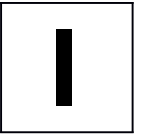


[Science] Physics O Level Exam Paper
Preliminary Examination Set [I]
Secondary Four Express & Five Normal



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Physics)

5076/01

Paper 1 Multiple Choice

5077/01

2024

30 min

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid/tape.

Write your name, class and index number on the Answer Sheet in the spaces provided.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** or **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

- 1 A pendulum bob takes t s to complete one oscillation.

What can be done to increase the magnitude of t ?

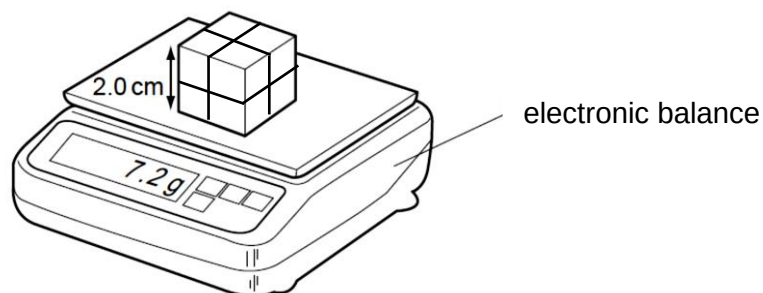
- I decrease the mass of the pendulum bob
- II increase the amplitude of pendulum swing
- III increase the length of the pendulum string
- IV replace the pendulum string with a rigid stick

- A I and II
- B I and III
- C III and IV
- D III only

- 2 What is the order of magnitude of the average diameter of an atom?

- A 1×10^{-1} m
- B 1×10^{-5} m
- C 1×10^{-10} m
- D 1×10^{-15} m

- 3 Eight small cubes of sides 1.0 cm are placed on an electronic balance as shown. The reading on the electronic balance is 7.2 g.



What is the density of each of the small cubes?

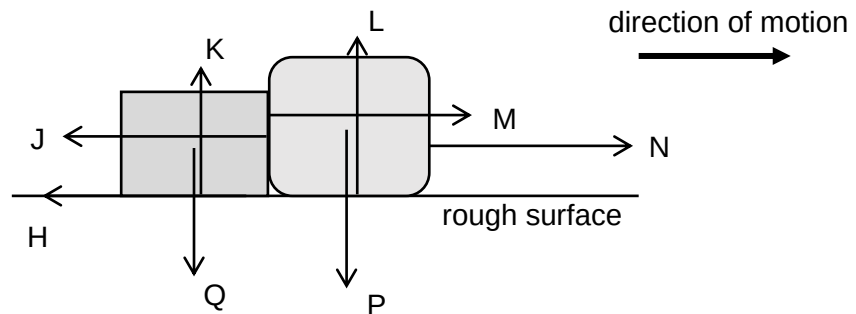
- A 0.11 g/cm^3
- B 0.90 g/cm^3
- C 1.1 g/cm^3
- D 7.2 g/cm^3

- 4 A chair of weight 50 N stands on four legs with a total area of contact of 0.0010 m^2 .

What is the pressure exerted by each leg on the floor?



- A 12.5 kPa
B 50.0 kPa
C 500.0 kPa
D 12500.0 kPa
- 5 Two blocks of wood are pushed towards the right by force N at constant speed along a rough horizontal surface. All forces acting on both blocks of wood are shown as well.



Which two forces form an action-reaction pair of forces?

- A H and N
B J and M
C K and Q
D P and Q
- 6 A bullet of mass 0.010 kg has 5000 J of energy just before it hits a tree trunk. Upon impact, 2000 J of the kinetic store of the bullet is converted into sound and heat.

Given that the tree trunk exerts a force of 20 kN to stop the bullet, what is the distance travelled by the bullet in the tree trunk?

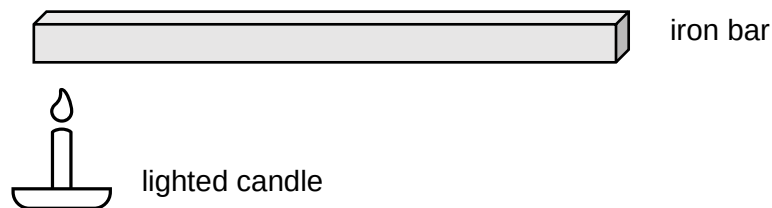
- A 0.10 m
B 0.15 m
C 0.25 m
D 150 m

- 7 Gaseous ethanol expands more than liquid ethanol when heated even though both are initially of the same volume.

Which statement best explains why this happens?

- A Molecules in the gaseous state are bigger.
- B Molecules in the gaseous state expand at a faster rate.
- C The attractive forces between the molecules in the gaseous state are weaker than those in the liquid state.
- D The molecules in the gaseous state move faster than the molecules in the liquid state.

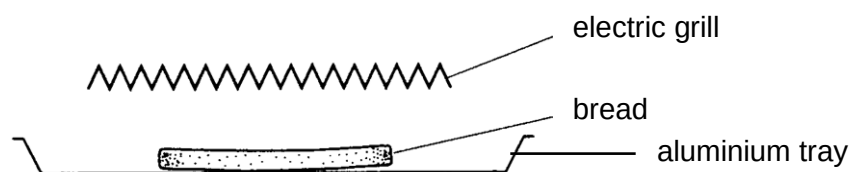
- 8 An iron bar is heated at one end by a lighted candle.



Which statement best describes the rapid conduction of thermal energy through the iron bar?

- A Atoms travel from the hot end and collide with atoms at the cold end.
- B Atoms vibrate vigorously at the hot end and collide with atoms at the cold end.
- C Free electrons move from the hot end and hit atoms further along the bar.
- D Free electrons vibrate and pass energy to other free electrons further along the bar.

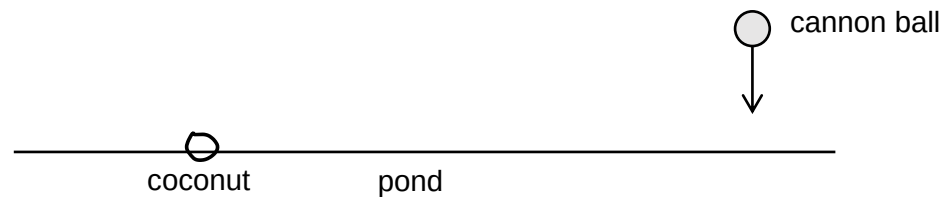
- 9 A slice of bread is toasted on an aluminium tray under an electric grill as shown.



How does thermal energy gets transferred to the slice of bread on the aluminium tray?

- A conduction and radiation
- B convection and radiation
- C conduction, convection and radiation
- D radiation only

- 10 When a cannon ball is dropped into a calm pond, a nearby coconut floating on the pond experiences the waves caused by the cannon ball.



Which statement describes the motion of the coconut as the waves pass by?

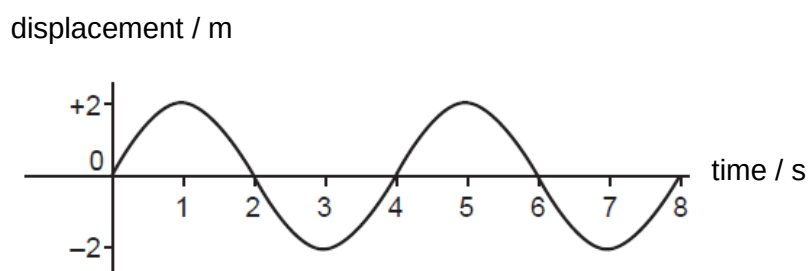
- A The coconut moves away from the cannon ball.
 - B The coconut moves back and forth parallel to the direction of the waves formed.
 - C The coconut moves up and down about the same position.
 - D The coconut remains stationary in the same position.
- 11 A girl claps in front of a cliff. An echo is heard by the girl 3.0 s after the clap.



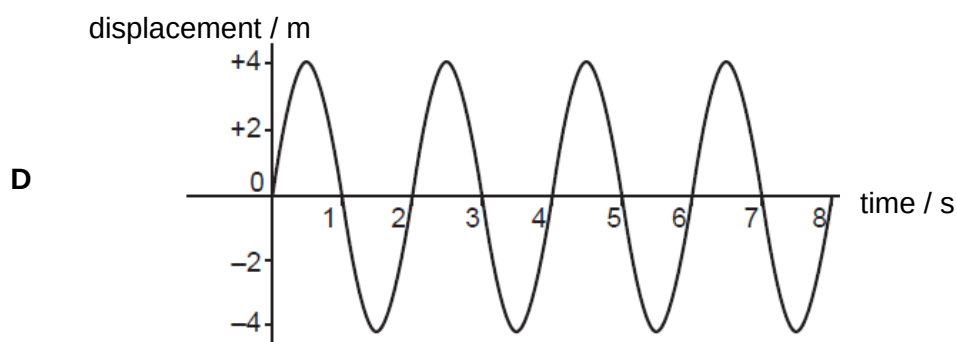
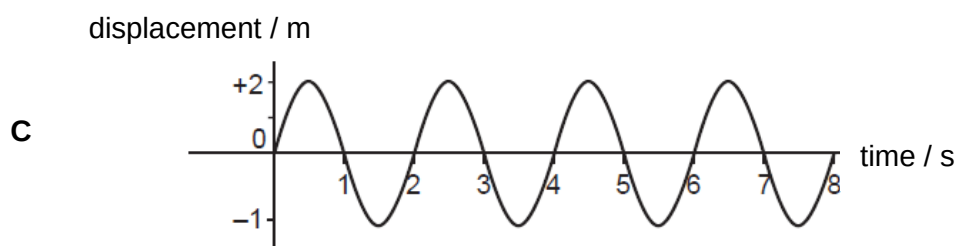
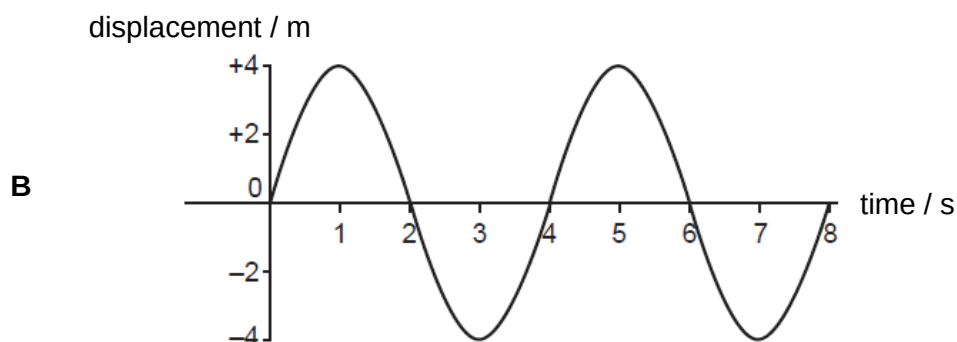
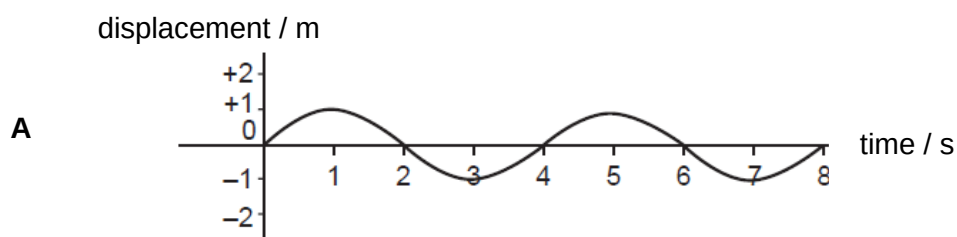
If sound travels through the air at a speed of 320 m/s, how far is the girl away from the cliff?

- A 107 m
- B 320 m
- C 480 m
- D 960 m

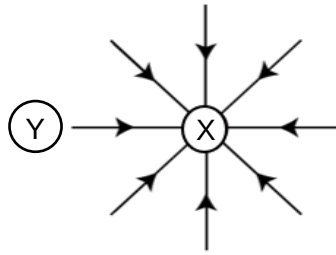
- 12 The displacement-time graph of a sound wave that is emitted by a fog horn is traced as shown.



Which graph shows the sound wave of another fog horn that is louder but with a higher pitch?



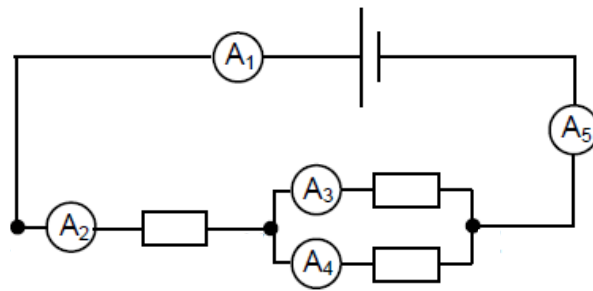
- 13** The diagram shows the electric field around an isolated point charge X.



If a positively-charged particle Y is brought near as shown, what is the direction of the force experienced by particle Y?

- A** downwards
 - B** into the paper
 - C** towards the left
 - D** towards the right
- 14** A current of magnitude 1.5 A is flowing through a fixed resistor.
- How long does it take for 20 C of charge to travel through the resistor?
- A** 0.075 s
 - B** 13 s
 - C** 15 s
 - D** 30 s
- 15** A dry cell with an electromotive force of 9.0 V has a charge of 6.0 C flowing through it.
- What is the maximum amount of electrical energy that can be obtained from the dry cell?
- A** 0.7 J
 - B** 1.5 J
 - C** 15.0 J
 - D** 54.0 J

- 16 There are two faulty ammeters that are connected to the circuit shown.



The readings on the ammeters are given below.

$$A_1 = 2.0 \text{ A}$$

$$A_2 = 2.5 \text{ A}$$

$$A_3 = 3.0 \text{ A}$$

$$A_4 = 1.5 \text{ A}$$

$$A_5 = 2.0 \text{ A}$$

Which of the two ammeters are faulty?

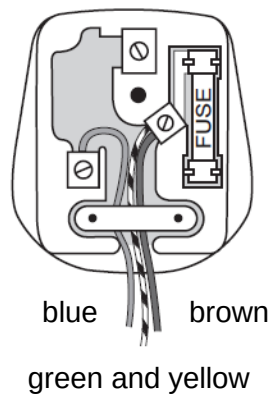
- A A_1 and A_2
 - B A_1 and A_3
 - C A_2 and A_3
 - D A_2 and A_4
- 17 A storage company is billed \$250 for using its single air-conditioner continuously in a 30-day month.

If the company is charged at \$0.25 per kWh, what is the average power rating of the air-conditioner?

- A 1.39 kW
 - B 33.3 kW
 - C 180 kW
 - D 1000 kW
- 18 A heater with a 5 A fuse is connected directly to a 240 V mains supply.
- Which is the most powerful heater that can be safely used with this fuse?

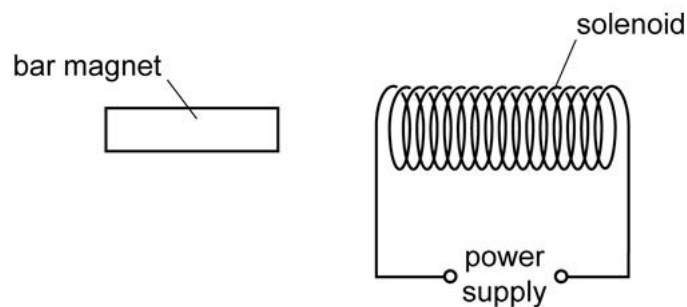
- A 48 W
- B 1100 W
- C 1200 W
- D 1300 W

- 19 A three-pin plug is wired as shown. It is connected to an old industrial fan which has a metal casing.



What will likely happen when the switch is turned on?

- A The fuse in the three-pin plug will melt.
 - B The metal casing of the fan will become live.
 - C The metal fan will not work and catch fire.
 - D The three wires in the three-pin plug will melt.
- 20 A solenoid carrying a current is used to demagnetise a bar magnet.



Which is the most suitable condition for the bar magnet to be demagnetised?

	current through solenoid	movement of bar magnet
A	alternating	through the solenoid quickly
B	alternating	through the solenoid slowly
C	direct	through the solenoid quickly
D	direct	through the solenoid slowly

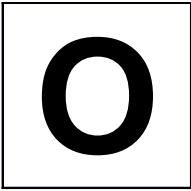
Data Sheet

Colours of Some Common Metal Hydroxides

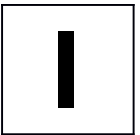
aluminium hydroxide	white
calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
zinc hydroxide	white

The Periodic Table of Elements

Group																				
1	2											13	14	15	16	17	18			
		1 H hydrogen 1																		
		Key proton (atomic) number atomic symbol name relative atomic mass																		
3 Li lithium 7	4 Be beryllium 9																			
11 Na sodium 23	12 Mg magnesium 24																			
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84			
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131			
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —		
87 Fr francium —	88 Ra radium —	89–103 actinoids		104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —		116 Lv livermorium —					
lanthanoids		57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175				
actinoids		89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —				



[Science] Physics O Level Exam Paper
Preliminary Examination Set [I]
Secondary Four Express & Five Normal



CANDIDATE NAME:

CLASS:

INDEX NUMBER:

Science(Physics)

Paper 2 Theory

5076/03

2024

5078/03

1 hour 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid/tape.

Section A

Answer **all** questions.

Section B

Answer **all** questions. Question 11 has a choice of parts to answer.

Candidates are reminded that **all** quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
Candidates are advised to show all their working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

Section A	
Section B	
Total	

Section A

Answer **all** the questions in the spaces provided.

- 1 Scientists use the Scoville scale to measure the pungency of chilli peppers. The scale ranges from 0 for a regular capsicum to 1.5 million for the infamous Carolina Reaper chilli. The Scoville Heat Units (SHU), can go even higher in other substances like capsaicin.

- (a) A Thai bird's eye chilli is measured to have 87 kSHU.

Convert 87 kSHU into MSHU.

87 kSHU = MSHU [1]

- (b) State and explain whether pungency is a scalar or a vector quantity.

.....
.....
..... [2]

- 2 Fig. 2.1 shows a fully loaded pick-up truck of mass 1600 kg travelling at a constant speed of 5.0 m/s on a straight and horizontal road.

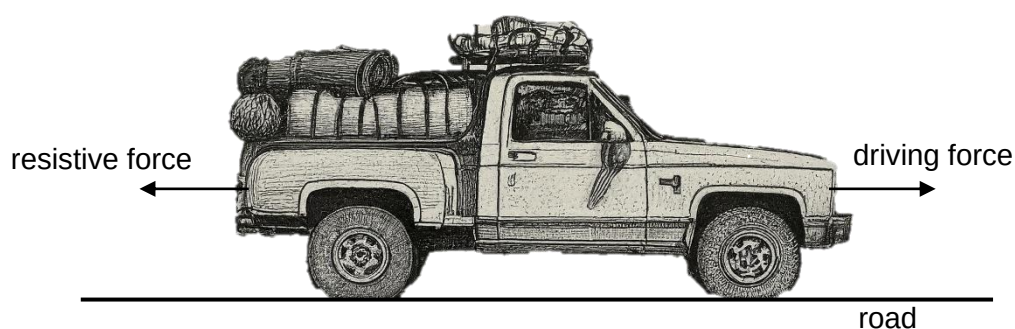


Fig. 2.1

- (a) (i) At time = 0 s, the driver steps on the accelerator such that the driving force is greater than the resistive force by 1500 N.

Calculate the acceleration of the pick-up truck.

acceleration = m/s² [2]

- (ii) Calculate the time taken for the pick-up truck to reach a speed of 15.0 m/s.

time taken = s [2]

- (iii) The pick-up truck then travels at constant speed for another 30 s. It subsequently undergoes constant deceleration of 3.5 m/s^2 until it comes to a stop.

On Fig. 2.2, sketch a speed-time graph of the pick-up truck throughout its entire journey.



Fig. 2.2

[3]

- (b) The pick-up truck is subsequently fully unloaded.

Given that the driving force of the pick-up truck remains the same, state whether the pick-up truck will have a greater or smaller acceleration. Explain your answer.

.....
.....
.....
..... [2]

- 3 Fig. 3.1 shows a man of mass 60 kg on the edge of a uniform diving board of length 3.0 m. The diving board has a weight of 500 N. The man is 2.5 m away from the pivot P. A spring S is installed 0.4 m from the pivot P.

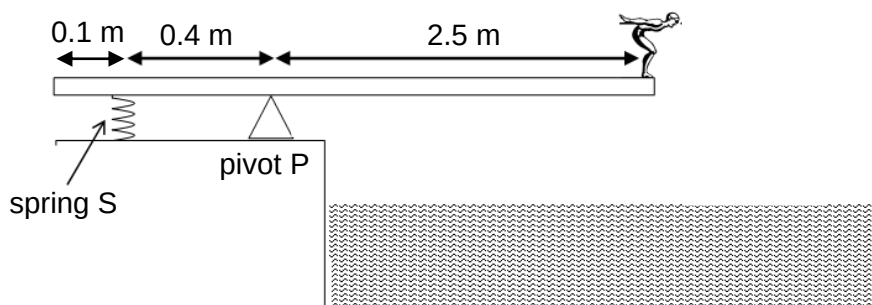


Fig. 3.1

- (a) Calculate the weight of the man.

weight = N [1]

- (b) Calculate the moment of the weight of the man about the pivot P.

moment = Nm [2]

- (c) The spring S is unable to withstand a force greater than 8000 N.

Explain whether it is safe for the man to dive from the diving board. Show all your working.

.....

 [3]

- 4 Fig. 4.1 shows an elevator that is supported by a cable. The cable passes around the axle of an electric motor and over a pulley. A tension T is exerted on the cable.

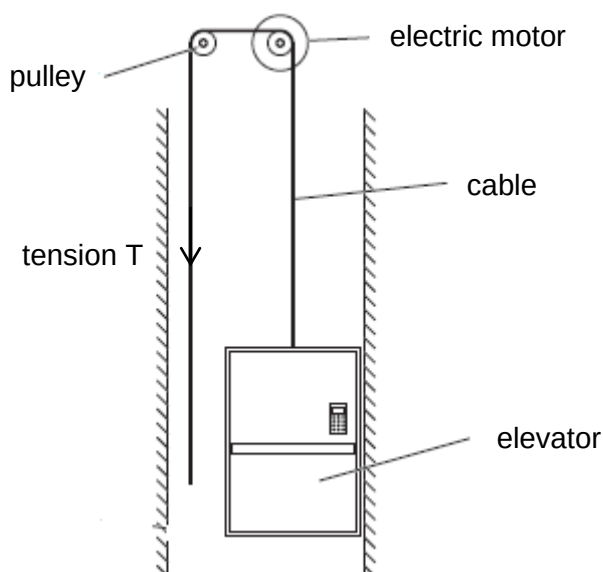


Fig. 4.1

When some passengers enter the elevator, the total weight of the elevator and the passengers is 2500 N.

- (a) State the tension T in the cable.

tension $T = \dots\dots\dots$ N [1]

- (b) The elevator has a rated power output of 7.5 kW.

Calculate the height that the elevator can carry the passengers up at constant speed in 12 s.

height = $\dots\dots\dots$ m [2]

- (c) In reality, the height that the elevator can carry the passengers is different from the value calculated in part (b).

State whether the actual height is greater or smaller than the value calculated in part (b). Explain your answer.

.....

 [2]

- 5 Fig. 5.1 shows an immersion heater that is used to heat up some water in a mug.

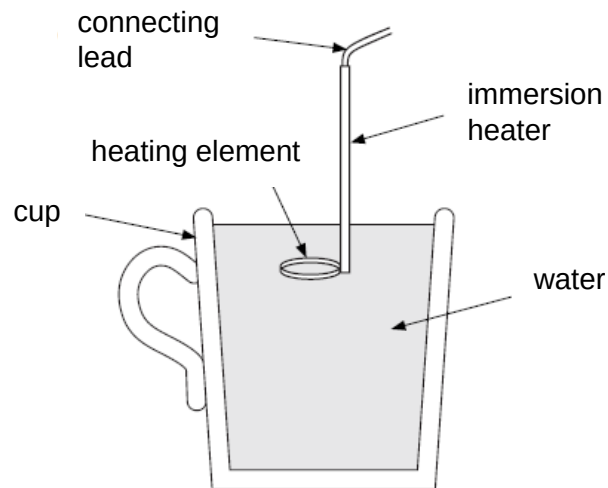


Fig. 5.1

The heating element must be placed at the bottom of the mug for all the water to be heated.

- (a) Explain how all the water in the mug gets heated by the immersion heater when the heating element is at the bottom of the mug.

.....
.....
.....
.....
..... [2]

- (b) Explain why the heating element should not be placed in the position shown on Fig. 5.1.

.....
..... [1]

- 6 Fig. 6.1 shows how the temperature of a pure substance changes with time when cooled in a refrigerator.

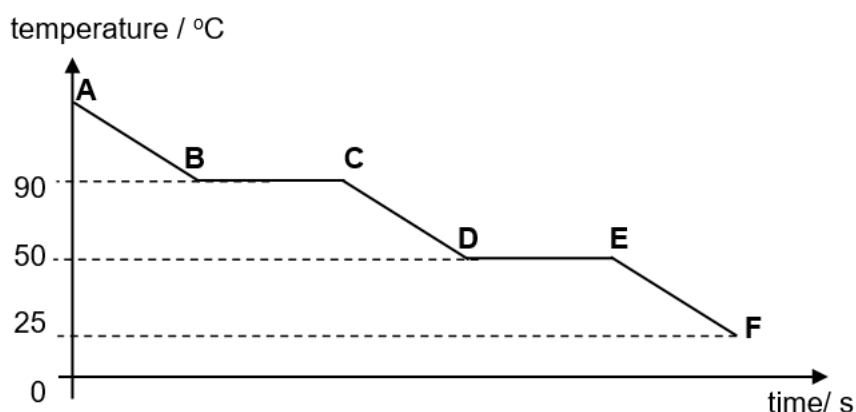


Fig. 6.1

- (a) State the parts of the graph when
- (i) the substance is undergoing a change of state:
- (ii) there are very strong forces of attraction between molecules: [2]
- (b) Using your knowledge of internal energy in the kinetic particle model of matter, explain why the temperature of the substance remains at 50 °C between **D** and **E**.
-
-
-
- [2]
- (c) State and explain whether the substance contracts more between **A** and **B**; or **C** and **D**.
-
-
-
- [2]

- 7 A spray gun is used to coat a layer of paint on an object as shown on Fig. 7.1. The paint droplets are negatively-charged as they exit the nozzle of the spray gun. This causes the droplets to spread out as they come into contact with the object.

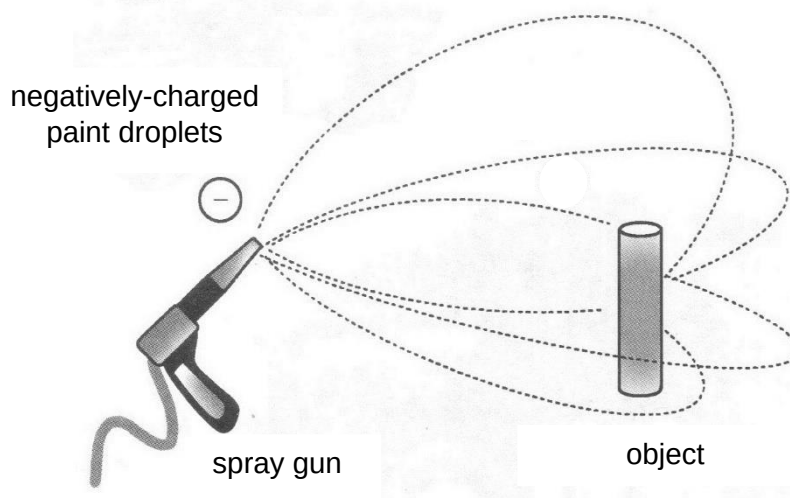


Fig. 7.1

- (a) Explain why the paint droplets spread out as they leave the nozzle of the spray gun.

.....
..... [1]

- (b) State one advantage of using electrostatic spray painting.

.....
..... [1]

- 8 Fig. 8.1 shows a circuit with two fixed resistors connected in series with a battery. The battery has an e.m.f. of 8.0 V.

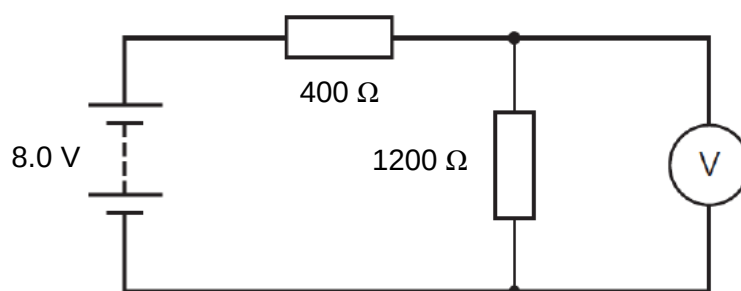


Fig. 8.1

- (a) State what is meant by an *e.m.f.* of 8.0 V.
-
-
- [1]
- (b) An LED is placed in series to the battery such that it will light up when current flows through it.
Draw the circuit symbol of the LED on Fig. 8.1. [1]
- (c) On Fig. 8.1, draw an arrow to represent the direction of electron flow. [1]
- (d) When connected correctly, the LED has negligible resistance in the circuit.
Calculate the amount of electric current flowing through the battery.

electric current = A [2]

- (e) By considering the potential difference in the voltmeter, determine the power output of the 1200 Ω resistor.

power output = W [3]

- 9 Fig. 9.1 shows an apparatus called a force-on-conductor balance.

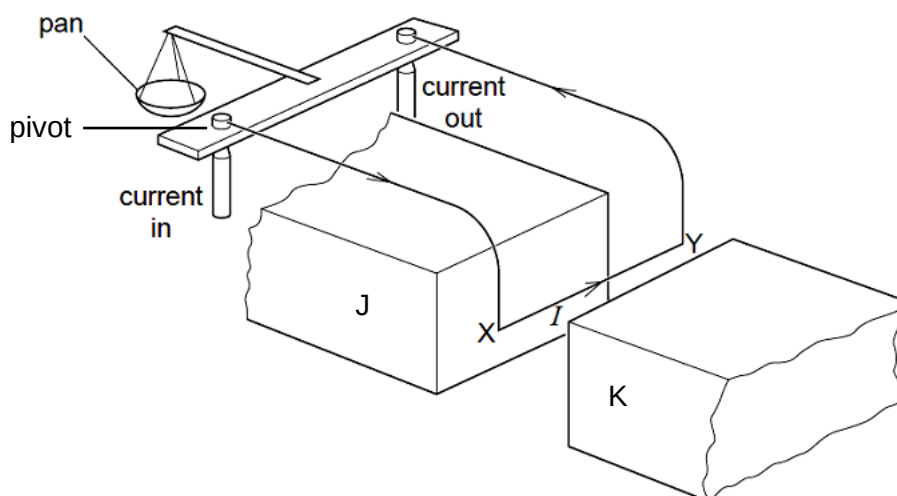


Fig. 9.1

When an electric current I flows through the wire XY, a downward force is exerted on the wire XY. This force can be measured by placing some weights in the pan until the wire XY returns to its original position. J and K are the poles of permanent magnets.

- (a) State the polarity of J and K respectively such that a downward force is exerted on the wire XY.

J:

K:

[1]

- (b) A change is made to the electric current such that some of the weights in the pan must be removed to keep wire XY in its original position.

State and explain the change that have occurred to the electric current.

.....
.....
.....
..... [2]

- 10 In the coal mining industry, radioactive gauges are used to determine the height of coal in an industrial hopper.

Fig. 10.1 shows a typical steel hopper filled with coal.

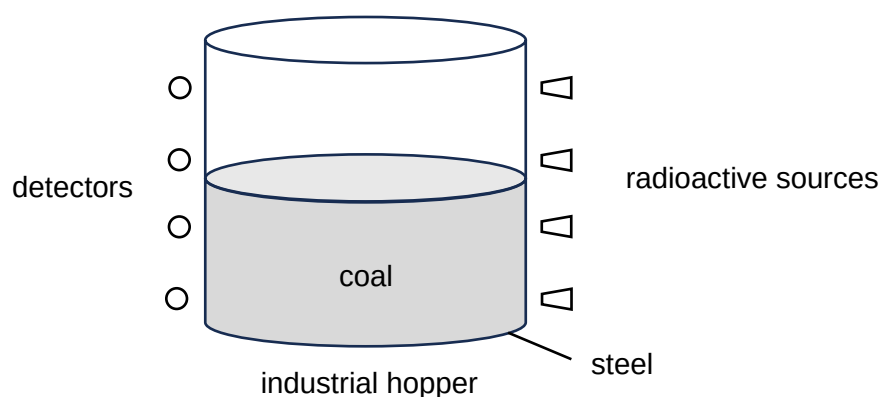


Fig. 10.1

- (a) An engineer is tasked to decide on a suitable radioactive source to determine the height of coal in the hopper. He is given three choices, Source X, Y and Z. Table 10.1 shows the types of radiation emitted by the sources.

Table 10.1

source	alpha radiation	beta radiation	gamma radiation
X	✓		
Y	✓	✓	
Z		✓	✓

- (i) State and explain which of the sources the engineer should decide on.

.....

 [2]

- (ii) Some technicians are tasked to replace the radioactive source used in the industrial hopper with another source that emits alpha, beta and gamma rays.

Describe two ways in which the technicians can safely carry out this replacement.

.....

 [2]

- (b) A possible radioactive isotope that can be used in the hopper is Actinium-222.

A scientist measures the activity of a sample of Actinium-222 over 2.5 minutes. The results, after taking background radiation into consideration, are shown on Table 10.2.

Table 10.2

time / min	0	0.5	1.0	1.5	2.0	2.5
activity / Bq	720	520	360	280	180	140

- (i) On the grid of Fig. 10.2, plot a graph to show how the activity of the sample varies over time.

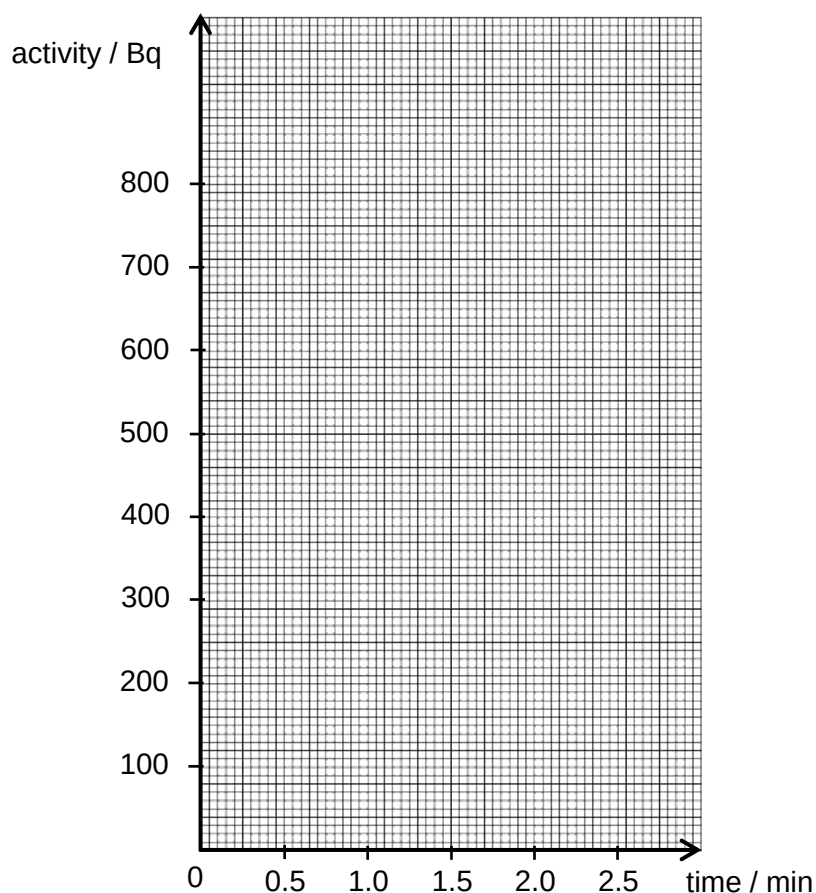


Fig. 10.2

[2]

- (ii) Calculate the half-life of Actinium-222. Show on your graph how you arrive at your answer.

half-life = min [2]

- (iii) An atom of Actinium-222 with a proton number of 89 undergoes spontaneous and random decay by emitting an alpha particle to form an isotope of Francium.

1. Write down the nuclide notation for the isotope of Francium.

${}^{222}_{89}\text{Fr}$ [1]

2. Calculate the number of neutrons in the isotope of Francium.

number of neutrons = [1]

Section B

Answer only one question in this section.

Write your answers in the spaces provided.

- 11** In 1994, the Asian Games held in Hiroshima, Japan, were broadcasted live across Japan using television masts. The Games were also broadcasted live via satellite television to several nations across Asia. Fig. 11.1 shows how the television signals were sent from the television mast and transmitter in Hiroshima to the receivers in Japan and Singapore.

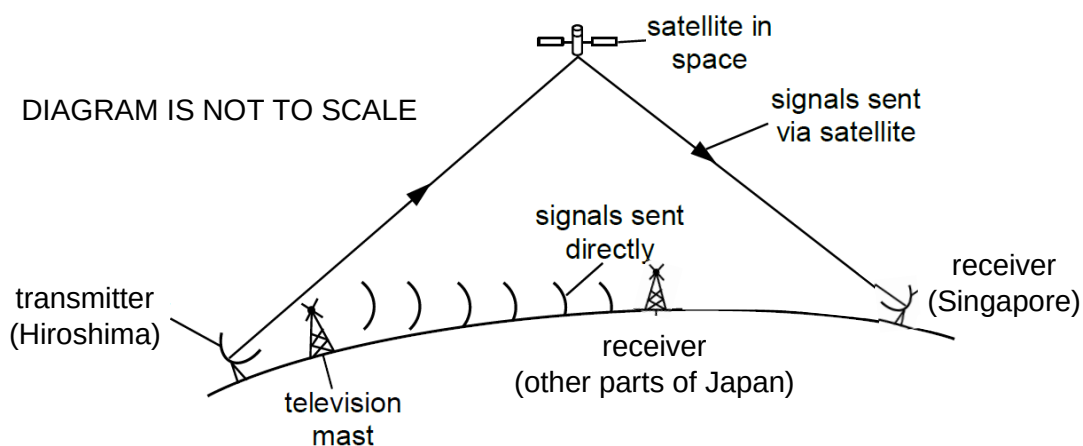


Fig. 11.1

- (a)** State the region of the electromagnetic spectrum that is used for sending the signals via the following methods.

television mast:

satellite:

[1]

- (b)** State the speed of the electromagnetic signals in vacuum.

..... [1]

- (c)** The frequency of the satellite signals is 2.0 GHz.

Calculate the wavelength of the satellite signals.

wavelength = [2]

- (d) In reality, due to the presence of the atmosphere, signals sent to and from the satellite undergo refraction. The atmosphere is optically denser than the outer space.

On Fig. 11.2, draw a ray diagram to show how the signal from the transmitter reaches the receiver.

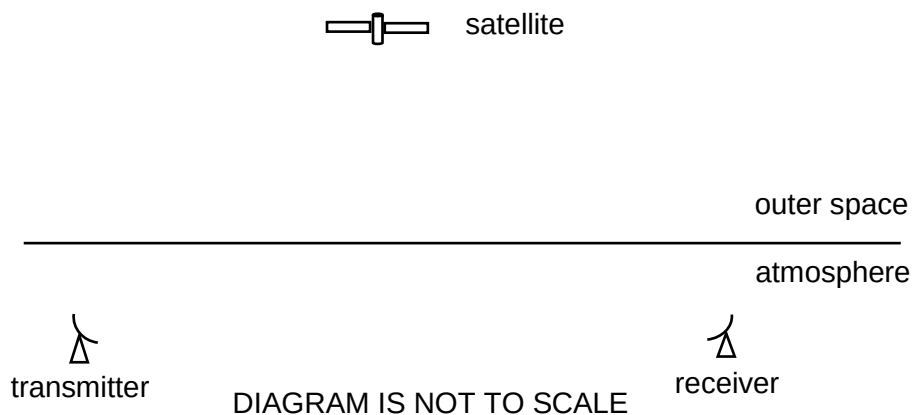


Fig. 11.2

[2]

- (e) A student proposes that the satellite signals could have been sent via the visible light part of the electromagnetic spectrum.

Suggest a reason why this is not a feasible idea.

.....
 [1]

- (f) Advances in technology have enabled the television signals to be sent across the globe via visible light. This is achieved by transmitting the light signals through cables made of glass.

Fig. 11.3 shows a ray of light entering a glass cable of refractive index 1.5.

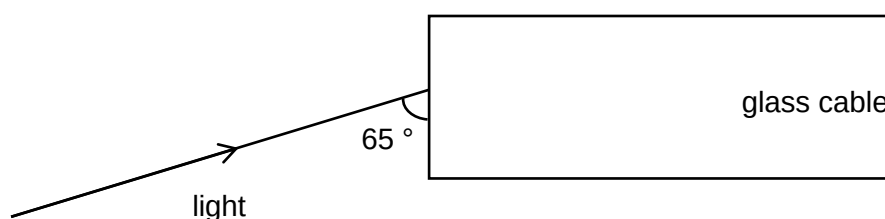


Fig. 11.3

- (i) State what is meant by a *refractive index of 1.5*.

.....

 [1]

- (ii) Calculate the angle of refraction as the light enters the glass cable on Fig. 11.3.

angle of refraction = ° [2]

- 12** A technician was tasked to set up an electric school bell using the set up as shown on Fig. 12.1.

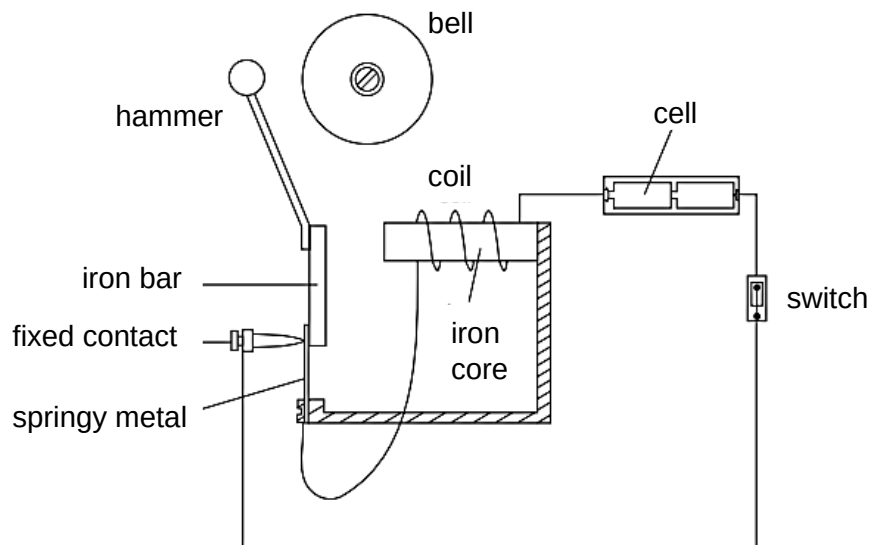


Fig.12.1

- (a) (i)** Explain how the electric school bell on Fig. 12.1 works when the switch is closed.

..... [3]

- (ii) A student suggests that the iron core should be replaced with stainless steel that will not rust easily.

Explain whether this is a good idea.

.....

.....

.....

..... [2]

(b) State the effect, if any, on the electric bell when the following changes are done:

(i) another dry cell is connected in series to the circuit

..... [1]

(ii) the direction of current in the circuit is reversed

..... [1]

(c) The sound made by the bell travels at a speed of 320 m/s through the air.

(i) Describe how the sound made by the bell is propagated through the air.

.....

.....

.....

..... [2]

(ii) Calculate the time taken for the sound to reach another part of the school that is 250 m away.

time taken = s [1]

END OF PAPER