Class / Index Number	Centre Number / 'O' Level Index Number	Name
/	/	

新加坡海星中学

MARIS STELLA HIGH SCHOOL

PRELIMINARY EXAMINATION

SECONDARY FOUR

PHYSICS — **6091/02**

Paper 2 Structured and Free Response

22 August 2024

1 hour 45 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Section A
Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section B
Answer one question.
Write your answers in the spaces provided. Circle your choice of question on the cover page.

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.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper (sections A and B) is 80.

For Examiner's Use	
Section A	70
Section B (12 / 13)	10
Total	80

This document consists of **23** printed pages inclusive of this cover page.

Section A

Answer **all** questions in this section.

1 Fig. 1.1 shows a man cycling forward on a straight road surface P. After cycling for 10 s, he enters a road surface Q. Throughout the entire journey, the man exerts a constant forward driving force of 600 N.

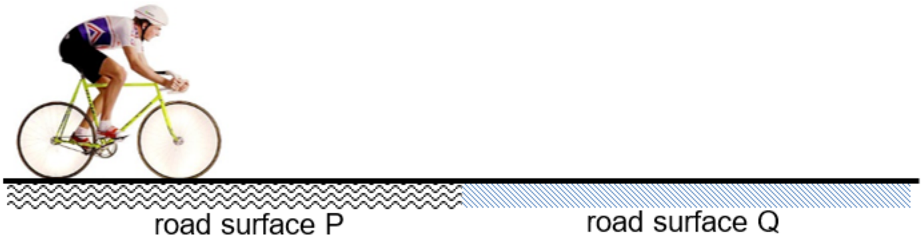


Fig. 1.1

Fig. 1.2 shows a graph of the resistive force acting on the bicycle against time.

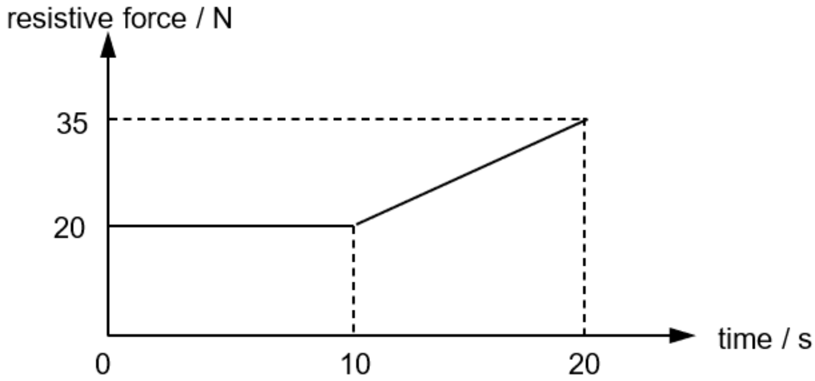


Fig. 1.2

The man and his bicycle have a combined mass of 150 kg. His initial speed is 2.0 m/s.

(a) Calculate the acceleration of the man and his bicycle at t = 5 s.

acceleration = ...[2]

(b) Calculate the speed of the bicycle at t = 10 s.

speed = ...[2]

(c) Describe the velocity and acceleration of the cyclist from 10 s to 20 s.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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

2 Fig. 2.1 shows an archer shooting an arrow at a target during a competition.

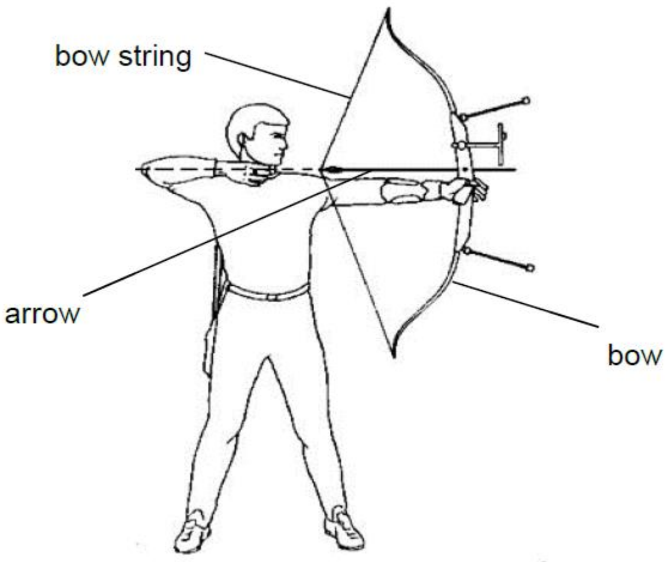


Fig. 2.1

(a) The arrow has a mass of 0.025 kg and is initially at rest. The arrow leaves the bow 0.013 s after the bow string is released. When it leaves the bow, the velocity of the arrow is 86 m/s.

Calculate

(i) the average force exerted on the arrow during the 0.013 s.

average force = ……………………………………….[2]

(ii) The magnitude of the force exerted on the arrow by the bow string is not consistent during the 0.013 s. Suggest why this is so.

....

....

....

....[2]

(b) On Fig. 2.2, sketch a possible speed-time graph for the arrow after the bow string is released. [2]

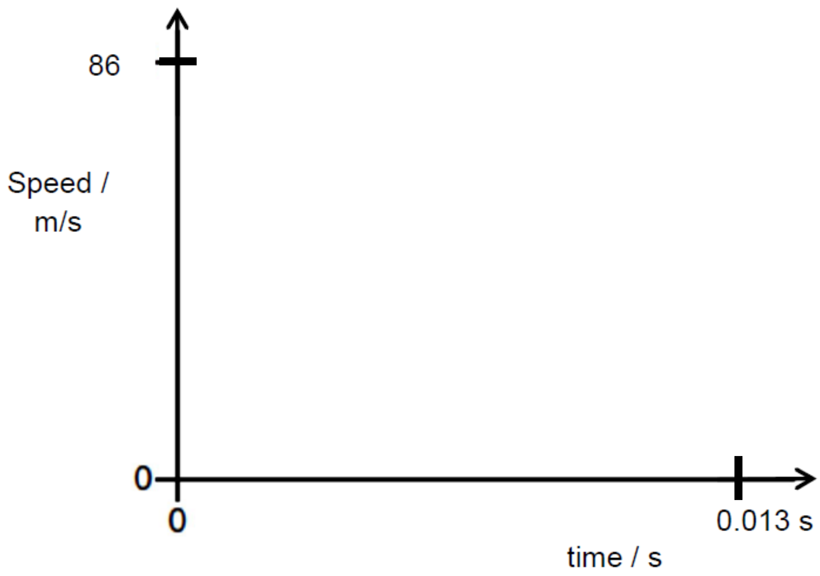


Fig. 2.2

3 A mass, hanging on the end of a string, is pulled horizontally sideways to the right so that the string makes an angle of 30º with the vertical as shown in Fig. 3.1. In this position, the tension in the string is 8.0 N.

By means of a scale diagram, determine the weight of the mass.

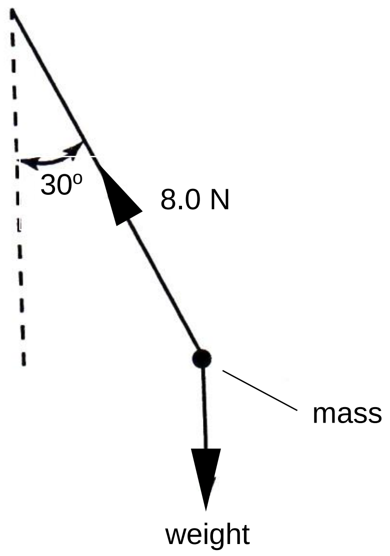


Fig. 3.1

weight of mass = ………………………………………….[4]

4 Fig. 4.1 shows a door and an automatic door-closer viewed from above.

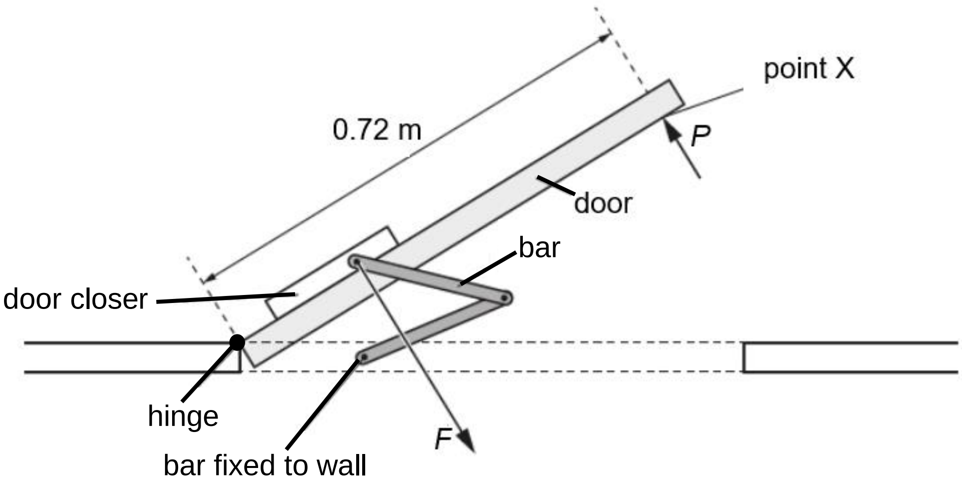


Fig. 4.1

When the door opens and closes, the hinge acts as a pivot.

A girl opens the door by exerting a force *P* at point X.

Force *P* is perpendicular to the surface of the door.

(a) Fig. 4.1 shows that point X is at a distance of 0.72 m along the front of the door from the hinge. The force *P* is 25 N.

(i) Calculate the moment of force *P* about the hinge.

moment of force = ...[1]

(ii) The door rotates about the hinge by 90º. As it rotates, the force *P* remains perpendicular to the surface of the door. The circumference of a circle of radius 0.72 m is 4.5 m.

Calculate the work done on the door by force *P*.

work done = ...[2]

(b) As the door opens, there is a force *F* on the door in the direction shown in Fig. 4.1. Although force *F* is larger than force *P*, the door rotates about the hinge.

Explain why.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………[2]

5 **(a)** Fig. 5.1 shows an electric circuit powered by a 12.0 V battery of negligible internal resistance.

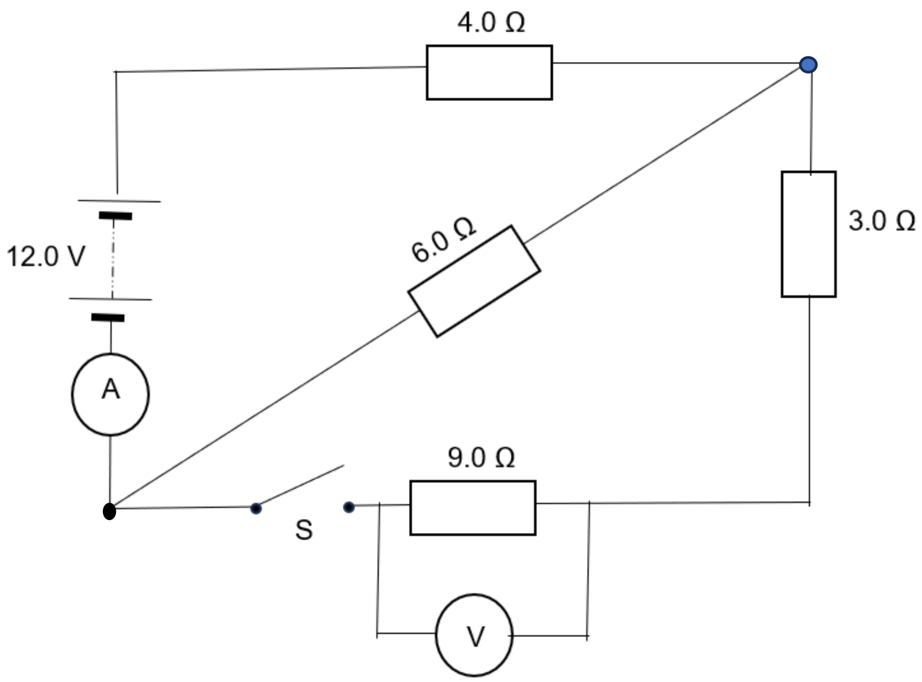


Fig. 5.1

When switch S is closed, calculate

(i) the total resistance of the circuit,

total resistance = ……………………………………..[2]

(ii) the current flowing through the ammeter.

current = ……………………………………………….[1]

(b) Describe the effect on the reading of the ammeter when the switch S is opened.

……………………………………………………………………………………………………..

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

6 Fig. 6.1 shows how the resistance of a thermistor, *R,* varies with temperature.

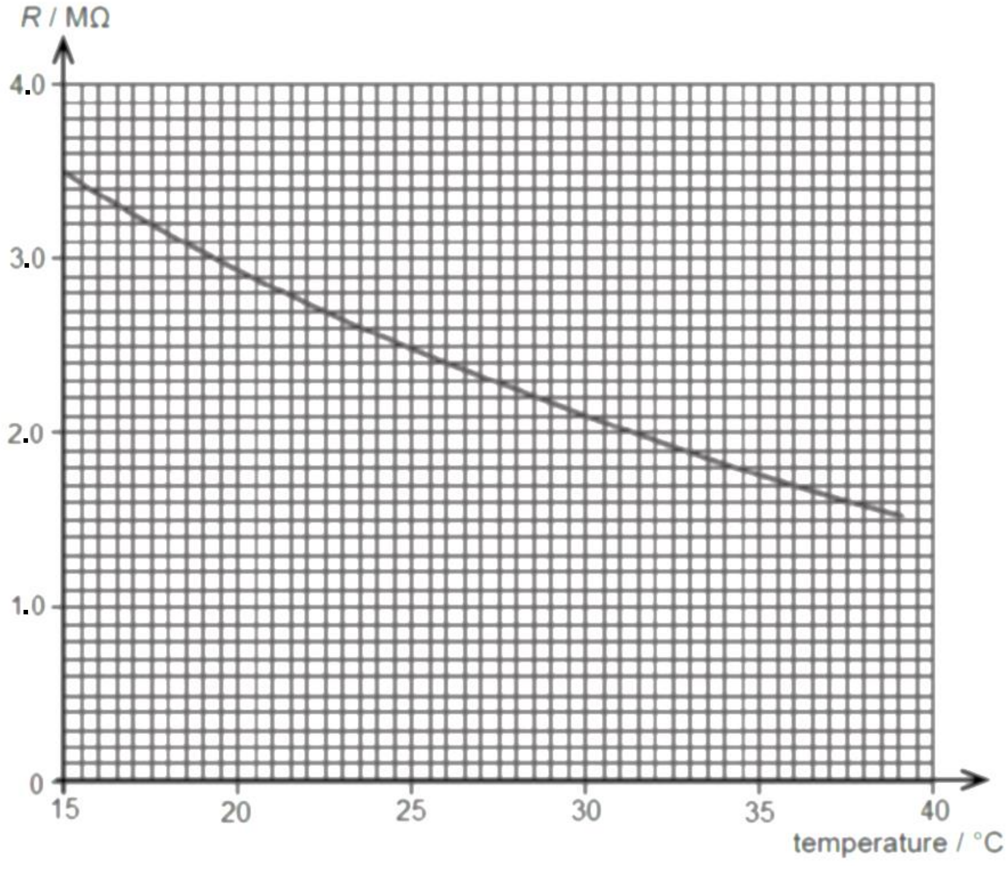


Fig. 6.1

The thermistor is connected to the circuit in Fig. 6.2.

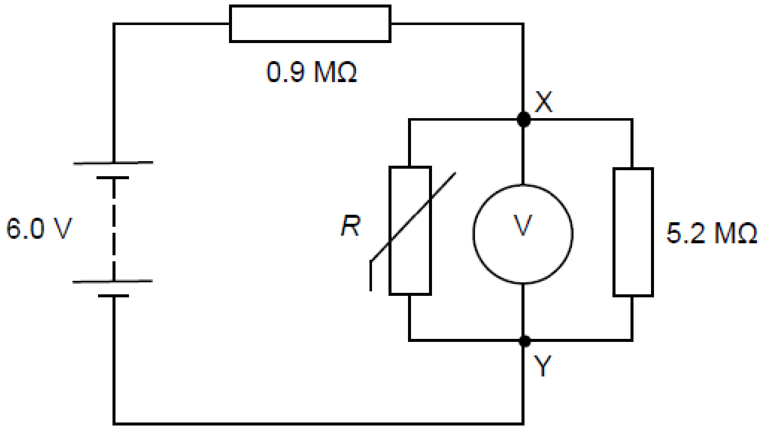


Fig. 6.2

The battery has an electromotive force (e.m.f.) of 6.0 V.

The voltmeter reads 4.0 V.

(a) Determine

(i) the total resistance between points X and Y,

total resistance between points X and Y = ...[2]

(ii) the temperature of the thermistor using Fig. 6.1.

temperature = ...[2]

(b) A student suggests that the circuit in Fig. 6.2 could be calibrated to measure temperature.

Suggest a disadvantage of using the thermistor for the measurement of temperature.

....

....[1]

7 Fig. 7.1 shows a d.c. generator.

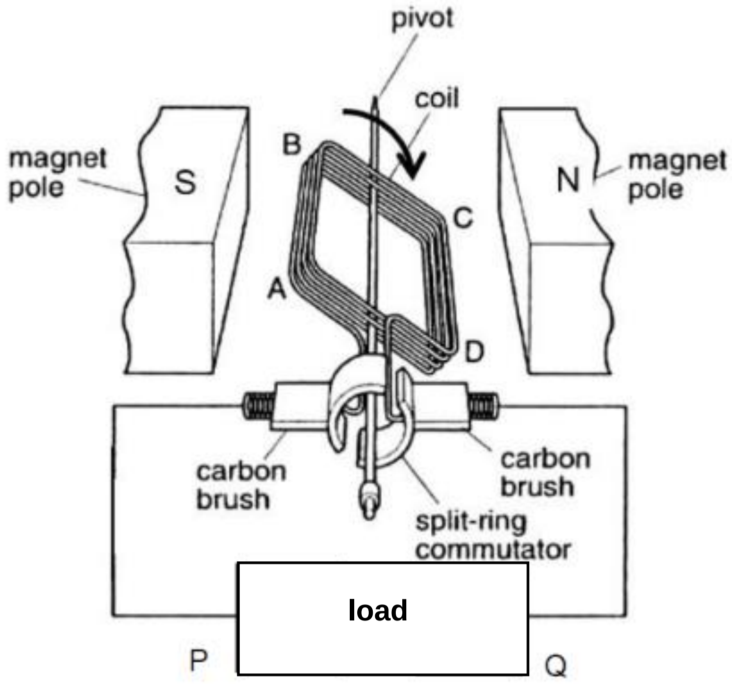


Fig. 7.1

(a) Coil ABCD rotates clockwise. Using arrows, draw the directions of the induced currents on the sides AB and CD of the coil on Fig. 7.1. [1]

(b) Sketch on Fig. 7.2, the graph of the induced e.m.f. against time when the coil is rotated. [3]

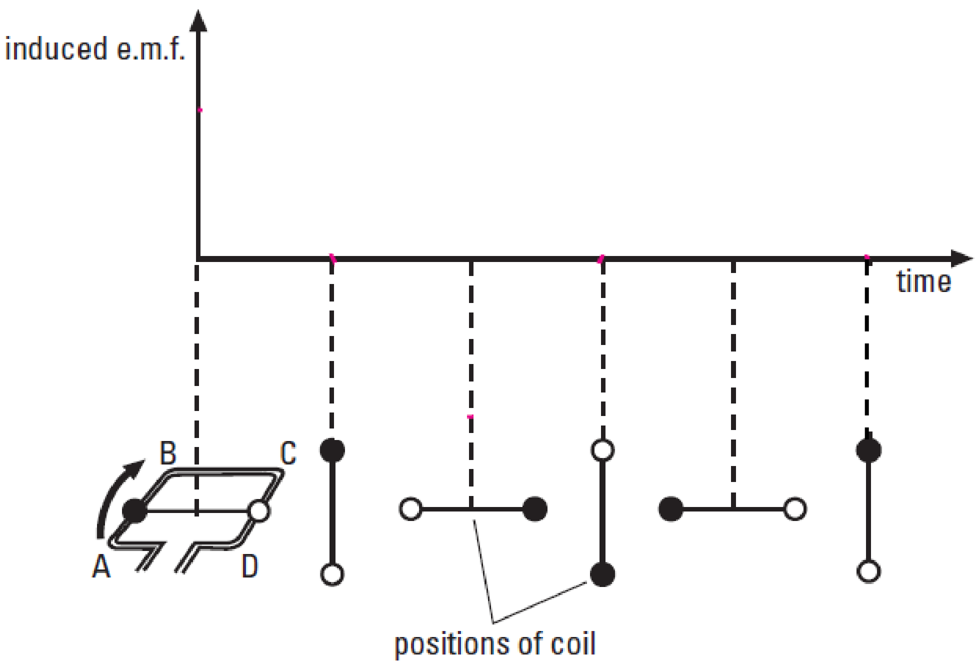


Fig. 7.2

(c) Explain why a motor can also be used as a generator.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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

8 Fig. 8.1 shows the structure of a transformer which is used in the transmission of electrical power through the cables.

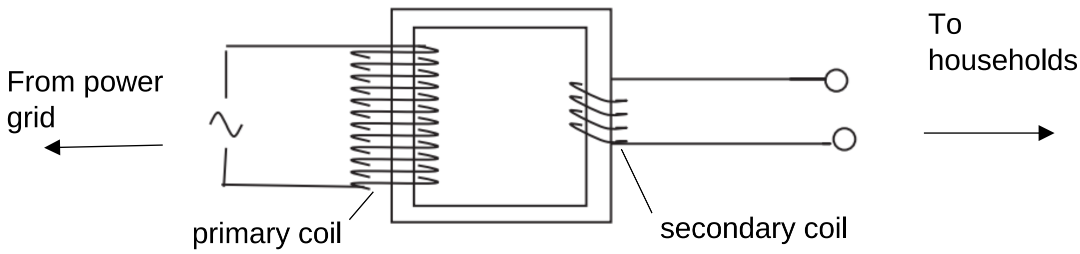


Fig. 8.1

An engineer is assigned to build a step-down transformer for stepping down the voltage from 3.3 kV to 220 V in the substation of a housing estate. He has the choice of using four types of coils with different number of turns as shown in Table 8.2 below.

coil	number of turns
J	50
K	100
L	1 000
M	1 500

Table 8.2

(a) Based on Table 8.2, select the most suitable pair of coils for making the primary coil and secondary coil of the transformer.

Explain your choice.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

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

(b) Assuming that the transformer is 75 % efficient and the power output is 15 kW, calculate the current flowing in the primary coil.

current = ……………………………………………….[2]

(c) Describe one feature of the transformer that improves its efficiency.

……………………………………………………………………………………………..

……………………………………………………………………………………………..

……………………………………………………………………………………………..

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

9 The nuclide sodium-24 ($^{24}_{11}Na$) undergoes radioactive decay to become magnesium-24 ($^{24}_{12}Mg$). A radioactive sample contains N_o atoms of sodium-24 and zero atoms of magnesium-24 at time t = 0. Fig. 9.1 shows the variation of number of sodium-24 atoms (N) with time t.

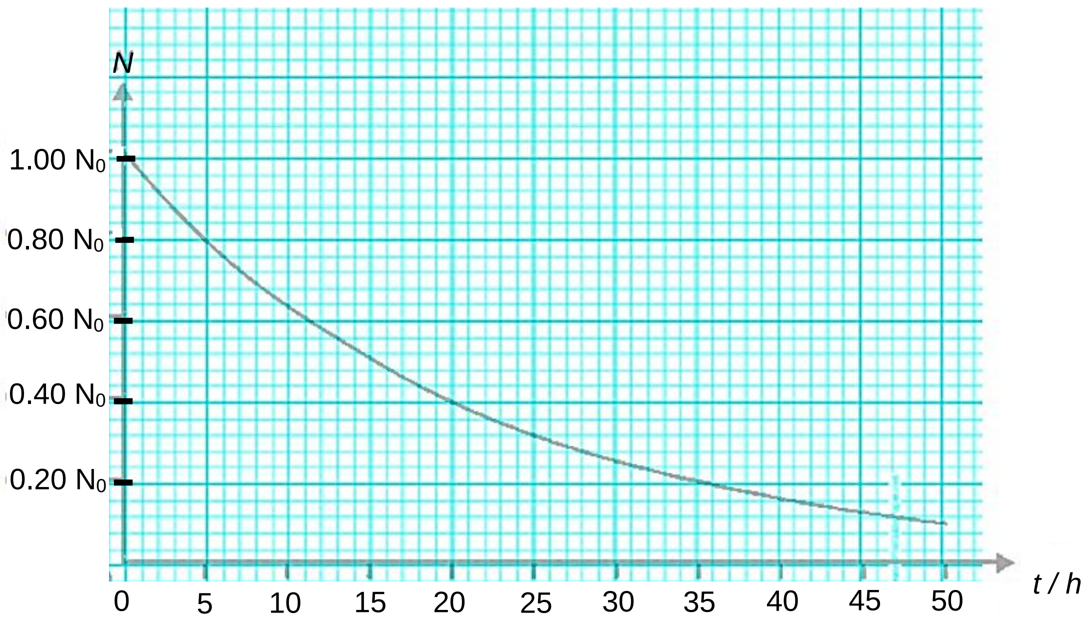


Fig. 9.1

(a) **(i)** Write the nuclide equation to represent sodium-24 decay to magnesium-24.

…………………………………………………………………………………………[1]

(ii) Explain the meaning of *half-life* of a radioactive nuclide.

…………………………………………………………………………………………………..

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

(iii) Using Fig. 9.1 to determine the half-life of sodium-24.

half-life = ……………………………………..……[1]

(iv) Suggest an application for the radioactive products of sodium-24.

……………………………………………………………………………………………...

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

(b) In a separate experiment, a different radioactive source is used. The background count rate is 20 counts / minute.

When the radiation detector is placed near the source, the count rate is 800 counts / minute.

The half-life of the source is 5 minutes.

(i) State what is background radiation.

………………………………………………………………………………………………

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

(ii) Determine the count rate on the detector at the end of 10 minutes.

count rate = ………………………………………[2]

(iii) Calculate how long it will take for the count rate on the detector to decrease to 118 counts / minute.

time = ………………………………………[2]

(iv) Radioisotopes are used to treat cancer. Internal radionuclide therapy is administered by injecting a small radiation source by mouth as a pill or injected into a vein.

Explain why the radioisotope should have a short half-life.

....

....

....[1]

10 Fig. 10.1 shows a cooling system used to cool a motor car engine by circulating water through it. The radiator is a heat exchanger where the hot water transfers its thermal energy to the air.

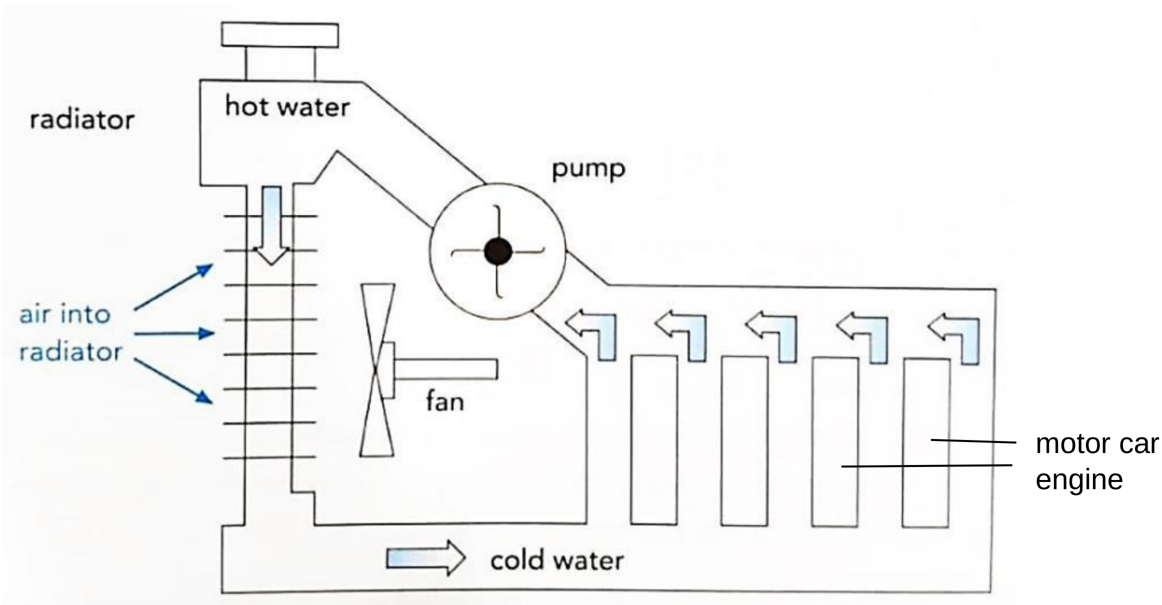


Fig. 10.1

A number of test runs are carried out to investigate the cooling system. Table 10.2 shows the data from one test run and the specific heat capacities of some substances.

Duration of test / min	4.0
Energy available from fuel used / J kg^{-1}	5.0×10^{7}
Fuel consumed / kg	0.80
initial temperature of air / ^{o}C	20.0
initial temperature of cold water / ^{o}C	30.0
final temperature of hot water / ^{o}C	80.0
rate of flow of water / kg s^{-1}	0.22
rate of flow of air over radiator fins / kg s^{-1}	1.25
specific heat capacity of castor oil / J kg^{-1} ^{o}C^{-1}	1800
specific heat capacity of glycerine / J kg^{-1} ^{o}C^{-1}	2430
specific heat capacity of water / J kg^{-1} ^{o}C^{-1}	4200
specific heat capacity of air/ J kg^{-1} ^{o}C^{-1}	760

Table 10.2

Fig. 10.3 shows an expanded view of the cross-section of the radiator.

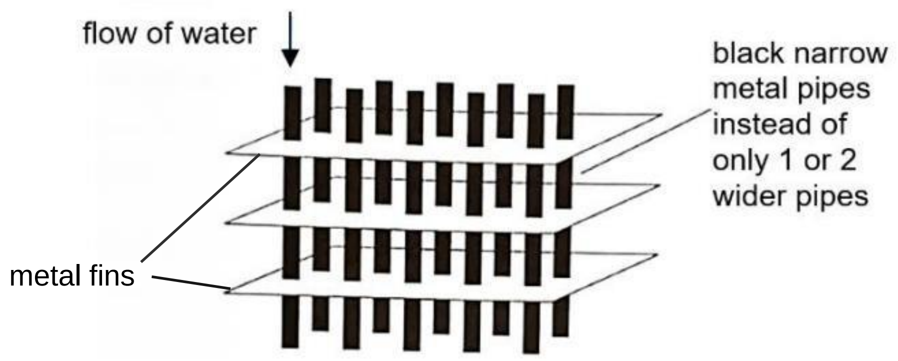


Fig. 10.3

(a) Explain why water is used as a coolant in the radiator of a motor car engine instead of the other fluids given in the table in Table 10.2.

………………………………………………………………………………………………..

………………………………………………………………………………………………..

………………………………………………………………………………………………..

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

(b) The manufacturer claims that 20% of the energy from the fuel is transferred into useful mechanical energy.

(i) Calculate the amount of thermal energy removed from the hot water in the test run based on the manufacturer's claim.

energy = …………………………………………..……..[1]

(ii) Calculate the actual amount of thermal energy removed from the hot water during the test run.

energy = …………………………………………..….[1]

(iii) Suggest a reason for the difference between the values in **(i)** and **(ii)**.

…………………………………………………………………………………………………

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

(c) Using Fig. 10.3, explain the features of the radiator that allow thermal energy to be transferred easily away from the hot water which flows through the tubes.

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

……………………………………………………………………………………………………..

…………………………………………………………………………………………………….[3]

(d) Assuming that there is no heat loss by the cooling water as it flows from the engine to the radiator, calculate the average final temperature of air leaving the radiator in the test run.

average final temperature = …………….………….[2]

11 Two metal cans A and B are filled with equal masses of the same liquid at a temperature of 75°C as shown in Fig. 11.1.

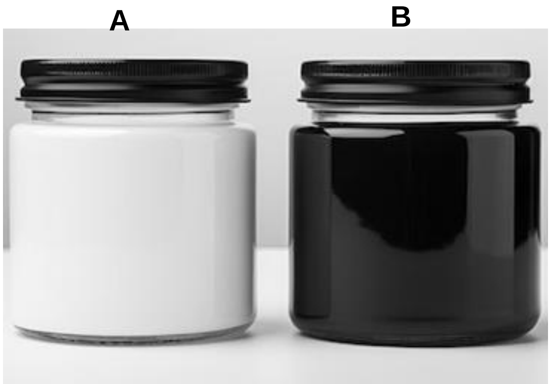


Fig. 11.1

The cans are identical except that can A has a polished silver surface and can B has a dull black surface.

Both cans are placed on a table and the temperature of each can is measured every minute.

The variation with time of the temperature of the liquid in can A is shown in Fig. 11.2.

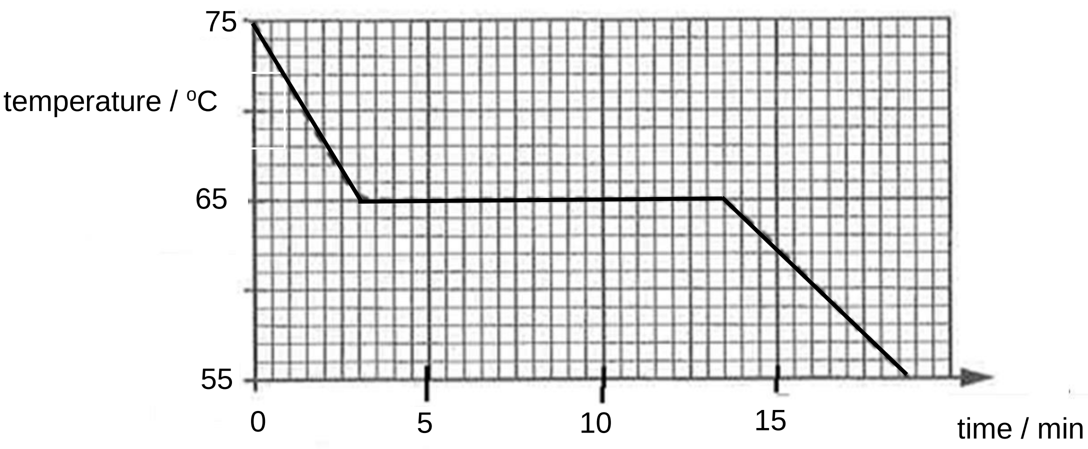


Fig. 11.2

(a) Describe how thermal energy is transferred from the liquid to the surroundings.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………[2]

(b) Determine the initial rate of fall in temperature, giving your answer in °C/min.

initial rate of fall in temperature = …...………………….....……[1]

(c) The mass of liquid in can A is 50 g. The specific heat capacity of liquid is 4.2 J/(g°C).

Calculate the average energy lost by the liquid per minute in the first 3.0 min.

average energy lost = ……………………………….[2]

(d) After some time, the temperature remains constant, even though heat is still being transferred by the liquid to the surroundings. Explain why.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

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

(e) On Fig. 11.2, sketch the variation with time of the temperature of the liquid in can B for the temperature change from 75°C to 55°C. [2]

(f) Explain why your graph for can B is different from the graph for can A.

……………………………………………………………………………………………

……………………………………………………………………………………………

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

Section B

Answer **one** question in this section.

12 Fig. 12.1 shows an electrical wiring in a water heater. It consists of a heater coil rated '240 V, 2500 W' and an exhaust fan rated '240 V, 300 W'. The mains supply 240 V to the water heater.

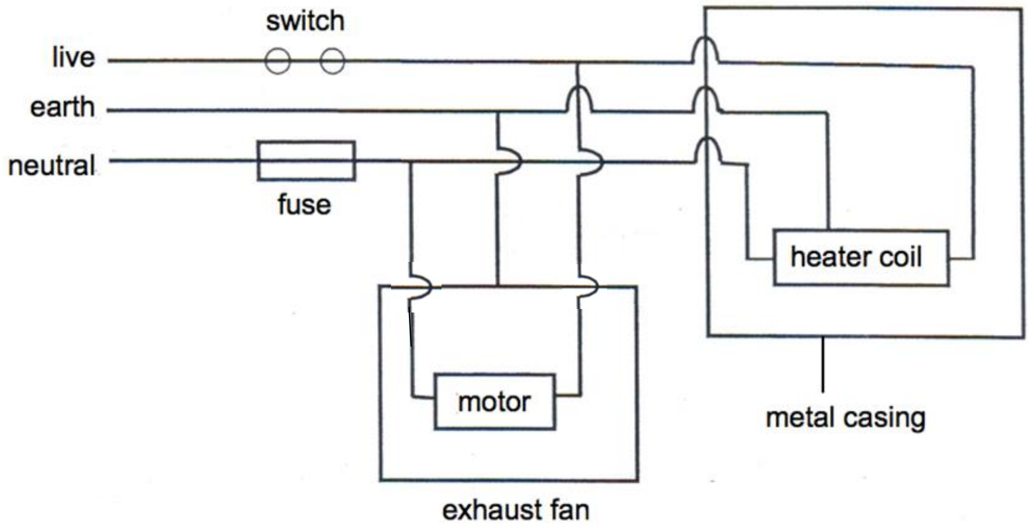


Fig. 12.1

(a) **(i)** The fuse rating in Fig. 12.1 is 11 A. Explain, with clear calculation, why the fuse rating is not suitable.

....

....

....[2]

(ii) Identify two other faults in Fig. 12.1 and describe how they should be corrected.

....

....

....

....

....

....[2]

(b) Fig. 12.2 shows two coils, A and B, with currents flowing through them in the directions indicated.
A is suspended from a spring balance while B is fixed.

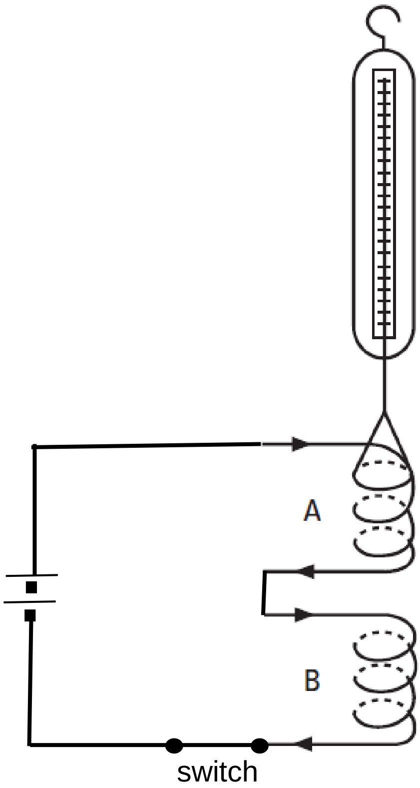


Fig. 12.2

(i) Mark at each end of A and B, the magnetic poles due to the current flowing through the coils. [1]

(ii) State the effect the coils will have on each other.

....[1]

(iii) Describe how this effect will change the reading on the spring balance.

....[1]

(iv) If the direction of current in both coils is opposite to that shown in Fig.12.2, describe the effect on the reading on the spring balance.

....[1]

(v) State and explain the effect on the spring balance when the switch is just opened.

....

....

....

....[2]

13 **(a)** The displacement-distance graph of a wave in a string at an instant in time is shown in Fig. 13.1.

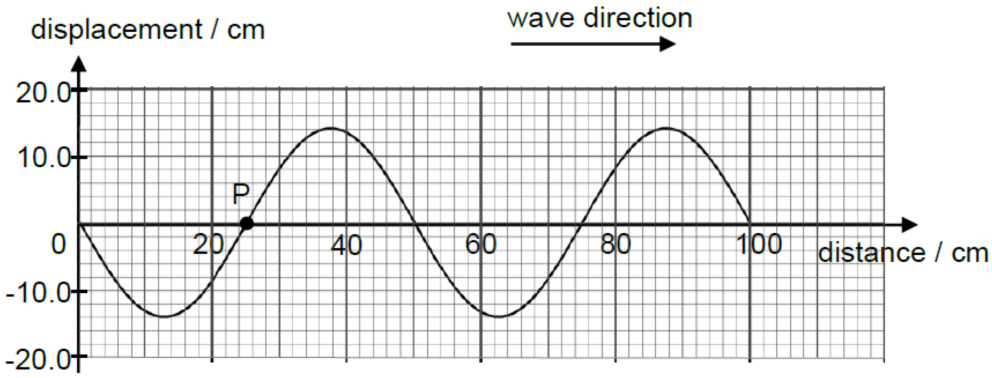


Fig. 13.1

(i) Determine the wavelength of the wave.

wavelength = ………………………………………..….[1]

(ii) The wave has a frequency of 2.0 Hz.

Calculate the distance travelled by the wave in 0.060 s.

distance travelled = …………………………………..[2]

(iii) Draw on Fig. 13.1 to show how the wave will appear after 0.060 s. [1]

(iv) Estimate the displacement of particle P after 0.060 s.

displacement = ………………………………………[1]

(b) Fig. 13.2 shows an ultrasound transmitter and receiver placed in close contact with the skin.

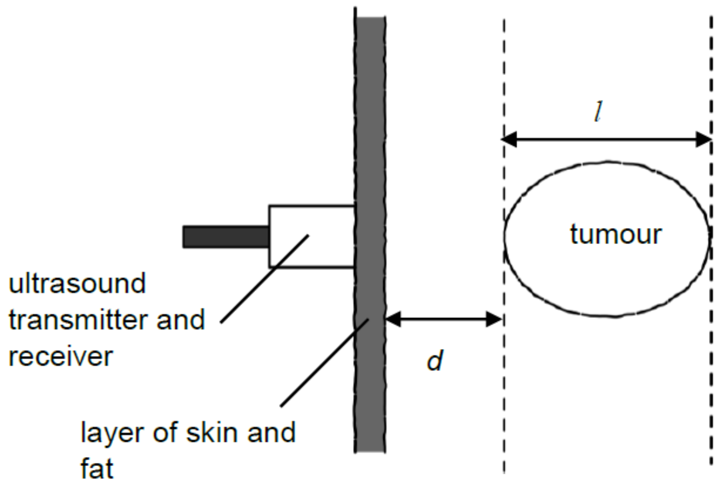


Fig. 13.2

The scan can determine the depth, d of a tumour below the skin and the length of the tumour, l.

On Fig. 13.3, the strength of the reflected ultrasound pulses A, B, C and D is plotted against time t where t is the time taken for the ultrasound receiver to receive the pulse after being transmitted. The ultrasound pulses are reflected at the different interfaces.

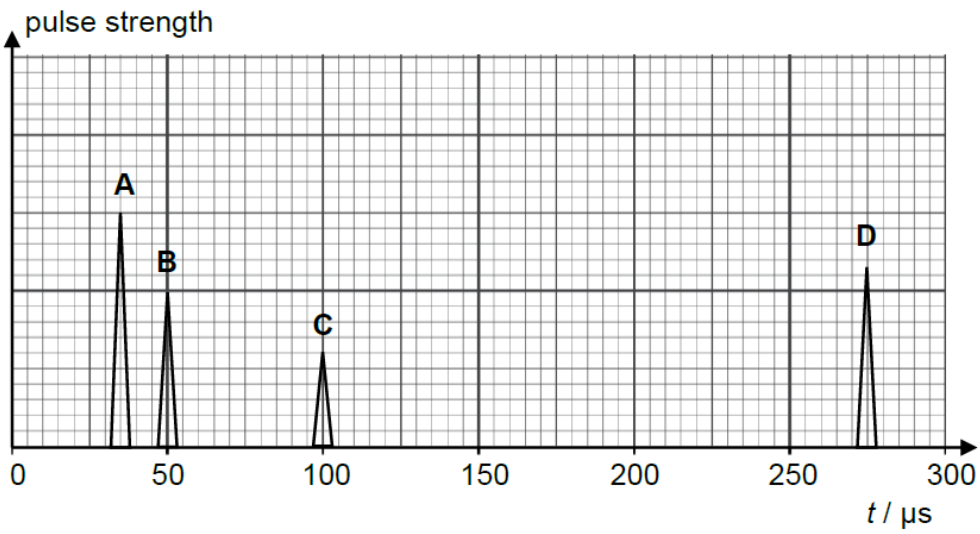


Fig. 13.3

(i) Suggest a reason why a layer of gel is applied between the ultrasound transmitter/receiver and the skin during the scan.

…………………………………………………………………………………..………

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

(ii) Indicate with a cross **X** on Fig. 13.2 the origin of the reflected pulse D. [1]

(iii) The average speed of the ultrasound in human tissue and muscle is 1.5×10^3 m/s.

Using Fig. 13.3, determine length l of the tumour.

l = …………………………………………………….[2]

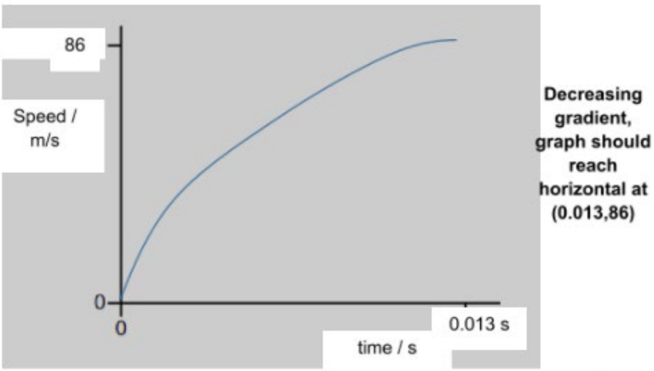
(iv) State one advantage of using ultrasound as opposed to using X-rays in medical diagnosis.

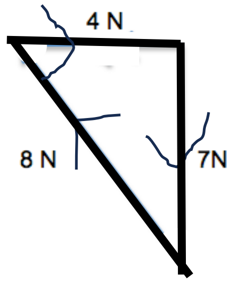
………………………………………………………………………………………………

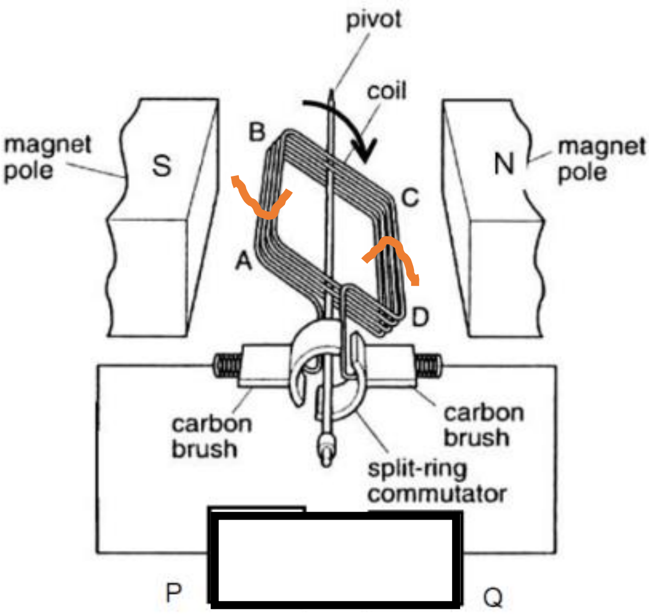
…………………………………………………………………………………..……[1]

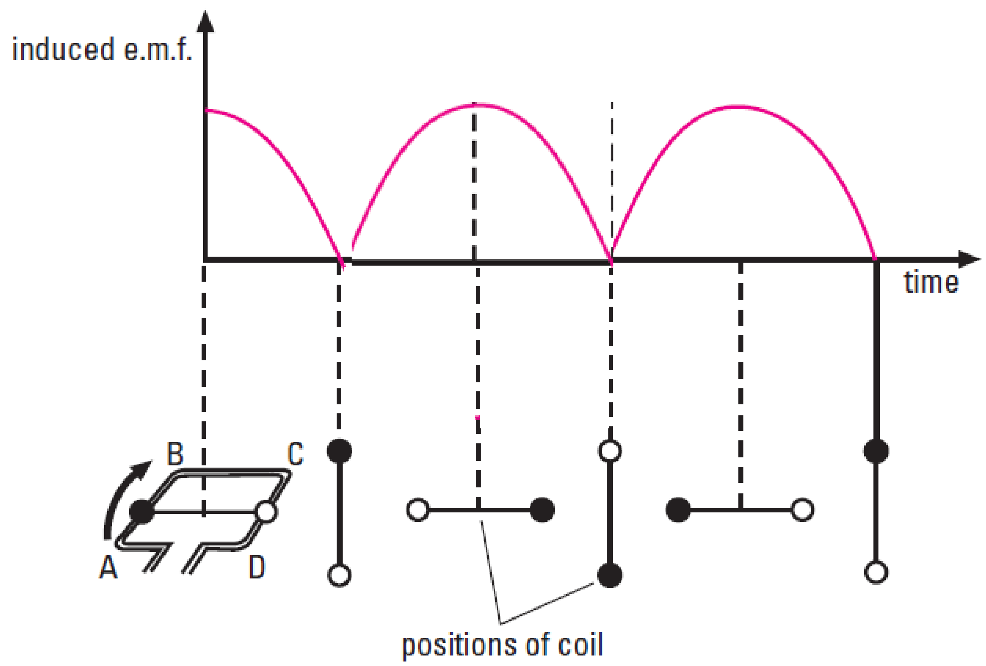
END OF PAPER

Answer Scheme:

1	a	F = ma 600 – 20 = (150)(a) [M1] a = 3.87 m/s^2 [A1]	
	b	a= (v-u)/t 3.87 = $\frac{V-2}{10}$ [M1] v = 40.7 m/s [A1]	
	c	The velocity of the cyclist increases uniformly, whilst his acceleration decreases at a uniform rate. [A1]	
2	ai	a = v – u / t = 86 – 0 / 0.013 = 6600 m/s^2 [C1] F = ma = 6600 x 0.025 = 165 N = 170 N (2sf) [A1]	
	ii	As the bow string is released, the arrow experiences the highest force as it is stretched the most initially. (more elastic energy is transferred per second to the arrow) This force will decrease until zero when the arrow leaves the bow. Alternative accepted answers: Work done to overcome air resistance/ resistive forces of arrow during motion, force on arrow decreases. Acceleration of arrow changes,as air resistance increases with its speed. Since F = ma so force changes.	B1 B1 B1 B1 Max [2]
	b	 1 mark – decreasing gradient 1 mark – reach horizontal line at 0.013, 86	
3			

		Scale : Let 1 cm represent 1 N  Weight of mass = 7.0 N (1 mark for scale 1 mark for correct orientation 1 mark for correct arrows 1 mark for correct magnitude)	
4	ai	M = Fd Moment = 25 x 0.72 = 18 Nm [A1]	
	aii	Work done = 25 x $\frac{2\pi \times 0.72}{4}$ [M1] = 28. 3 J (3 sf) [A1] Or Work done = 25 x $\frac{4.5}{4}$ = 28. 1 J	
	b	The perpendicular distance of the line of action of P to hinge is greater than that of F, to the extent that M =Fd for P is greater than that of F, so that the door can rotate. [B1] The moment of force P about hinge is greater than the moment of force F about the same hinge. [B1]	
5	ai	$\frac{1}{R_T} = 4.0 + (\frac{1}{6} + \frac{1}{3+9})^{-1}$ $R_T = 8.0\ \Omega$ [A1]	
	aii	I = V / R = 12 / 8 [C1] = 1.5 A [A1]	

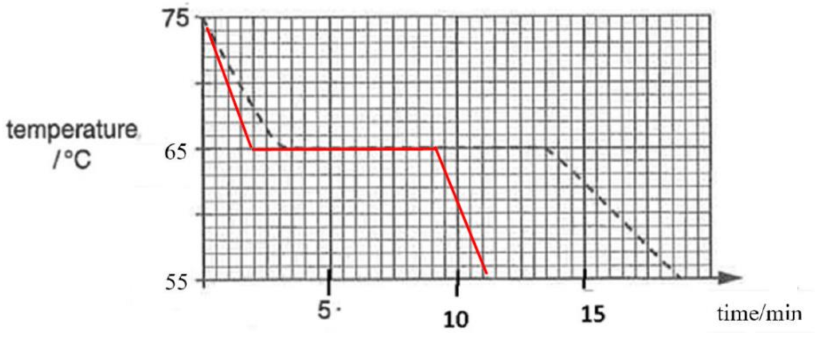
	b	The ammeter reading decreases. [A1] As the overall resistance increases.	
6	**(a)** **(i)**	2 V across 0.9 MΩ 4 V across the voltmeter will be twice the resistance according to potential divider principle, [C1] total resistance across points X and Y = 0.9 × 2 = 1.8 MΩ [A1]	
	(ii)	Resistance across the thermistor, R 1/1.8= 1/R+ 1/5.2 [M1] R = 2.75 MΩ From Fig. 6.1, the temperature of the thermistor = 22.0 °C [A1]	
	(b)	It is not accurate. It’s response is non-linear at high temperatures. It has a limited temperature range. It is self-heating. It Is fragile. Any one.	[1]
7	(a)	 2 arrow correct – 1 mark	
	(b)		

		 1 mark – each curve at correct position	
	(c)	When a motor is rotated, there is a change in magnetic flux linked to the coil. This induces an emf and a current in the coil. Therefore, the motor can become a generator. [1]	
8	a	Comparing the voltages of primary coil to secondary coil: Step down ratio = 3 300 : 220 = 15 : 1 [C1] Hence the coils must be step down to the same ratio of 15 : 1 Comparing the turn ratio i.e Coil M : Coil K [A1] = 1 500 : 100 = 15 : 1	
	b	Input power = 100 / 75 x 15 kW = 20 kW [M1] I = P / V = 20 000 / 3 300 = 6.1 A [A1]	
	c	Feature [1] Explanation [1] (Any one)	

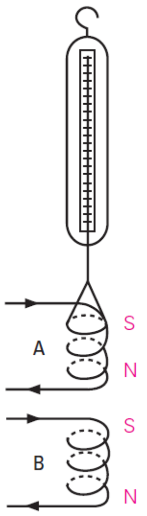
		Laminating the iron core reduces the eddy currents / power loss due to heat produced by induced current in the core itself. Using low resistance (primary and secondary) coils will minimize the amount of heat produced in the coils. To increase the magnetic flux linkage between the primary and secondary coils by using a soft magnetic material (iron core) to link	
	9(ai)	${}^{24}_{11}Na \longrightarrow {}^{24}_{12}Mg + {}^{0}_{-1}e$ [A1]	
	9(aii)	A half-life of a radioactive nuclide is the time taken for half the nuclei of the nuclide in any sample to decay. [A1]	
	9(aiii)	1 $N_o \longrightarrow$ 0.5 N_o Takes 15 hours [A1]	
	9(aiv)	Measure thickness of thin materials in the industry. Find leaks in pipes, Treatment of thyroid disorder/ leukemia/liver and brain tumours Locate obstructions to the flow of blood. [Any one]	
	9(bi)	Background radiation refers to nuclear radiation in an environment where no radioactive source has been deliberately introduced. [A1]	
	9(b)(ii)	780 counts/min $\longrightarrow$ 390 counts/min $\longrightarrow$ 195 counts/min [M1] Add background count: 195 + 20 = 215 counts / min [A1]	
	9(b)(iii)	780 counts/min $\longrightarrow$ 390 counts/min $\longrightarrow$ 195 counts/min $\longrightarrow$ 97.5 counts /min [M1] Add background count: 97.5 + 20 = 117.5 = 118 counts/ min Total time = 5 + 5 +5 = 15 min [A1]	
	9(biv)	So that the amount remaining in the body is low after a few days and non-target organs will not be harmed. [A1]	

10	**a**	Water is used as a coolant because of its very high specific heat capacity. [B1] It can take in a large amount of thermal energy with only a small rise in its temperature. [B1]
	bi	Thermal energy required to be removed as claimed by manufacturer = (0.8 x 5.0 X 10^7) x 80%

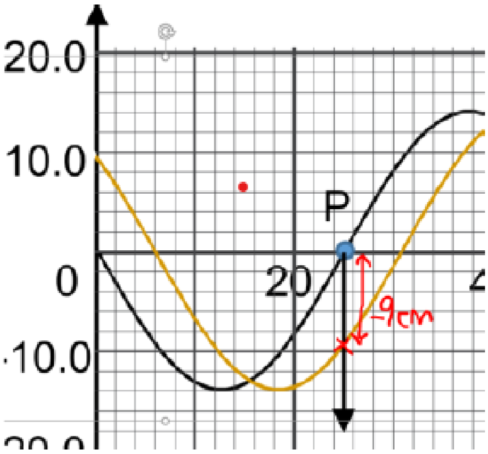
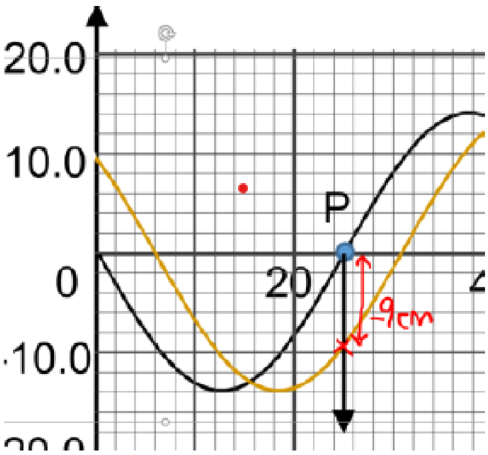
		$= 3.2 \times 10^7$ J [1]
	ii	Actual amount of thermal energy removed $Q = mc\Delta\Theta$ $= (0.22 \times 4 \times 60)(4200)(80-30)$ $= 1.1088 \times 10^7$ J $= 1.1 \times 10^7$ J [1]
	iii	Some thermal energy is lost to the surroundings, apart from it being absorbed by the cooling water. [1]
	c	Metal pipes are used as they <u>are good conductors of heat</u> [1] and allows heat to be conducted faster away from the hot water to the external wall of the pipe. The metal pipes being <u>coloured in black are good emitters of radiation</u> [1] and therefore radiates heat to the surrounding air at a higher rate. Using <u>narrow pipes increase the surface area</u> [1] to facilitate a higher rate of emission of heat to the surrounding air.
	d	Energy absorbed by air = 1.1088×10^7 J (allow for e.c.f.) $(1.25 \times 4 \times 60)(760)(\Theta - 20) = 1.1088 \times 10^7$ J [M1] $\Theta = 68.6\ ^{o}C$ Or $69\ ^{o}C$ [A1]
11	**(a)**	The thermal energy in the liquid is transferred to the surroundings through radiation in the form of <u>infra-red radiation</u>. [1]. Thermal energy is also transferred to the surroundings <u>through conduction</u>, where particles in the can nearest to the liquid will gain energy from the liquid, vibrate faster, collide and pass on energy to the neighbouring particles. [1]
	(b)	Initial rate of fall in temp = (75 – 65) / 3.0 (accept t = 3.0 - 3.5 s) $= 3.3^{o}C$ / min [1]
	(c)	average energy lost by the liquid per minute $= (mc\triangle\phi) / t$ $= 50 \times 4.2 \times 3.33$ [1] = 700 J/min [1]
	(d)	Liquid is solidifying. Thermal energy is released as the particles move closer together. The PE decreases and this energy is lost to the surroundings. [1] Since the average kinetic energy of the molecules remains unchanged, temperature is constant. [1]

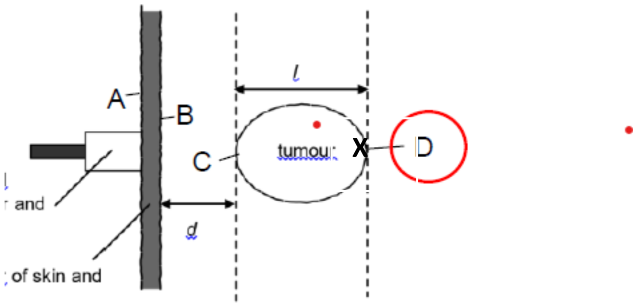
		Or Thermal energy is released as intermolecular bonds are formed between the liquid molecules, and this thermal energy is lost to the surroundings. Since the average kinetic energy of the molecules remains unchanged, temperature is constant. [1]
	(e)	 **1st and last section: steeper line** **Middle portion: shorter line.**
	(f)	Can B (dull black) is a better emitter of radiation than can A, and this increases the rate of heat loss to the surrounding by radiation, hence rate of temperature fall for can B is greater.

12(ai) Show operating current of fan = 1.25 A P = VI I = P / V = 300 / 240 = 1.25 A Show operating current of heater = 10.4 A P = V/I I = 2500 / 240 = 10.4 I Total current = 1.25 + 10.41 = 11.66 A [1]

The 11 A Fuse will blow under normal operating condition because the total current exceeds the fuse rating. [1] (only award if there is calculation)
12(aii) The fuse is wrongly connected to the neutral wire. A fuse should be connected to the live wire. [1] The earth wire is wrongly connected to the heater coil . The earth wire should be connected to the metal casing of the heater coil (must mention the heater coil) [1]
12(bi)  All poles correct - [1]
12(bii) They will attract each other. [1]
12(biii) The reading on the spring balance will increase. [1]
12(biv) The effect is still an attraction and the reading of the spring balance will increase. [1]
12b (v) When the switch is opened, the ends of the coil of A and B which are facing each other will be of <u>opposite poles and still attract each other</u>. [1] When the switch is opened, the current is cut off and the magnetic fields diminish. When the magnetic fields withdraw from the other coil, the polarity of the magnetic fields will be such as to attract each other. This is according to Lenz's Law. [1]

Or

13(a) (i)	wavelength = 50 cm [1]	
13(a) (ii)	$v = f\lambda$ $= (2.0) \times 50$ $= 100$ cm/s [1] d = s x t = 100 x 0.06 = 6.0 cm [1]	
13(a) (iii)	 Sketch for the first 1 ½ cycle. The rest of the wave is repeated. [1] full ecf based on student answer from (ii)	
13(a) (iv)	-9.0 cm (-7 to 11 cm) [1] full ecf based on student answer from (ii) 	

13(b) (i)	To ensure that no air is trapped between transmitter and skin, otherwise nearly all the transmitted pulse will be reflected at the surface of the skin. [1]	
13(b) (ii)	*[1] for correct marking of X.* 	
13(b) (iii)	Pulse take 275 – 100 = 175 μs to travel 2*l* $2\,l = s \times t = 1.5 \times 10^3 \times 175 \times 10^{-6}$ [1] l = 0.131 m [1]	
13(b) (iv)	Ultrasound is non-ionising, hence it not dangerous compared to using X-rays as it doesn't damage human cells. [1]	