NAME:		( )	CLASS:	

YISHUN TOWN SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SEC 4 EXPRESS

PHYSICS

(6091/2)

DATE : 21 August **DAY : Wednesday**

DURATION: 1 hr 45 min **MARKS: 80 marks**

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number in the spaces provided at the top of this page.

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

Section B
Answer **one** question. Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

Candidates are reminded that all quantitative answers should include appropriate units.

You may use an approved calculator.

Section A	/70
Section B	/10
TOTAL	/80

This question paper consists of **25** printed pages.

Section A

Answer **all** questions.

1 Belle attends a body toning course. At the end of the course, the trainer measures the circumference of Belle's arm and it decreases from 35 cm to 28 cm.

(a) State the name of the measuring instrument used by the trainer.

.....[1]

(b) By modelling the arm as a simple cylinder that is 18 cm long, calculate the amount of volume lost through the training.

volume lost = ...[1]

(c) The density of fat is approximately 0.90 kg/m^3. Assuming the mass lost are all from fat, calculate the mass lost through the training in kg.

mass lost = ...kg [2]

2 Fig 2.1 shows the cross-sectional view of a simple DC motor. When current passes through the wires, they begin to spin along the dotted line about the axle of the motor.

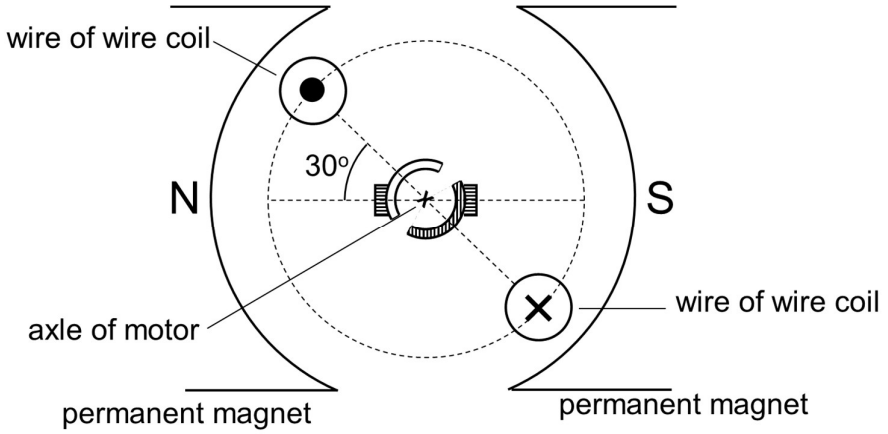


Fig 2.1

The diameter of the dotted circle is 12 cm.

(a) On Fig 2.1, draw and label the force acting on each wire and label them as F. [1]

(b) When the wire coil is at 30° from the horizontal, the moment generated by the motor is 7.2 Nm. Calculate the amount of force F acting on each wire.

F = ...[2]

(c) Explain why F is induced on the wire when a current flows through the wire.

.....

.....

.....[2]

(d) When the wire coil is at the vertical position, there is no moment about the axle. Explain why the wire coil would spin pass this position without any moment.

.....

.....[1]

3 In some electrical scooters, dynamos are installed to recharge its battery pack. Fig 3.1 shows how the dynamo is turned by the front wheel of the scooter as it turns the drive wheel of the dynamo.

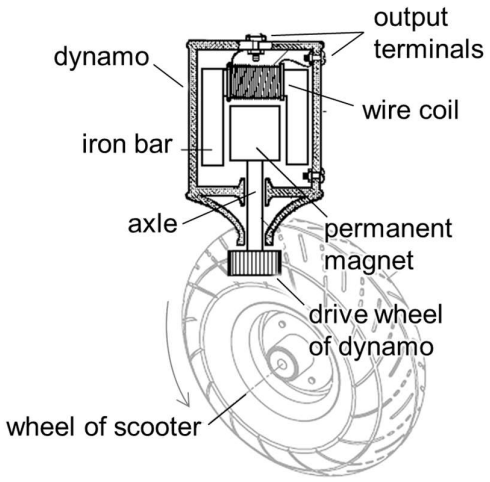


Fig 3.1

(a) Describe the stages of energy transfer and conversion from the spinning front wheel of the scooter to the energy store in the battery.

.....

.....

.....[2]

(b) Explain how an EMF is induced across the dynamo when the wheel of the scooter turns the driving wheel of the dynamo.

.....

.....

.....

.....

.....[3]

(c) Fig 3.2 shows a rider recharging his scooter by going down a slope from rest.

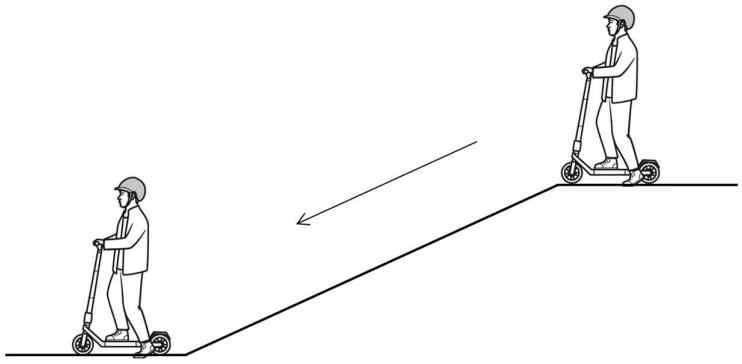


Fig 3.2

At the top of the slope the gravitational potential energy (GPE) store of the rider and scooter is 4.2 kJ. At the bottom of the slope, the kinetic energy (KE) store in them is 360 J. The effect of air resistance acting on them is negligible.

(i) Determine the work done on the dynamo.

work done = ...[1]

(ii) The battery of the scooter is marked "*energy capacity, 0.35 kWh*". Calculate the minimum number of times the rider needs to go down the slope to fully charge the battery from 0 kWh.

number of times = ...[2]

4 Fig 4.1 shows a gas canister. Since the canister is pressurised, it can store gas, such as methane, in liquid form at room temperature.

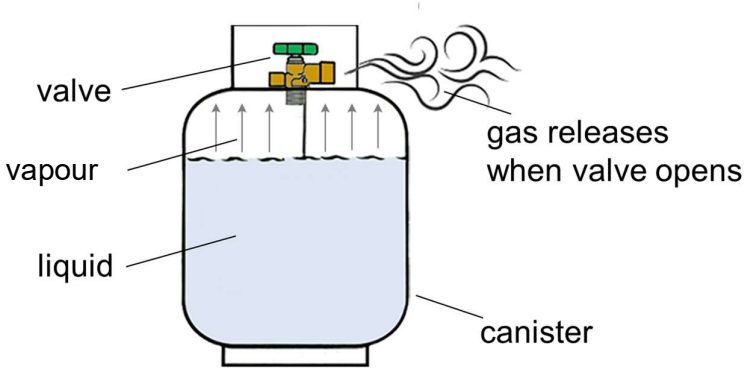


Fig 4.1

When the valve is opened, pressure in the canister drops and the liquid boils. The vapourised liquid then leaves the canister through the valve.

(a) Explain how by pressuring the canister, the gas can remain in its liquid form at room temperature.

.....

.....

.....[2]

(b) Explain, using the kinetic model of matter, why the pressure in the canister would rise with temperature.

.....

.....

.....

.....

.....[2]

5 Fig 5.1 shows four features insulating a house to reduce thermal energy loss and reduce fuel costs in winter.

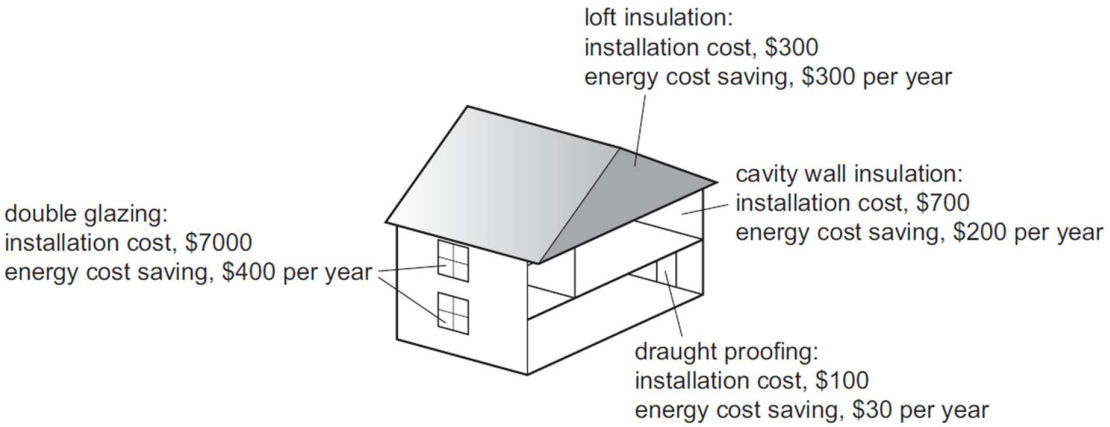


Fig 5.1

(a) Explain how a double glazed window insulates the house during winter.

.....

.....

.....

.....[2]

(b) **(i)** Explain how painting the roof black helps to keep the house warm in the day during winter.

.....

.....[1]

(ii) Describe a disadvantage, in terms of its effect on heat transfer, of a black coloured roof in winter.

.....

.....[1]

(c) Determine the thermal insulation feature that pays back the cost of installation in the shortest time.

.....[1]

6 Fig 6.1 shows a liquid-cooled heat sink. It is a device used to absorb heat from another device to keep it cool.

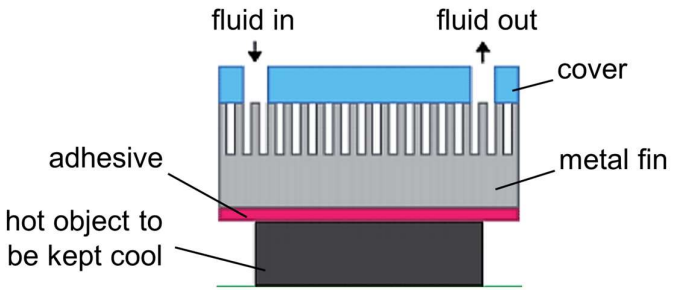


Fig 6.1

A good heat sink should absorb heat quickly while keeping the temperature rise of the heat sink small. Water is a fluid that is commonly used in liquid-cooled heat sinks.

(a) State the property of water that makes it a common fluid used in liquid-cooled heat sinks.

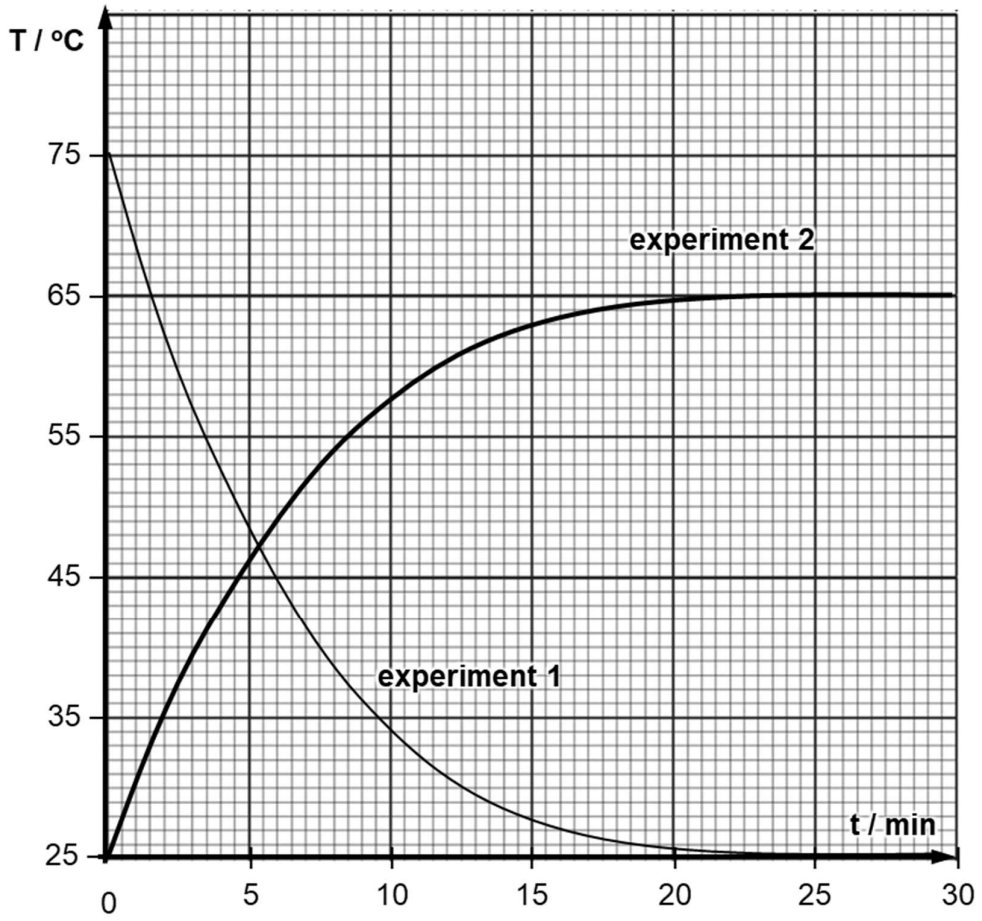
.....[1]

(b) Alex conducts two experiments to investigate how the temperature of water changes with time. Both experiments are conducted at atmospheric pressure and 0.40 kg of pure water is used in each experiment.

Experiment 1: he records the temperature as hot water at 75 °C cools to room temperature.

Experiment 2: he records the temperature of water as it gets heated up by a power supply.

He records his readings in the temperature – time graph on the next page. The specific heat capacity of water is 4200 J/kgK.



(i) Calculate the heat lost from hot water to the room as it cools to room temperature.

heat lost = ...[2]

(ii) Suggest a reason why the temperature remains constant in experiment 2 despite energy being continuously supplied.

.....

.....[1]

(iii) In a third experiment, Alex increases the power supply to 1200 W. The water reaches boiling point and boils off completely in 14 minutes. Assuming that all of the heat supplied is used to change the water from liquid to gaseous state, calculate the specific latent heat of vaporisation of water.

specific latent heat of vaporisation = ...[2]

7 Isaac Newton discovered that sunlight consists of a spectrum of colours by aiming a beam of sunlight at a prism as shown in Fig 7.1

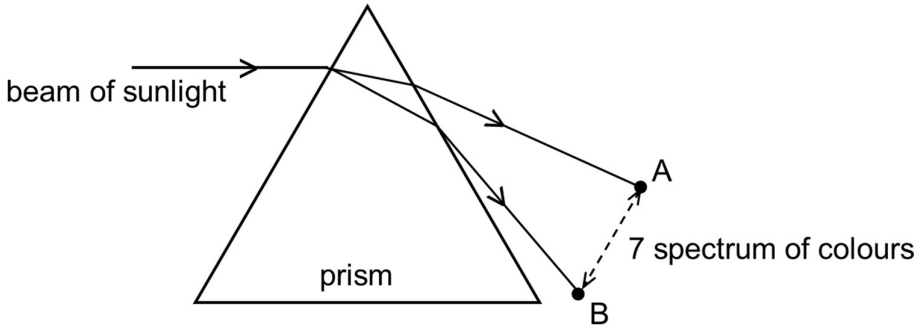


Fig 7.1

Another scientist, Fredrick Herschel, then extended on Newton's discovery and placed thermometers at the different bands of colours to investigate the rate of energy transfer by the different colours.

(a) State the colour at A and B.

A: ..... B: ..... [1]

(b) Herschel then placed another thermometer slightly beyond the band of colours in the spectrum, in a region where no sunlight is visible. To his surprise this region showed the highest temperature recorded.

Suggest an explanation for this observation.

.....

.....[1]

(c) Danny attempts to reproduce Newton's experiment and directed a beam of sunlight at a crystal equilateral triangular prism as shown in Fig 7.2

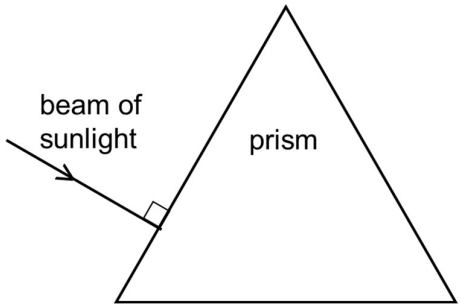


Fig 7.2
(not drawn to scale)

The refractive index of the crystal is 1.6.

(i) Calculate the critical angle of the prism.

critical angle = ...[1]

(ii) By completing the path of sunlight on Fig 7.2 until the beam emerges from the prism, state if Danny could reproduce Newton's results.

.....[2]

8 Two energy sources, a lit candle and a speaker playing a tone, are placed below the copper sheets. Thermocouples, measuring temperature, are connected to the sheets. Assume that the rate of energy emitted by the lit candle and the speaker are the same.

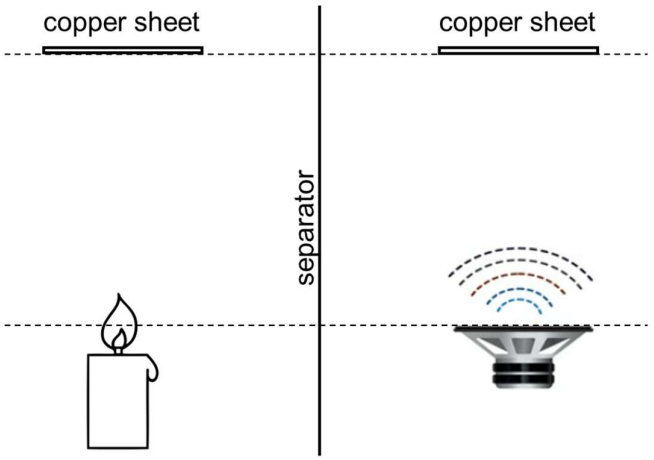


Fig 8.1

The thermocouples at both copper sheets show an increase in temperature, indicating that energy is transferred from both energy sources to the copper sheets.

(a) Explain why conduction cannot be the main method of heat transfer from the lit candle.

.....

.....

.....[2]

(b) 700 J of energy is supplied to the speaker but the energy absorbed by the copper sheet above it is only 52 J.

(i) Calculate the efficiency of the energy transfer.

efficiency = ...[1]

(ii) Suggest a reason why the efficiency of energy transfer from speaker to the copper sheet is so much lower than that between the candle and the copper sheet

.....[1]

9 A radioactive source Uranium-238 (U-238) goes through two stages of decay to Thorium-234 (Th-234) and then into Protactinium-234 (Pa-234). During these two stages of decay, Uranium-238 emits α-particles, β-particles and γ-radiation.

(a) State what is meant by radioactivity.

.....

.....

.....[1]

(b) State which type of radioactive emission produces the strongest ionising effect.

.....[1]

(c) Write the nuclide equations for the two stages of decay of U-238:

stage 1: U-238, $^{238}_{92}U$, decays to Th-234 and emits an Alpha particle and a unit of Gamma radiation.

stage 2: Th-234 decays to Pa-234 and emits a Beta particle and a unit of Gamma radiation.

stage 1: .....[1]

stage 2: .....[1]

(d) Fig 9.1 shows a GM counter used to measure the radioactivity of U-238.

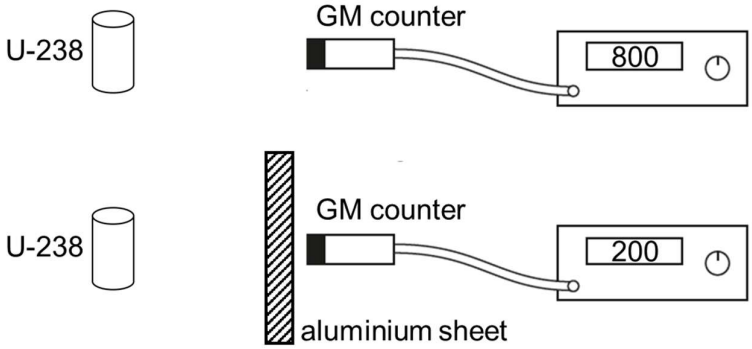


Fig 9.1

First, the counter is placed near the U-238 and it measures 800 counts/min. Then, a thick aluminium sheet is placed in between the counter and U-238. The counter measures 200 counts/min.

Suggest two reasons why this set up cannot prove that U-238 emits all three types of radioactive emissions during its decay.

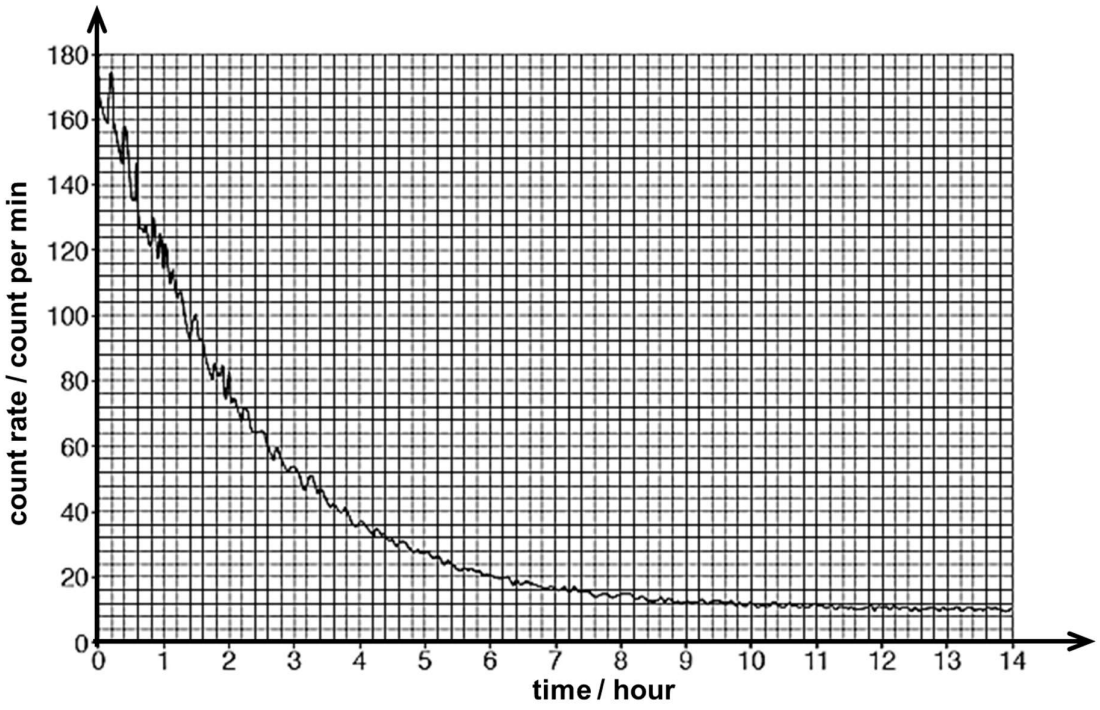
reason 1: .....

.....

reason 2: .....

.....[2]

10 The graph below shows the decay curve of a radioactive nuclide.



By sketching a best fit line on the graph above, determine the half-life of the nuclide. Show your working clearly with statements.

half-life = ...[2]

11 In 1849, French scientist Armand Fizeau came up with an experiment to measure the speed of light on Earth. Fig 11.1 shows a simplified Fizeau's experiment. Instead of using a lens to focus light from a light source, a laser is used instead. The partial mirror in Fig 11.1 is a special mirror that allows most of the incoming light to pass through and only reflect some of the light away.

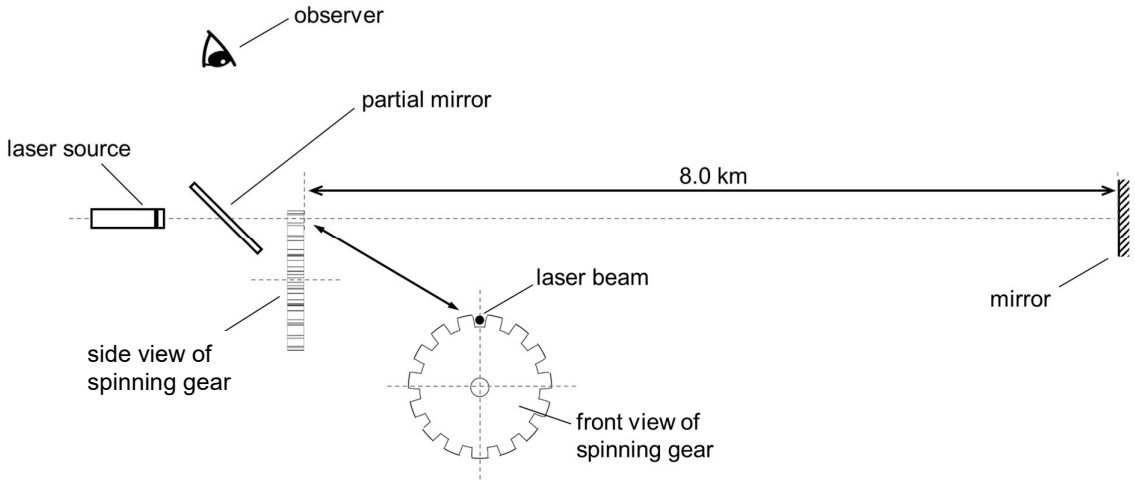


Fig 11.1

A spinning gear is placed in front of the laser so that the laser beam can pass through the gaps while the tooth of the gear will block the path of the beam.

When the laser is switched on, the laser beam can pass through one of the gaps of the gear and reaches the mirror 8.0 km away from the gear as shown in Fig 11.2.

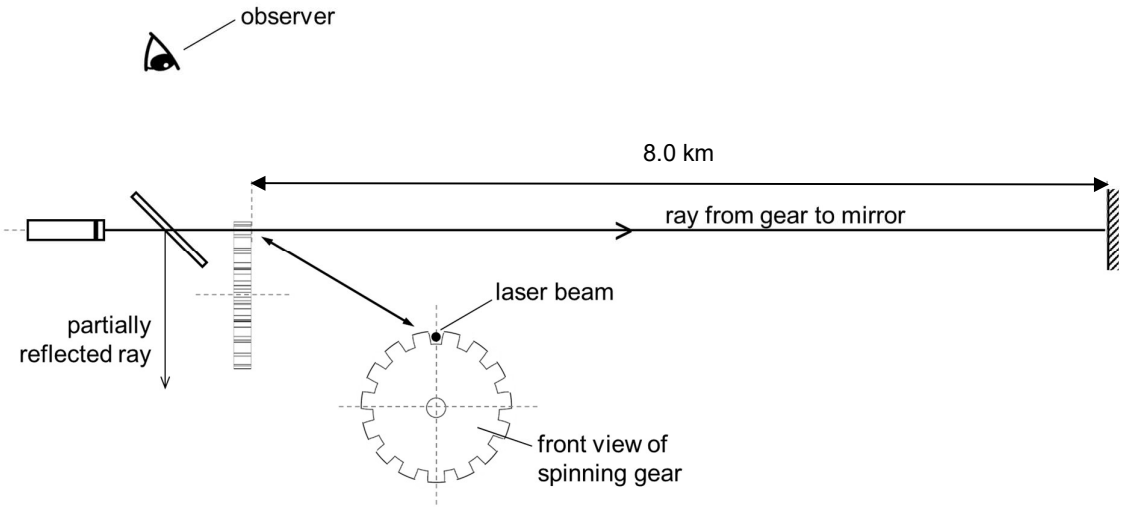


Fig 11.2

When the gear is spinning at low speed, the reflected beam will pass through the same gap that the beam passed through even if the gear is already spinning. As a result, the reflected beam can be observed by the scientist as shown in Fig 11.3.

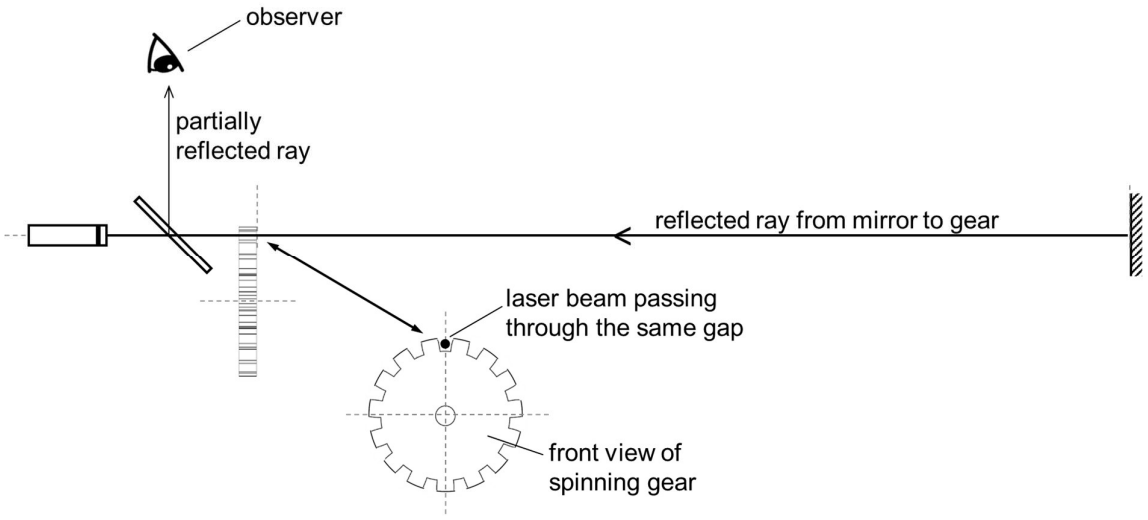


Fig 11.3

By increasing the spinning speed of the gear, the reflected beam can be blocked by the teeth adjacent to the gap that the outgoing beam passed through. As a result, the reflected beam cannot be observed by the scientist as shown in Fig 11.4.

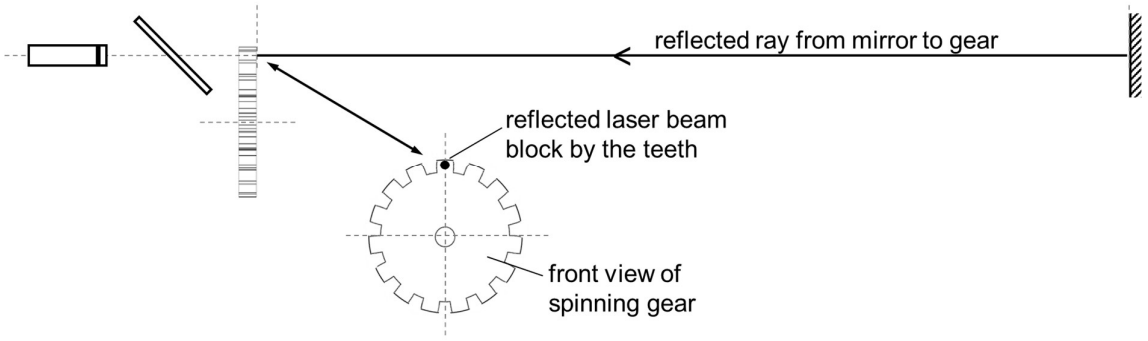


Fig 11.4

By adjusting the speed of the spinning gear so that the reflected beam is first blocked by the teeth of the gear, we can determine the speed of light using the data as shown in Table 11.5

Number of teeth on the gear	720
Spinning speed of the gear that blocks the reflected beam	13 revolutions / second
Distance between gear and mirror	8.0 km

Table 11.5

(a) Prove, with clear statements and working, that the time taken for the gear to move from the center of a gap to the center of its adjacent teeth is 5.34188×10^{-5} s.

[2]

(b) Let the speed of light be c. Write an expression, in terms of c, for the time taken for the laser beam to travel from gear to mirror and back to the gear.

c = ...[2]

(c) Hence, using your answers in **(a)** and **(b)**, determine the speed of light. Leave your answer to 5 significant figures.

speed of light = ...[2]

(d) To date, the speed of light is measured to be 2.9979 x 10^8 m/s. Calculate the percentage deviation from your answer in **(c)**.

percentage deviation = ...[1]

(e) A student wants to improve the set up in Fig 11.1. She installs a Light Dependent Resistor (LDR) at where the eye symbol is. The LDR is connected to a potential divider as shown in Fig 11.6.

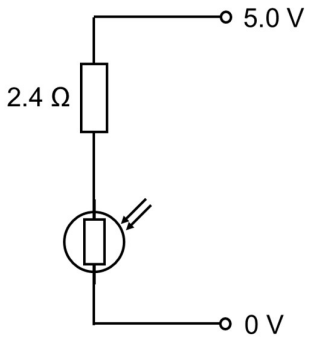


Fig 11.6

The resistance of the LDR is 12.0 Ω and 6.0 Ω under different lighting conditions.

(i) Add and connect a voltmeter to Fig 11.6 so that when the beam of laser **does not** reach the LDR, the voltmeter will measure a lower reading. [1]

(ii) Hence, calculate the voltmeter reading when the laser is blocked by the teeth of the gear.

voltmeter reading = ...[2]

12 Fig 12.1 shows a sportsman doing a high jump. As he jumps, he exerts a force F_P on the floor as he pushes his legs downwards against the floor. F_P is measured to be 1220 N.

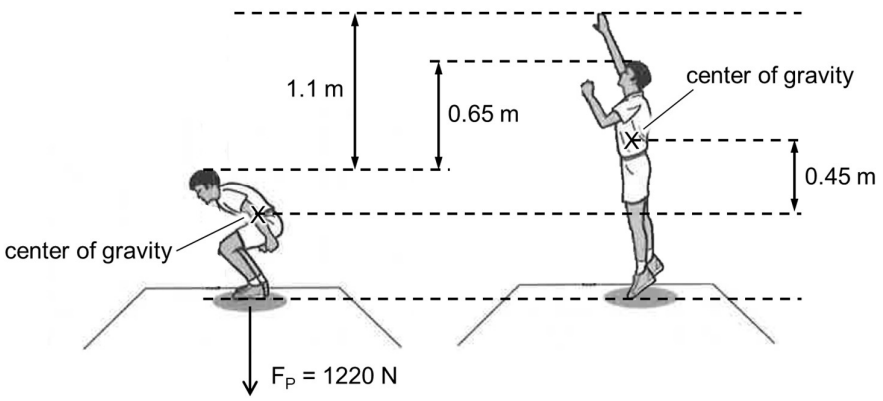


Fig 12.1

(a) Complete the **two** statements about the reaction force of F_P, which is the force responsible for launching the sportsman upwards. [2]

The reaction force of F_P has a magnitude of ..... N and is in the

..... direction.

This reaction force is exerted on the ..... by the .....

(b) The sportsman has a mass of 65 kg. Apply Newton's Laws and calculate the acceleration of the sportsman when his feet is about to leave the ground.

acceleration = ...[2]

(c) As the sportsman exerts F_P on the floor, his body straightens up. Calculate the work done by the sportsman.

work done = ...[1]

(d) Hence, calculate the maximum change in height the sportsman is able to reach.

maximum change in height = ...[1]

(e) Sketch on Fig 12.2, the velocity – time graph of the sportsman from the instance his feet leaves the ground to the instance he reaches the maximum height. Label this line **(e)**. The effect of air resistance is negligible. You need **not** show the value of the initial velocity and the time when he reaches the maximum height on your sketch. [2]

Fig 12.2

(f) Sketch on Fig 12.2, the velocity – time graph of the sportsman if the effect of air resistance is included. Label this line **(f).** [2]

Section B

Answer **one** question from this section.

13 Fig 13.1 shows a simplified electricity transmission system.

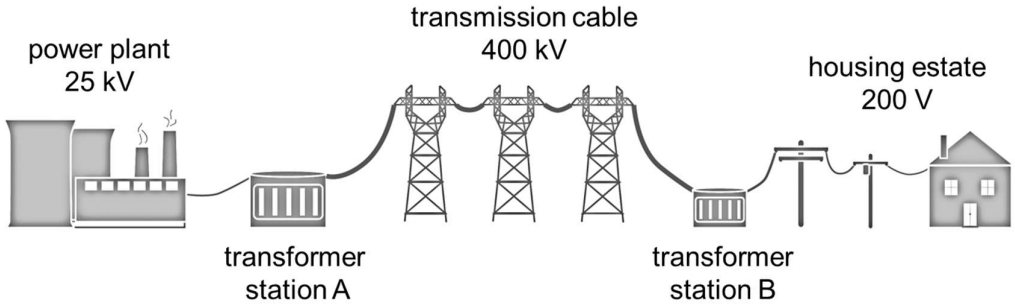


Fig 13.1

Assume that both transformers shown in Fig 13.1 are ideal transformers.

(a) Explain what is meant by “ideal transformers”.

.....

.....[1]

(b) Calculate the turn ratio of the step-up transformer.

turn ratio = ...[1]

(c) Explain why there is less power lost when electrical power is transmitted at high voltage.

.....

.....

.....[2]

(d) To check if there is any damage to the insulation at the site where the transmission cables are connected to the step-up transformer, workers will probe the surrounding area with a long metal rod. The metal rod has pointed ends and is connected to an earth wire. As the high voltage cables are charged, a spark forms between the cables and the pointed end of the rod if the insulation of the cable has worn off.

(i) Explain why sparks form when the pointed end of the metal rod is brought near to the exposed high voltage cables.

.....

.....

.....

.....[2]

(ii) Explain how the earth wire connected to the metal rod protects the workers.

.....

.....

.....

.....[1]

(e) Fig 13.2 shows a part of the main electrical circuit in a house.

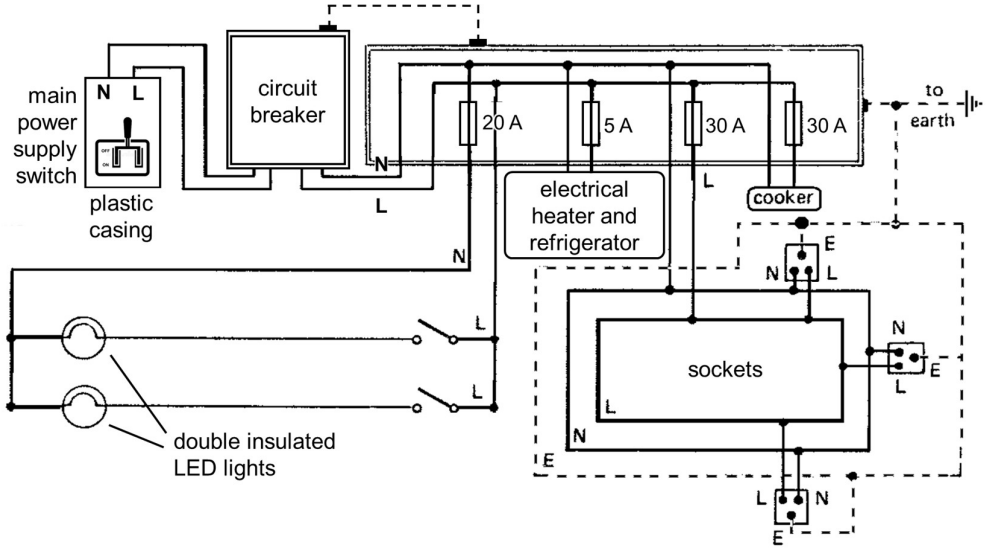


Fig 13.2

(i) Calculate the maximum current that can flow through the circuit breaker and suggest a rating for the circuit breaker.

maximum current = ...[1]

rating = ...[1]

(ii) Identify and describe one error in Fig 13.2 that makes the circuit unsafe.

.....

.....[1]

14 Fig 14.1 shows a circuit with three identical 10 Ω resistors: E, F and G, and a 20 Ω ohmic light bulb.

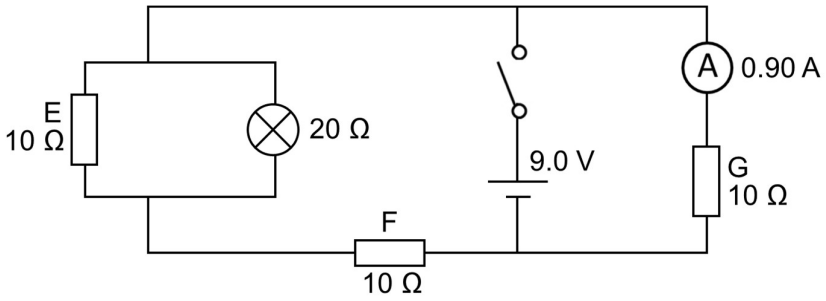


Fig 14.1

When the switch is closed, the ammeter reads 0.90 A.

(a) An ohmic conductor follows Ohm's Law. State Ohm's Law.

.....

.....

.....[2]

(b) Calculate the effective resistance of the circuit.

effective resistance = ...[2]

(c) Hence, calculate the current flowing through the battery.

current = ...[1]

(d) Calculate the electrical energy emitted by the bulb per second.

electrical energy per second = ...[3]

(e) In order to control the brightness of the bulb, Timmy replaces one of the resistors with a rheostat that has a range of 10 – 20 Ω.

(i) Identify the resistor to be replaced so that when the resistance of the rheostat is increased, the bulb becomes dimmer.

.....[1]

(ii) Explain how your answer in **(i)** dims the bulb when the resistance of the rheostat increases. You may use the space given to show calculations that supports your explanation.

.....

.....

.....[1]

		Answer	Remarks

Ques	Ans		Ques	Ans		Ques	Ans		Ques	Ans
1	A		**11**	B		**21**	B		**31**	B
2	C		**12**	B		**22**	C		**32**	A
3	D		**13**	C		**23**	A		**33**	B
4	D		**14**	A		**24**	A		**34**	B
5	B		**15**	B		**25**	A		**35**	D
6	D		**16**	C		**26**	B		**36**	D
7	C		**17**	A		**27**	C		**37**	B
8	C		**18**	B		**28**	D		**38**	B
9	A		**19**	C		**29**	A		**39**	C
10	C		**20**	A		**30**	B		**40**	D

To award for answers based on intermediate working so long physics concept shown is correct / logical

-1 max for sf (whole paper)
-1 max for unit (whole paper)

1 (a) Measuring Tape **[1]**

(b) $\pi\left(0.5\left(\frac{35}{\pi}\right)\right)^2(18)-\pi\left(0.5\left(\frac{28}{\pi}\right)\right)^2(18)=631.69$

`

Ans = 630 cm^3 [1]

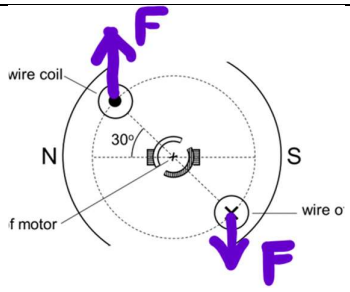
(c) **[1]** for converting cm^3 to m^3.
EITHER 631.69 cm^3 = **6.31686 x 10^{-4} m^3 [1]**
OR 0.9 kg/m3 = **9.0 x 10^{-7} kg/cm^3 [1]**

working mark [1] for multiplying volume to density

[1] for getting answer
Ans = 5.69 x 10^{-4} kg [1]

Condone truncation error

2 (a)



Max minus [1] for any of the following
- Arrow does not start from the wires
- Label F is missing

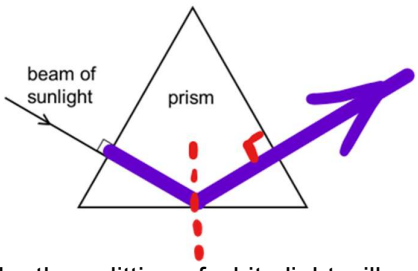
(b) Perpendicular distance = $6\cos(30)$
= **5.196 cm [1]**

Working mark [1] if length not converted to meter

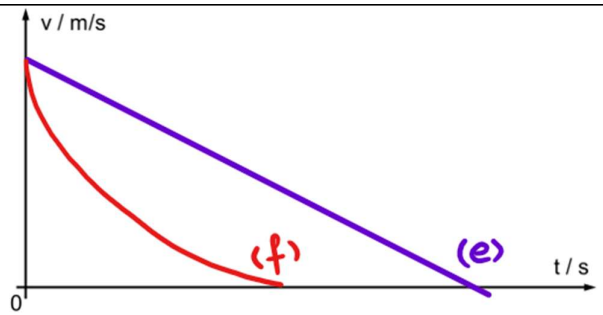
$7.2 = 2F \times d$
Total **M = 69 N [1]**

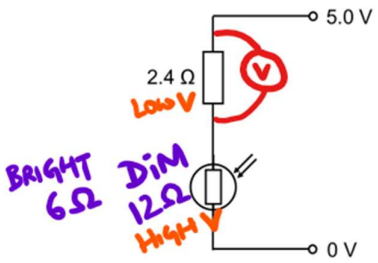
		Answer	Remarks
	(c)	A **M-field is induced** around the **wire when a current** flows through.	**[1]**
		This **M-field interacts with the M-field of the permanent magnets**, and induces F on the wires.	**[1]**
	(d)	The wire coil is **already turning**, the **inertia** of the wire coil will cause it to continue to **turn (spin) in the same direction** in the absence of a net-moment. Also accept reasonable answers with regard's to Newton's first law or to do with momemtum	**[1]**
3	**(a)**	**Kinetic energy store** of the **scooter wheel** is **transfer** to the **drive wheel of the dynamo** via **work done**.	Award **[1]** for any of these three points
		The **kinetic energy store** of the **dynamo drive wheel** is **transfer** to the **battery** via **electrical energy**	Award **[2]** if all three points are stated
		This energy is then **converted into chemical potential energy store** of the battery.	Can also generally accept KE → KE of dynamo → CPE but phrased properly
	(b)	When the driving wheel turns, **the permanent magnet turns**.	**[1]**
		The **wire coil** will **experience** a **changing M-flux linking to the (spinning) magnet**.	**[1]**
		By **Faraday's Law**, an **EMF will be induced** across the wire coil.	**[1]**
	(c)	**(i)** GPE = KE + WD on dynamo WD = **3840 J [1]**	
		(ii) **[1]** for changing kWh to J 0.35 kWh = **1 260 000 J [1]**	
		1 260 000 / 3840 = 328.125 Ans = **329 times [1]**	Allow 1 mark max for not coverting kWh to J
4	**(a)**	When pressure is higher than the P_{ATM}, **more energy is needed to overcome the intermolecular forces between the molecules**.	**[1]**
		Hence, the liquid will only **boil at higher temperature**.	**[1]**
	(b)	At higher T, **molecules will move faster** (**or gain energy**).	Award **[1]** for any of these three points

		Answer	Remarks
		Hence, the **collision force and frequency between molecules and canister wall** will **increase**.	Award **[2]** if all three points are stated
		By **P = F/A**, **F increases** and **A is constant**, **P increases**.	
5	**(a)**	Double glaze window **traps air in between its two layers of glass**.	**[1]**
		Since **air is a poor conductor**, it slows down heat lost (from the house to the outside)	**[1]**
	(bi)	Black surfaces are **good absorbers** (of radiation) and **speeds up heat gain from the sun to the roof** via **radiation**.	**[1]**
	(bii)	At night, the black roof would **speed up heat lost from the roof (house) to the surrounding** via **radiation**	**[1]**
	(c)	Loft Insulation	**[1]**
6	**(a)**	Specific Heat Capacity (Heat capacity not accepted because it is not unique.)	**[1]**
	(b)	**(i)** $Q = mc\Delta\theta$ $Q = (0.40)(4200)(75-25)$ $Q = 84000J$	**[1]** for identifying the T-change **[1]** for Ans
		(ii) The rate of energy supply is balanced by the rate of heat lost.	**[1]**
		(iii)	**[1]** for Pt **[1]** for Ans

		Answer	Remarks
		$L_V = ml_V$ $Pt = (0.40)l_V$ $(1200)(14\times 60) = (0.40)l_V$ $l_V = 2.5\times 10^6 J/kg$	
7	**(a)**	**A:** Red **B:** Purple (Violet)	**[1]** or **[0]**
	(b)	The region is under **infra-red radiation**. The wave that **transfer heat most effectively**.	**[1]**
	(c)	$\sin c = \frac{1}{n}$ $c = 38.68$ **Ans = 39°**	**[1]**
	(d)	 No, the splitting of white light will not happen.	**[1]** for correct ray diagram with arrows **[1]** for conclusion 0 or 2 marks Must be correct for both points
8	**(a)**	Air is a poor conductor of heat	**[1]**
		As air particles are much further apart and hence, eat transfer via conduction is much more inefficient. OR	**[1]**

		Answer	Remarks
		(explains using convection should be the main mode of heat transfer due to density changes and bulk movement of air)	
	(b)	**(i)** **Ans = <u>7.4%</u> [1]**	
		(ii) Sound wave **<u>travels (transfer energy) in all directions</u>** but convection current **(transfer energy upwards) <u>rises only</u>**.	**[1]**
9	**(a)**	Radioactivity refers to the **<u>spontaneous decay</u>** of **<u>unstable nucleus</u>**. It involves **<u>emission of waves, or subatomic particles or both</u>**.	**[1]**
	(b)	Alpha Emission	**[1]**
	(c)	$^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}\alpha + \gamma$	**[1]**
		$^{234}_{90}Th \rightarrow {}^{234}_{91}Pa + {}^{0}_{-1}\beta + \gamma$	**[1]**
	(d)	#1: The **<u>200 count/min</u>** could **<u>only be background radiation</u>**.	**[1]**
		#2: One could not deduce if the **<u>additional 600 count/min is from Alpha emission only, or Beta emission only, or both</u>**.	**[1]**
10		Good best fit curve **[1]**	
		BG radiation count = 12 Time = 1.4, Reading = 100, Actual Count = 88 Actual Count = 44, Reading = 56, Time = 2.8 **Ans = <u>1.4 h</u> [1]**	Mark according to best fit curve of student

		Answer	Remarks
12	**(a)**	1220, upwards **[1]** sportsman, floor **[1]**	
	(b)	$F_{NET} = ma$ $\text{sum of forces} = ma$ $\text{reaction to } F_P - W = ma$ $1220 - 650 = 65a$ $a = 8.769$ Ans = **8.8 m/s^{-2} [2]**	Working **[1]** for W = 650 N If used wrong net force of 1220 N only, award max 1 m
	(c)	WD = 1220 x 0.45 Ans = 550 J **[1]**	
	(d)	WD = mgh h = 0.85 m	
	(e) **(f)**		**(e)** [1] Constant negative gradient [1] From high V to 0 m/s **(f)** [1] time at v = 0 is earlier than (e) [1] decreasing gradient

		Answer	Remarks
11	**(a)**	Divide the gear into (720 + 720) parts. Time to complete one revolution = 1/13 sec. Time to move from gap to teeth = (1/13)÷1440 = **<u>5.34188 x 10^{-5} s</u>**	Working **[1]** for **EITHER** gettering time for 1 revolution = 1/13 s **OR** gear can be divided into 1440 parts
	(b)	Distance travelled = 8 + 8 km Time taken = **<u>16 000 / *c*</u>**	Working **[1]** for **EITHER** getting total D = 16 km **OR** getting 16/c (forget to convert km to m)
	(c)	**<u>2.9952 x 10^{8} m/s</u> [2]** (Minus 1 for not giving in 5SF, do not count towards 2SF errors)	Working **[1]** for equating (b) = (a) **NO ECF**
	(d)	**<u>0.090%</u> [1]**	
	(e)		
		$V_{voltmeter} = 5 \times \frac{2.4}{2.4+12}$ $V_{voltmeter} = 0.83V$	Award max 1m if used 2.4 + 6 instead of 2.4 + 12

		Answer	Remarks
13	**(a)**	It means that the transmission of power from pri to sec coil is 100%.	Do not accept "no energy lost." Accept "no energy lost during transfer between pri and sec coil"
	(b)	Ans = **16** **[1]**	Accept 16:1 or 16/1 No 1:16, 1/16
	(c)	When power is transmited at high V, then **current is low**	**[1]**
		By **$P = I^2R$**, the power lost **in cables** will be low.	**[1]**
	(d)	**(i)** The high voltage cable will **induce an opposite charge** at the pointy end.	**[1]**
		The charges will **concentrate at the pointy end** and produce a **strong E-field**. (This enables a spark to form between the pointy end and the exposed cable.)	**[1]**
		(ii) The earth wire has a very **low resistance** (relative to the man). Hence, the **current will not flow through the man** (but instead flow through the earth wire.)	**[1]**
	(e)	**(i)** Max I = 85 A Rating = Accept 86 – 90 A (whole numbers only)	 **[1]** **[1]**
		(ii)	**[1]**

		Answer	Remarks
		EITHER the 20A fuse is connected is connected to the neutral wire (instead of the live wire) **OR** the 5A fuse rating is too low to support devices that draws larger current like heater and refrigerator (or air con)	
14	**(a)**	PD directly proportional to I…	**[1]**
		… when physical conditions are kept constant.	**[1]**
	(b)	$\left(\frac{1}{10}+\frac{1}{20}\right)^{-1}=\frac{20}{3}$ $\frac{20}{3}+10=\frac{50}{3}$ $\left(\frac{1}{\frac{50}{3}}+\frac{1}{10}\right)^{-1}=6.25$ Ans = **<u>6.3 Ω</u> [2]**	**Working** [1] for any one correct step
	(c)	Ans = **<u>1.4 A</u> [1]**	**1.44 A if used 6.25 ohm**
	(d)	Current through F = 1.4 – 0.90 = 0.5 A PD across F = (0.5)(10) = 5.0 V or 5.4 V PD across bulb = 9 – 5 = 4.0 V or 3.6 V Power of Bulb = $(4^2)/20$ = 0.80 W or 0.65 W **[3]**	Working **[1]** for any of these. (or any other correct calculation of the V, I or R values obtained by student) (except PD across G) If final answer is wrong, max **[2]**.

		Answer	Remarks
	(e)	**(i)** F	
		(ii) When R of F increases, PD across F increases. This will lead to lower PD across bulb. By applying $P = V^2/R$ to bulb, P of bulb decreases.	Award **[1]** only if articulation of explanation is clear and sequential