This is a Class 1 exam

Lebanon Evangelical School for Boys and Girls

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 01

17FEB2025

Do NOT write in this box. Your MARK will be placed here.

Subject :	Physics
Class :	10A
Teacher :	Dr Ruth Brett
Duration :	1 hour

You should find any formulae you need on the last page, along with the value of g.

You are to answer the questions to this exam on : This exam paper

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Q1. Carousel Quiz Questions. (One mark each)

a) How can we find the volume of an irregular object?

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b) What is a magnetic field?

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c) How do most types of insulation keep homes warm?

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d) How is energy loss reduced in power lines?

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e) How can we induce a voltage in a wire?

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f) What are the two differences between boiling and evaporation?

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g) How can we know the direction of a magnetic field around a solenoid?

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h) What is Boyle's law?

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i) Define nuclear fission

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j) What is the role of the control rod in a nuclear reactor?

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k) What are the conditions necessary for nuclear fusion to take place?

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(Total for question = 11marks)

Q2. The photograph shows a truck with a crane that is used to move large bags of building materials.



(Source: © Alistair Petrie/Alamy Stock Photo)

(a) (i) A bag of building materials has a weight of 8750 N.

Calculate the work done on the bag when it is lifted a vertical distance of 230 cm from the ground until it is stationary again.
Give the unit.

(3)

work done = ... unit .....

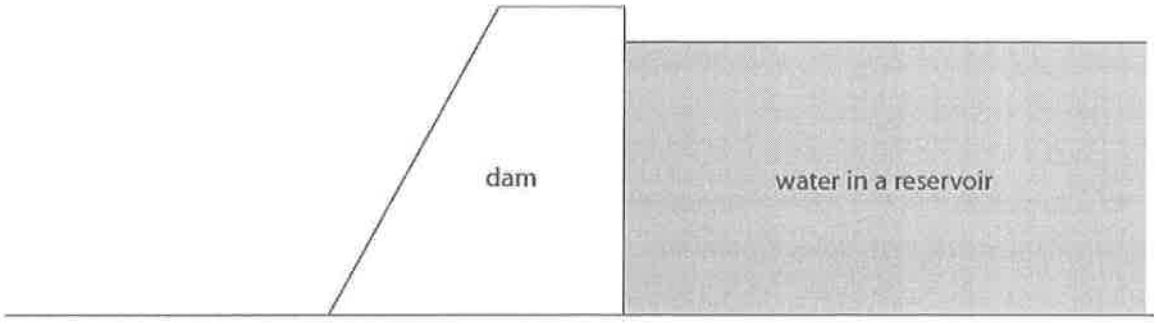
(ii) The crane takes 7.0 s to lift the bag.
Calculate the mean power output of the crane when it is lifting the bag.

(2)

mean power output = ... W

(Total for question = 5 marks)

Q3. A dam is a structure designed to hold water in a reservoir.



(a) The water in the reservoir has a depth of 35 m.

Atmospheric pressure at the surface of the reservoir is 100 kPa.
Calculate the total pressure at the bottom of the reservoir.
[for water, density = 1000 kg / m^3]

(3)

pressure = ... kPa

(b) An underwater camera is used in the water reservoir.

The camera lens experiences a force of 430 N at a pressure of 260 kPa.
Calculate the area of the camera lens.
Give a suitable unit.

(4)

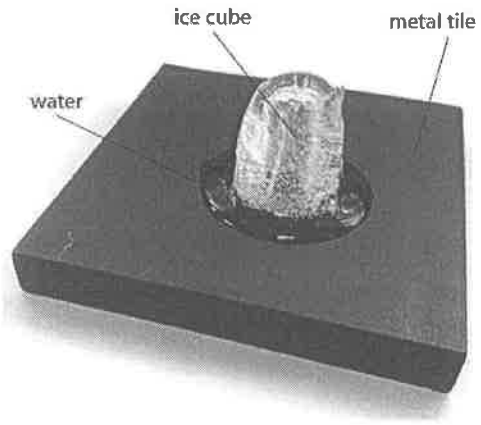
area = ... unit .....

(Total for question = 7 marks)

Q4.

The photograph shows an ice cube placed on a metal tile.

The solid ice cube melts to become liquid water.



(a) Compare the arrangement of particles in a solid with the arrangement of particles in a liquid.
You may draw a diagram to help your answer.

(3)

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(b) Describe the difference in the movement of particles in a solid compared with the movement of particles in a liquid.

(2)

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(c) After the ice cube has melted, the liquid water increases in temperature.

The water has a mass of 16 g and a specific heat capacity of 4200 J/kg °C.
Calculate the energy transferred to the liquid water as it increases in temperature from 3 °C to 21 °C.

(3)

energy transferred = ... J

(Total for question = 8 marks)

Q5. (a) Diagram 1 shows a metal ball held at rest above the floor.

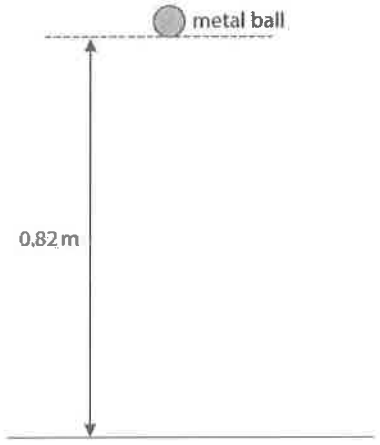


Diagram 1

The metal ball has a mass of 0.52 kg and is held at a height of 0.82 m above the floor.

(i) Calculate the decrease in the metal ball's GPE store when the ball falls to the floor from this height.

(2)

decrease in GPE store = ... J

(ii) State the amount of energy in the metal ball's kinetic store just before it hits the floor. Ignore the effects of air resistance.

(1)

energy in kinetic store = ... J

(iii) Calculate the speed of the metal ball just before it hits the floor.

(4)

speed = ... m/s

(Total for question = 7 marks)

Q6. Radon is a radioactive gas that contributes to background radiation.

(a) Describe what is meant by the term **background radiation**.

(2)

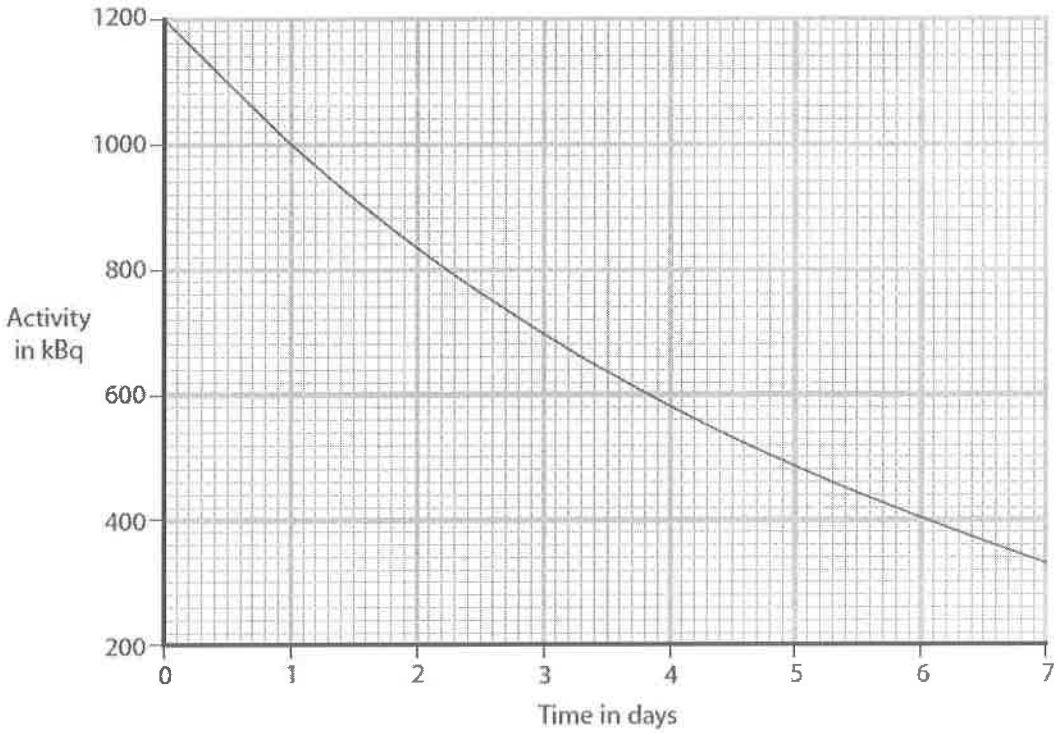
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(b) The graph shows the activity of a sample of radon-222.



(i) State what is meant by the term **half-life**. (2)

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(ii) Use the graph to determine the half-life of radon-222.

(2)

half-life = ... days

(c) Radon-222 is formed by multiple alpha decays of uranium-234.

Complete the nuclear equation by giving the missing information.

(3)

$$^{234}_{92}U \rightarrow {}^{222}_{\square}Rn + 3\,{}^{\square}_{\square}\alpha$$

(d) Radon-222 also emits alpha radiation.

Explain the hazard to humans of breathing in air contaminated with radon-222.

(2)

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(Total for question = 11 marks)

Q7. The photograph shows a brass mass.



© Dudaeva/Shutterstock

The brass mass has a mass of 454 g. The density of brass is 8.46 g/cm^3.

Calculate the volume of the brass mass. Give the unit.

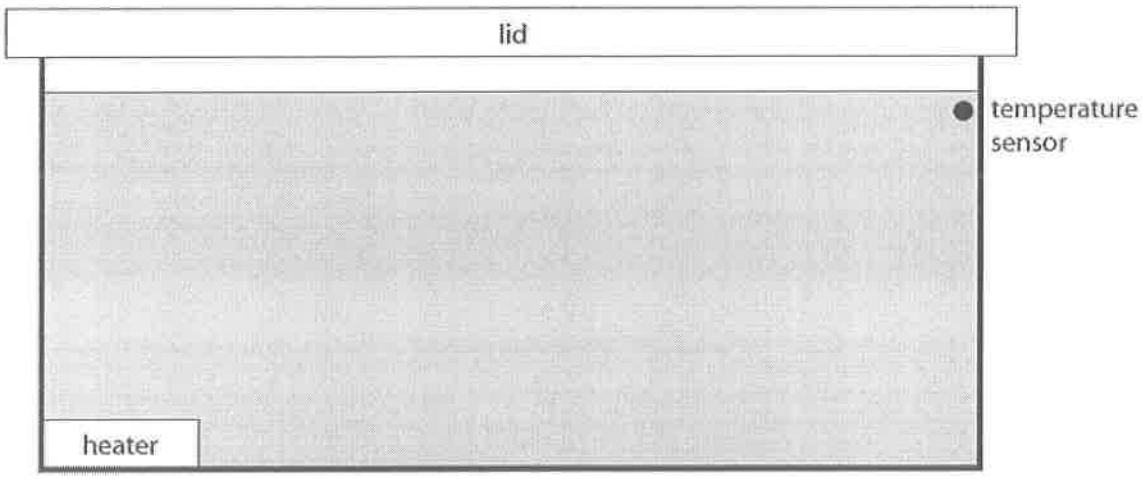
(3)

volume = ... unit .....

(Total for question = 4 marks)

Q8. The diagram shows a container of water.

The container has a heater in the bottom corner, a temperature sensor and a lid.



Explain how a convection current is formed in the container.

You may add to the diagram or draw your own diagram to support your answer.

(4)

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(Total for question = 4 marks)

Q9.

Diagram 1 shows some apparatus used to demonstrate the magnetic force on a current-carrying wire in a magnetic field.

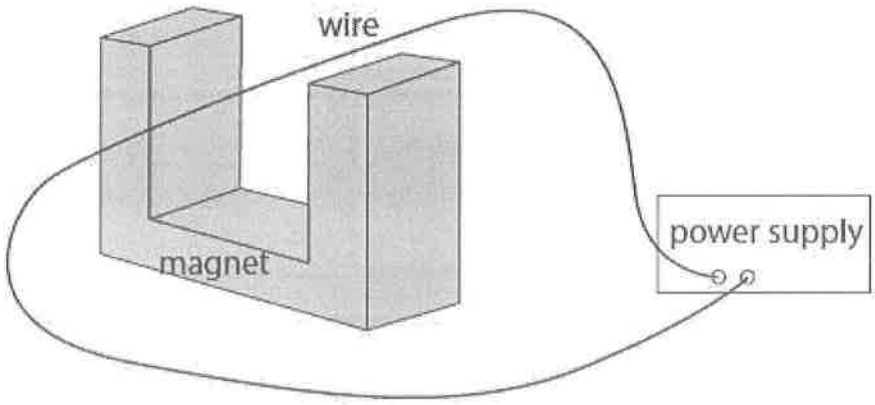


Diagram 1

(a) Diagram 2 shows four different arrangements of the apparatus.

The symbol ⊙ shows that the current is directed out of the page.

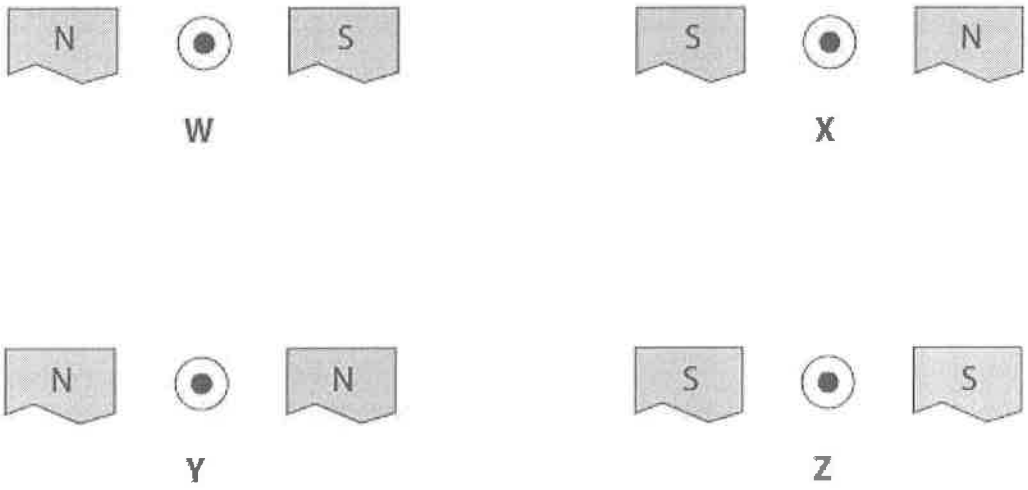


Diagram 2

Which arrangement of the apparatus will cause there to be an upwards magnetic force on the wire?

(1)

☐ **A** W

☐ **B** X

☐ **C** Y

☐ **D** Z

(b) Name one factor that would increase the magnitude of the magnetic force on the wire, and explain what needs to be done to make that change.

(2)

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(Total for question = 3 marks)

DATA AND EQUATIONS

You may remove this page. You don't have to hand it in with your paper.

Where necessary, assume the acceleration of freefall, $g = 10\ \text{m/s}^2$

4. Energy resources and energy transfers	
efficiency = $\frac{\text{useful energy output}}{\text{total energy output}} \times 100\%$	
work done = force × distance moved	$W = F \times d$
gravitational potential energy = mass × gravitational field strength × height	$GPE = m \times g \times h$
kinetic energy = $\frac{1}{2}$ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
5. Solids, liquids and gases	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
pressure difference = height × density × gravitational field strength	$p = h \times \rho \times g$
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$

Q1. Carousel Quiz Questions. (One mark each)

a) How can we find the volume of an irregular object?

Measure the volume of fluid displaced when the object is fully submerged (1)

b) What is a magnetic field?

A volume of space around a magnet where magnetic materials are affected. (1)

c) How do most types of insulation keep homes warm?

Air is trapped, which reduces conduction and stops convection currents circulating. (1)

d) How is energy loss reduced in power lines?

By using a high voltage and low current. (1)

e) How can we induce a voltage in a wire?

By making the wire cut magnetic field lines (1)

f) What are the two differences between boiling and evaporation?

Boiling happens throughout the liquid, while evaporation happens only at the surface.
Boiling occurs at one specific temperature, while evaporation can take place at any temperature. (1)

g) How can we know the direction of a magnetic field around a solenoid?

Grip the solenoid with the right hand so the fingers point in the direction of the current. The thumb will point in the direction of the north pole. (1)

h) What is Boyle's law?

Pressure is inversely proportional to volume if the temperature is constant. (1)

i) Define nuclear fission

The splitting of a large nucleus into two daughter nuclei and neutrons (1)

j) What is the role of the control rod in a nuclear reactor?

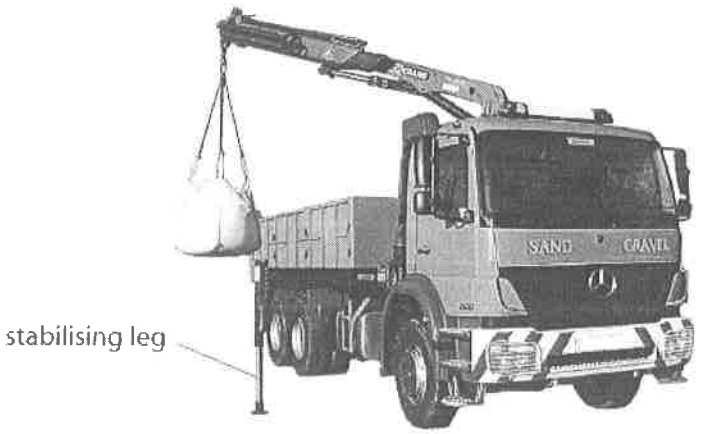
The control rod absorbs neutrons, which (slows or) stops the chain reaction. (1)

k) What are the conditions necessary for nuclear fusion to take place?

Very high temperature and pressure. (1)

(Total for question = 11marks)

Q2. The photograph shows a truck with a crane that is used to move large bags of building materials.



(Source: © Alistair Petrie/Alamy Stock Photo)

(a) (i) A bag of building materials has a weight of 8750 N.

Calculate the work done on the bag when it is lifted a vertical distance of 230 cm from the ground until it is stationary again.
Give the unit.

↓ ÷ 100
2·30m

(3)

$W = F \times s$

$W = 8750 \times 2{\cdot}3 = 20125$ (1)

work done = 20100 (1) unit J (1)

(ii) The crane takes 7.0 s to lift the bag.
Calculate the mean power output of the crane when it is lifting the bag.

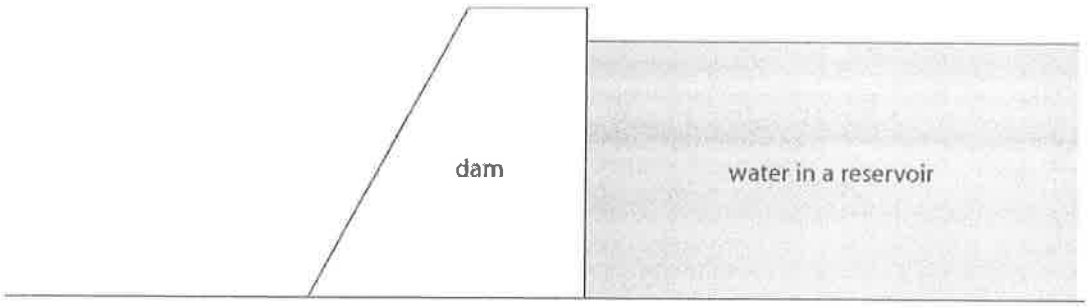
(2)

$P = \frac{W}{t} = \frac{20100}{7}$ (1) $= 2875$

mean power output = 2875 (1) W

(Total for question = 5 marks)

Q3. A dam is a structure designed to hold water in a reservoir.



(a) The water in the reservoir has a depth of 35 m.

Atmospheric pressure at the surface of the reservoir is 100 kPa.
Calculate the total pressure at the bottom of the reservoir.
[for water, density = 1000 kg / m^3]

(3)

$\Delta p = h \times e \times g$

$\Delta p = 35 \times 1000 \times 10 = 350\,000$ Pa (1) (1)

$\Delta p = 350$ kPa

Total pressure $= (350 + 100) = 450$ kPa

(1)

pressure = 450 kPa

(b) An underwater camera is used in the water reservoir.

The camera lens experiences a force of 430 N at a pressure of 260 kPa.
Calculate the area of the camera lens.
Give a suitable unit.

(4)

$p = \frac{F}{A}$

$260\,000 = \frac{430}{A}$ (1)

$A = \frac{430}{260\,000} = 1.65 \times 10^{-3}\ m^2$ (1)

or $0.00165\ m^2$
or $16.5\ cm^2$ with correct working

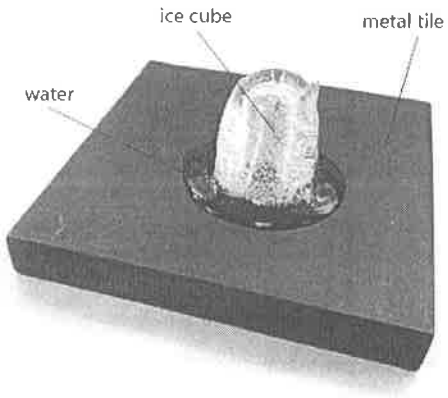
area = 1.65×10^{-3} (1) unit m^2 (1)

(Total for question = 7 marks)

Q4.

The photograph shows an ice cube placed on a metal tile.

The solid ice cube melts to become liquid water.



(a) Compare the arrangement of particles in a solid with the arrangement of particles in a liquid.
You may draw a diagram to help your answer.

(3)

Particles in a solid are ~~arrag~~ arranged regularly. (1)
Particles in a liquid are aranged randomly. (1)
Particles in both are closely packed. (1)

(b) Describe the difference in the movement of particles in a solid compared with the movement of particles in a liquid.

(2)

Particles in a solid vibrate in place (1)

Particles in a liquid move past each other (1)

(c) After the ice cube has melted, the liquid water increases in temperature.

The water has a mass of 16 g and a specific heat capacity of 4200 J/kg °C.
Calculate the energy transferred to the liquid water as it increases in temperature from 3 °C to 21 °C.

(3)

$\Delta Q = m \times c \times \Delta T$

$\Delta Q = 0.016 \times 4200 \times 18$ (1)

$\Delta Q = 1209.6\ J$

$m = 16\ g \xrightarrow{\div 1000} 0.016\ kg$

$\Delta T = 21 - 3 = 18\ °C$ (1)

energy transferred = 1210 (1) J

(Total for question = 8 marks)

Q5. (a) Diagram 1 shows a metal ball held at rest above the floor.

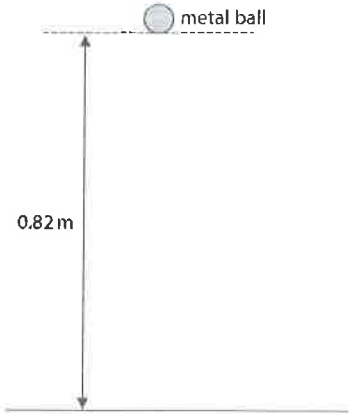


Diagram 1

The metal ball has a mass of 0.52 kg and is held at a height of 0.82 m above the floor.

(i) Calculate the decrease in the metal ball's GPE store when the ball falls to the floor from this height.

(2)

GPE = m x g x h = 0·52 x 10 x 0·82 (1)

GPE = 4·264 J

decrease in GPE store = 4·26 (1) J

(ii) State the amount of energy in the metal ball's kinetic store just before it hits the floor. Ignore the effects of air resistance.

(1)

Same as (i)

energy in kinetic store = 4·26 (1) J

(iii) Calculate the speed of the metal ball just before it hits the floor.

(4)

$KE = \frac{1}{2} \times m \times v^2$

(1) Subs

$4 \cdot 26 = \frac{1}{2} \times 0 \cdot 52 \times v^2 = 0 \cdot 26 \times v^2$

(1) rearrange

$v^2 = \frac{4 \cdot 26}{0 \cdot 26} = 16 \cdot 4$

$v = \sqrt{16 \cdot 4} = 4 \cdot 05$

(1)

speed = 4·05 (1) m/s

(Total for question = 7 marks)

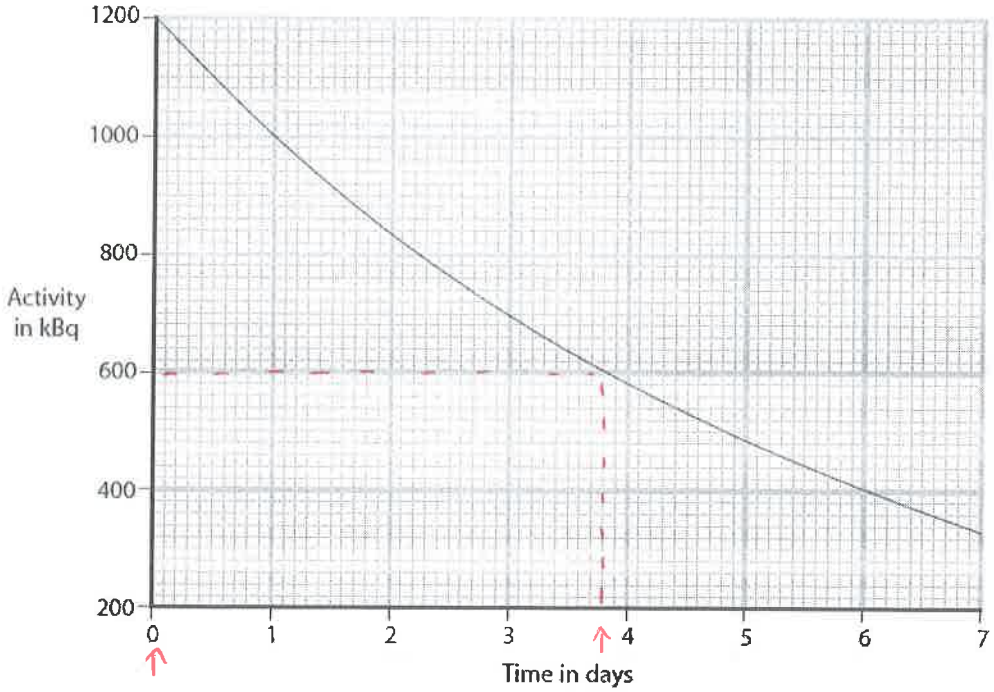
Q6. Radon is a radioactive gas that contributes to background radiation.

(a) Describe what is meant by the term **background radiation**.

(2)

Radiation that is present all the time when no sources are present.

(b) The graph shows the activity of a sample of radon-222.



(i) State what is meant by the term **half-life**. (2)

Time taken (1) for the activity of a sample to halve. (1)

Could be number of nuclei

(ii) Use the graph to determine the half-life of radon-222. (1)

(2)

$\frac{1200}{2} = 600$ Time for activity to fall from 1200 kBq to 600 Bq = 3.8 days

half-life = 3.8 (1) days

allow 3.8 → 3.85

(c) Radon-222 is formed by multiple alpha decays of uranium-234.

Complete the nuclear equation by giving the missing information.

(3)

$$^{234}_{92}U \rightarrow \boxed{222}_{\boxed{86}}Rn + 3\,^{\boxed{4}}_{\boxed{2}}\alpha$$

(1) (1) (1)

(d) Radon-222 also emits alpha radiation.

Explain the hazard to humans of breathing in air contaminated with radon-222.

(2)

α is highly ionising (1) and it can reach internal and irradiate organs. α can damage/kill cells or cause cancer. (1) (1)

MAXIMUM (2)

(Total for question = 11 marks)

Q7. The photograph shows a brass mass.



© Dudaeva/Shutterstock

The brass mass has a mass of 454 g. The density of brass is 8.46 g/cm^3.

Calculate the volume of the brass mass. Give the unit.

(3)

$\rho = \frac{m}{V}$

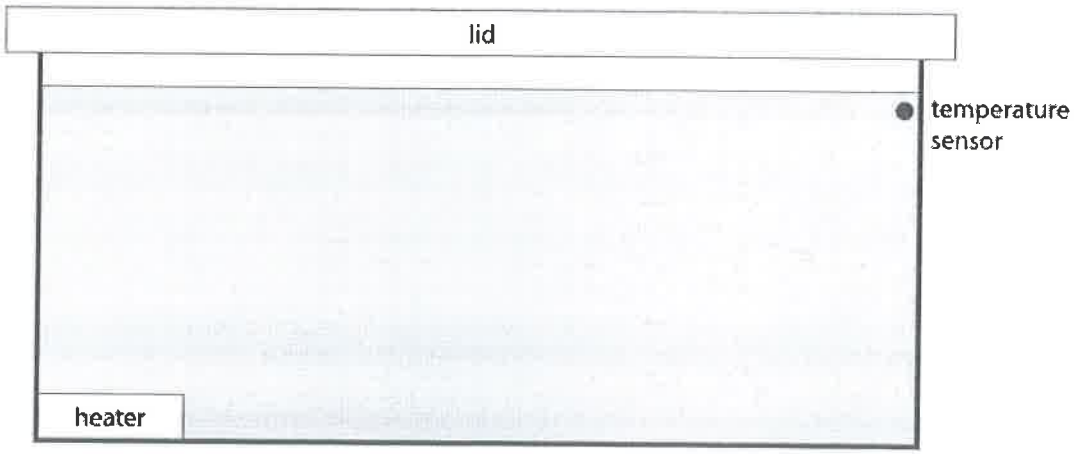
$8.46 = \frac{454}{V}$ (1) $\quad V = \frac{454}{8.46} = 53.66$

volume = 53.7 (1) unit cm^3 (1)

(Total for question = 4 marks)

Q8. The diagram shows a container of water.

The container has a heater in the bottom corner, a temperature sensor and a lid.



Explain how a convection current is formed in the container.

You may add to the diagram or draw your own diagram to support your answer.

(4)

Water near the heater is heated (1) and expands (1)
This makes the water less dense (1) so it rises. (1)
Cooler water is more dense so it sinks (1) and then
gets heated and the procers repeats. (1)

MAXIMUM (4)

(Total for question = 4 marks)

Q9.

Diagram 1 shows some apparatus used to demonstrate the magnetic force on a current-carrying wire in a magnetic field.

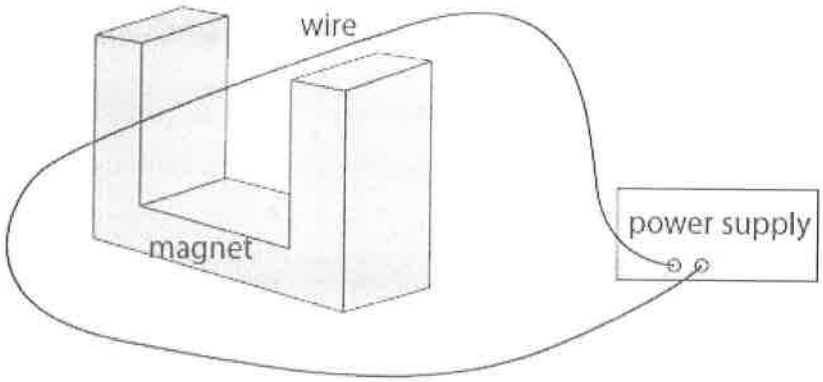


Diagram 1

(a) Diagram 2 shows four different arrangements of the apparatus.

The symbol ⊙ shows that the current is directed out of the page.

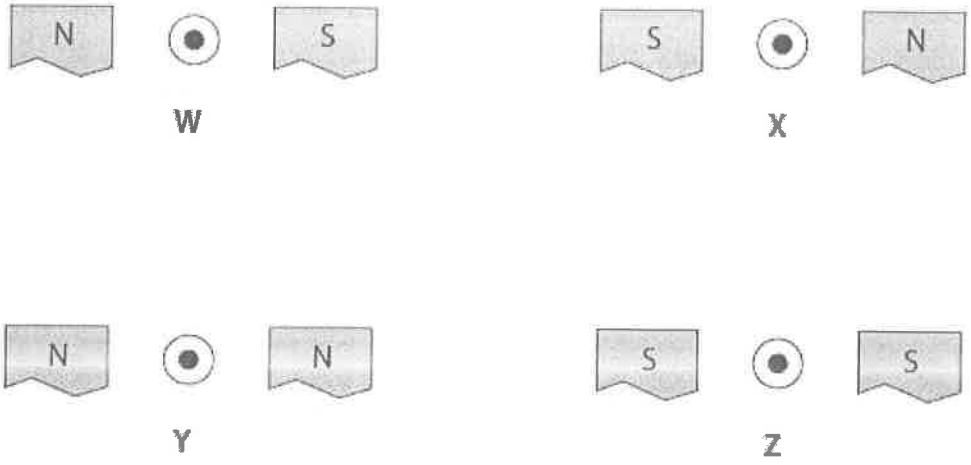


Diagram 2

Which arrangement of the apparatus will cause there to be an upwards magnetic force on the wire?

(1)

☒ **A** W (1)

☐ **B** X

☐ **C** Y

☐ **D** Z

(b) Name one factor that would increase the magnitude of the magnetic force on the wire, and explain what needs to be done to make that change.

(2)

Increase the current by increasing the voltage.

or

Increase the magnetic field strength by using stronger magnets (or moving them closer together)

(Total for question = 3 marks)

DATA AND EQUATIONS

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4. Energy resources and energy transfers	
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kinetic energy = $\frac{1}{2}$ × mass × speed^2	$KE = \frac{1}{2} \times m \times v^2$
power = $\frac{\text{work done}}{\text{time taken}}$	$P = \frac{W}{t}$
5. Solids, liquids and gases	
density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$
pressure = $\frac{\text{force}}{\text{area}}$	$p = \frac{F}{A}$
pressure difference = height × density × gravitational field strength	$p = h \times \rho \times g$
$\frac{\text{pressure}}{\text{temperature}}$ = constant	$\frac{p_1}{T_1} = \frac{p_2}{T_2}$
pressure × volume = constant	$p_1 \times V_1 = p_2 \times V_2$
change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta T$