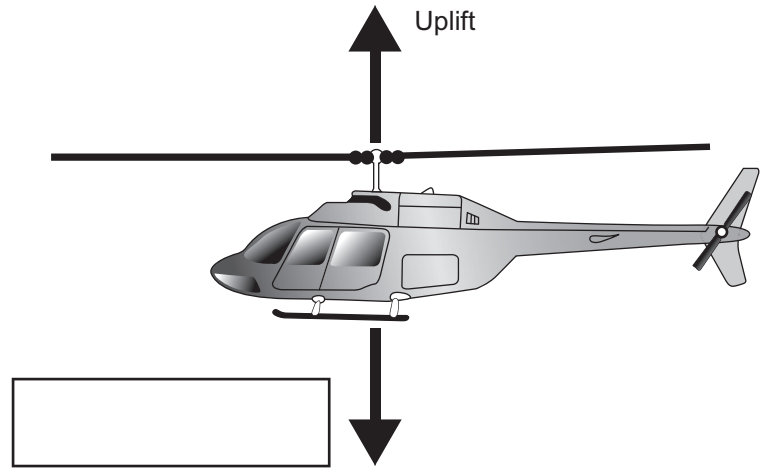
[2]

(ii) Calculate the distance travelled in the first 6 seconds of the motion. **Show clearly how you get your answer.**

Distance = _____ m [4]

[Turn over

2 The diagram below shows a helicopter and the forces acting on it.
The helicopter is hovering, **it is not moving vertically or horizontally.**



Source: Principal Examiner

(a) (i) Name the downward force shown by the arrow.
Write the name in the box provided. [1]

(ii) What can you say about the size of the two forces?

_____ [1]

The helicopter moves horizontally.
The horizontal forces acting on it are shown in the diagram.

Source: Principal Examiner

(iii) Calculate the size of the resultant force on the helicopter and state its direction.

Resultant force = _____ N

Direction = _____ [2]

(iv) The helicopter has a mass of 1600 kg.
Calculate the acceleration of the helicopter.
Show clearly how you get your answer, starting with the equation you plan to use.

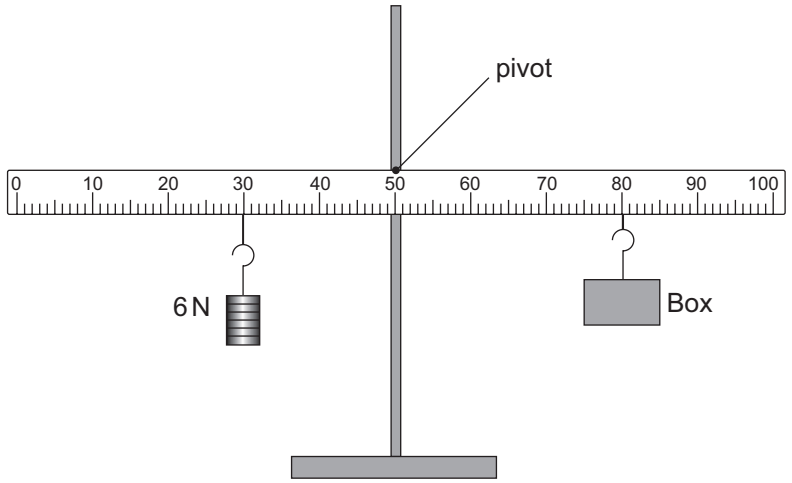
Acceleration = _____ m/s^2 [3]

[Turn over

(b) (i) Write down the equation used to calculate the moment of a force.

_____ [1]

(ii) A 6 N weight and a box are attached to a metre rule as shown below. Their positions on the rule were adjusted until the rule was balanced.



Source: Chief Examiner

Using the Principle of Moments, calculate the weight of the box.
Show clearly how you get your answer, starting with the equation you plan to use.

Weight of the box = _____ N [4]

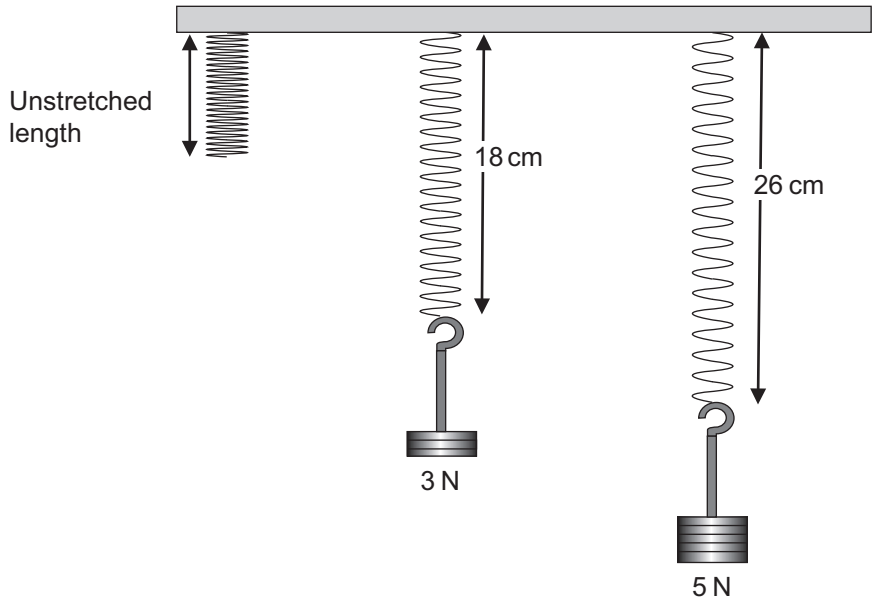
(c) (i) State Hooke's law.

_____

_____

_____ [2]

Three identical springs are hung from a support as shown below.
Forces of 3 N and 5 N are attached to the springs.
The springs stretch to the lengths shown.



Source: Chief Examiner

(ii) Using the values shown on the diagram, calculate the **extension** a force of 1 N would produce.
Show clearly how you get your answer.

Extension produced by 1 N = _____ cm [2]

(iii) Using your answer to part **(ii)**, calculate the unstretched length of the spring.
Show clearly how you get your answer.

Unstretched length of spring = _____ cm [2]

[Turn over

3 **(a)** Lead has a density of 11.3 g/cm^3 and wood has a density of 0.6 g/cm^3.

A 1 kg cube of lead and a 1 kg cube of wood are each wrapped in brown paper and set on a bench.
Without touching them, how would you know which one is wood?

_____

_____

_____ [1]

(b) The kinetic theory of matter states that all matter is made up of particles.

(i) What does the theory state about the positions of the particles in a solid?

_____ [1]

(ii) What type of motion do the particles in a solid have?

_____ [1]

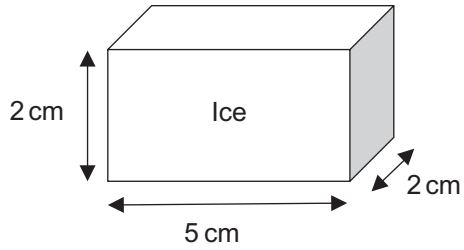
(iii) In liquids, the particles can move around.
How does the structure of a liquid allow this to happen?

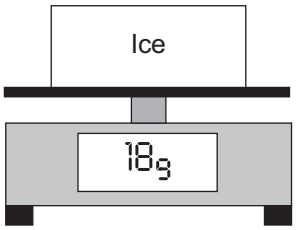
_____ [1]

(iv) In a gas, the particles can move freely and completely fill their container.
How does the kinetic theory explain this property?

_____ [1]

(c) A block of ice has the dimensions shown in the diagram below.





Source: Chief Examiner

(i) Calculate the volume of the ice.
Show clearly how you get your answer.

Volume of ice = _____ cm^3 [2]

(ii) The block of ice was then placed on a digital balance.
Using the information shown in the diagram, calculate the density of ice.
Show clearly how you get your answer, starting with the equation you plan to use.

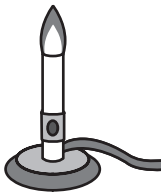
Density of ice = _____ g/cm^3 [3]

[Turn over

4 **(a)** Below are some devices that convert energy from one form to another.
For each one, name the input energy and the **useful** output energy form.

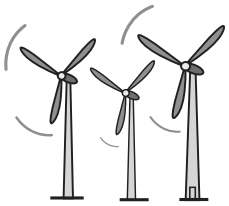
Light bulb

Input energy → Output energy



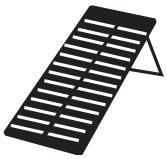
Bunsen burner

Input energy → Output energy



Wind turbine generator

Input energy → Output energy



Solar cell

Input energy → Output energy

Source: Chief Examiner

[4]

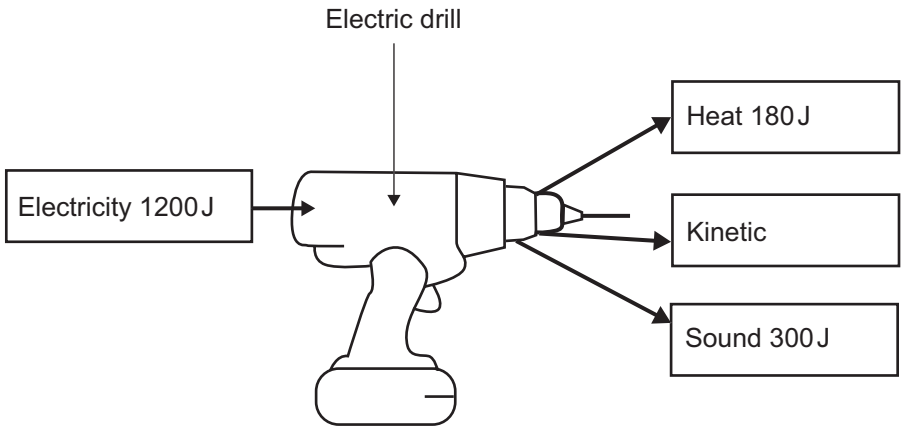
(b) (i) State the Principle of Conservation of Energy.

_____

_____

_____ [2]

(ii) Devices do not convert all their input energy into useful output energy.



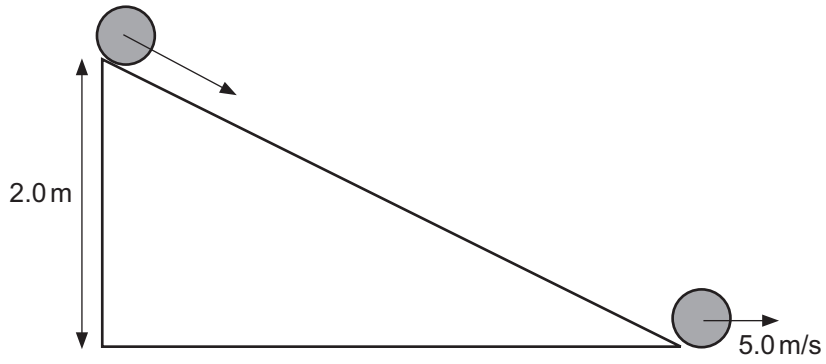
Source: Chief Examiner

An electric drill is designed to convert electricity to kinetic energy.
Using the values from the diagram above, calculate the efficiency of the drill.
Show clearly how you get your answer, starting with the equation you plan to use.

Efficiency = _____ [4]

[Turn over

(c) A metal ball of mass 0.2 kg is allowed to roll down a slope as shown below.



Source: Chief Examiner

(i) Calculate the potential energy of the ball at the top of the slope.
Show clearly how you get your answer, starting with the equation you plan to use.

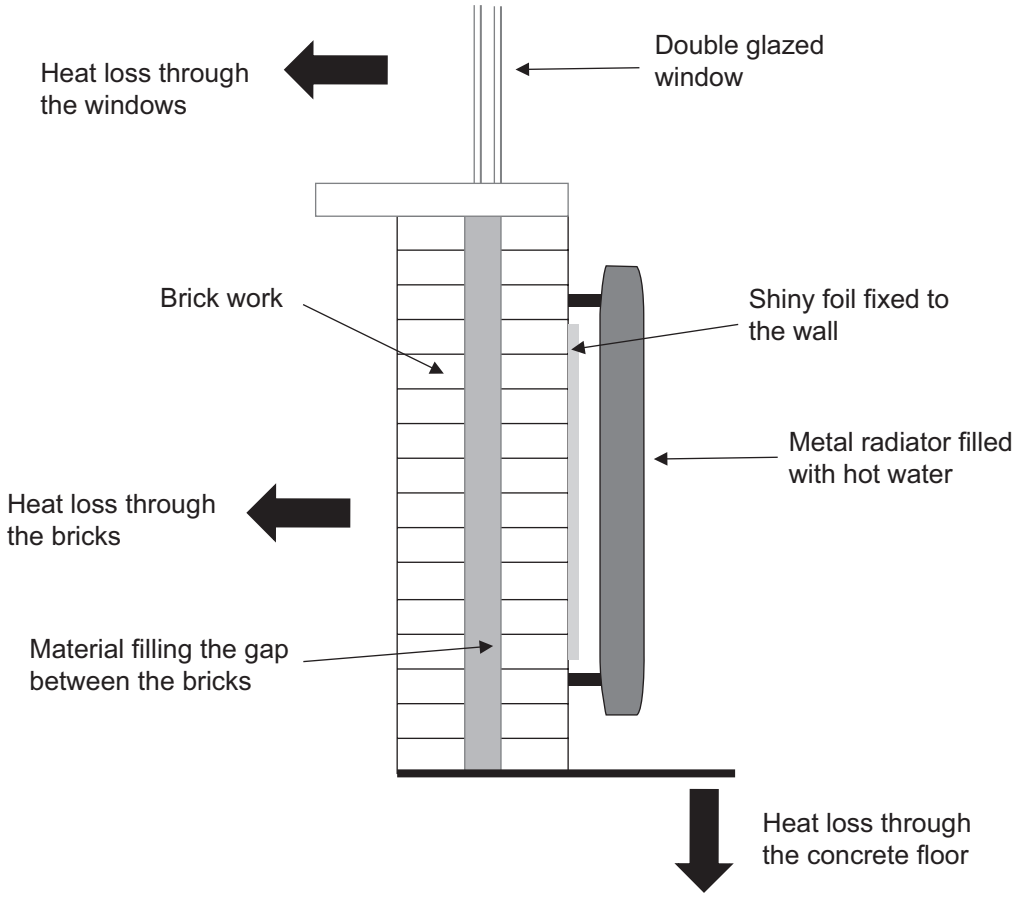
Potential energy = _____ J [3]

(ii) When the ball reaches the bottom of the slope its speed is 5.0 m/s.
Calculate the kinetic energy of the ball at the bottom of the slope.
Show clearly how you get your answer, starting with the equation you plan to use.

Kinetic energy = _____ J [3]

(d) The diagram below shows the structure of the outside wall and window of most houses.
The diagram also shows a radiator attached to the inside of the wall. Heat from the metal radiator heats the room.
The large arrows show the direction of heat loss through the various parts of the room.

Heating our homes costs money. It is important that steps are taken to reduce the loss of heat from our homes. The diagram also shows some measures that are used to reduce heat loss.



Source: Chief Examiner

[Turn over

In this question you will name the processes of heat transfer and describe how each is reduced by the various measures shown in the diagram.

In your answer you should:

- name the three methods by which heat is transferred;
- describe how the heat from hot water gets through the metal radiator, and name the particle responsible for this process;
- describe how heat is transferred throughout the room;
- explain the role the shiny foil placed behind the radiator plays in reducing heat loss from the room;
- name a material that is usually placed in the gap between the two layers of brick to reduce heat loss and state which method of heat transfer is reduced in this way;
- name the method of heat transfer reduced by using double glazing;
- describe what could be done to reduce heat loss through the concrete floor.

In this question you will be assessed on your written communication skills including the use of specialist science terms.

Write your answers in the appropriate spaces on the next page.

Methods of heat transfer _____

_____

How heat from hot water gets through the metal radiator and the particle responsible

_____

_____

How the room is heated _____

_____

_____

The role of the shiny foil _____

_____

_____

Cavity wall material and the method of heat transfer reduced _____

_____

_____

Heat transfer method reduced by double glazing _____

_____

_____

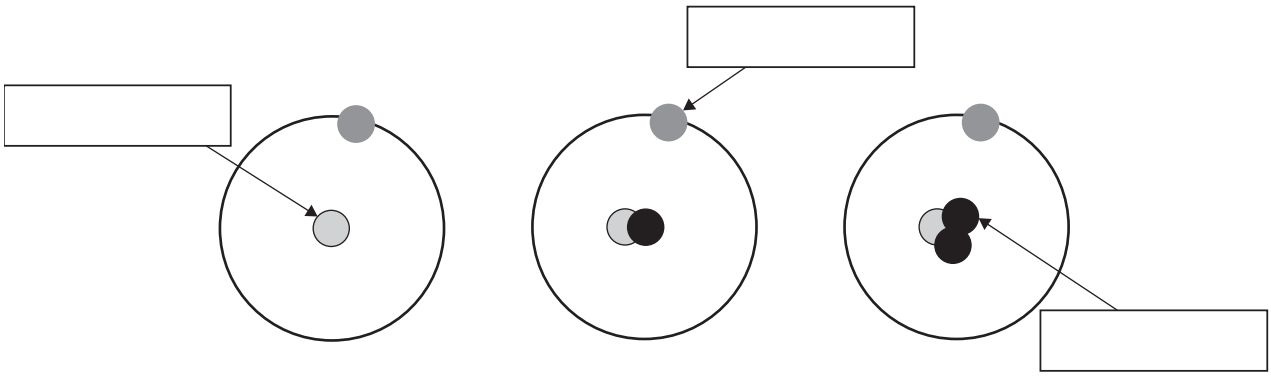
How heat loss is reduced through the concrete floor _____

_____ [6]

[Turn over

5 **(a)** The diagram below shows the structure of the atoms of three isotopes of hydrogen. Atoms are electrically neutral.

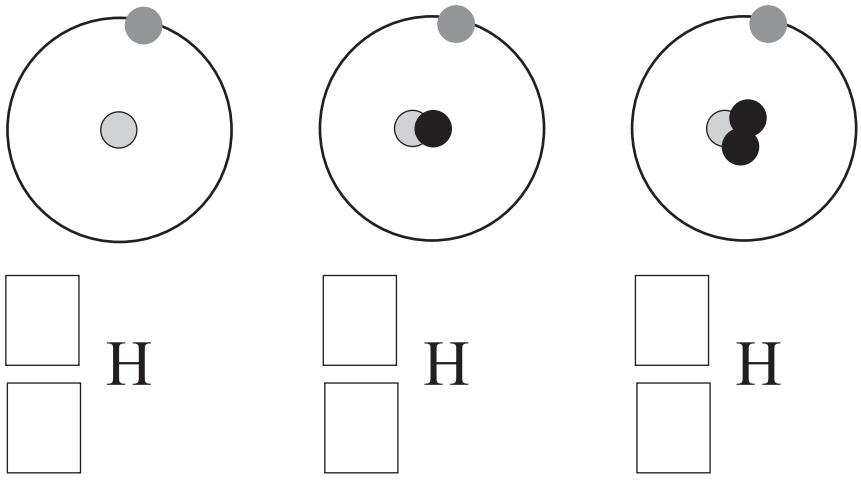
(i) Write the names of the particles marked by arrows in each of the boxes provided.



Source: Chief Examiner

[3]

(ii) Using notation ${}^{A}_{Z}H$, describe the structure of each isotope. Write the appropriate numbers in the boxes below.



Source: Chief Examiner

[3]

(b) (i) Some atomic nuclei are radioactive.
Name the three radiations that are emitted by such nuclei.
Do not use symbols.

_____

_____

_____ [3]

(ii) Which one of the three radiations is a high energy electromagnetic wave?

_____ [1]

THIS IS THE END OF THE QUESTION PAPER

DO NOT WRITE ON THIS PAGE

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

Examiner Number