O

JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
Secondary 4 Express

STUDENT NAME			
CLASS		INDEX NUMBER	

PHYSICS 6091/01

Paper 1 Multiple Choice **13 August 2024**

Additional Materials: Multiple Choice Answer Sheet **1 hour**

READ THESE INSTRUCTIONS FIRST

Do not open this booklet until you are told to do so.

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, index number and class in the spaces at the top of this page.

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 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.

Take acceleration due to gravity on Earth, g, to be 10 m/s^2 unless stated otherwise.

For Examiner's Use
40

Setter: Mr Lam Seng Tat

This document consists of **16** printed pages.

1 Which is the unit for specific heat capacity in base units?

A kg m / s^2 K

B m^2 / s^2 kg K

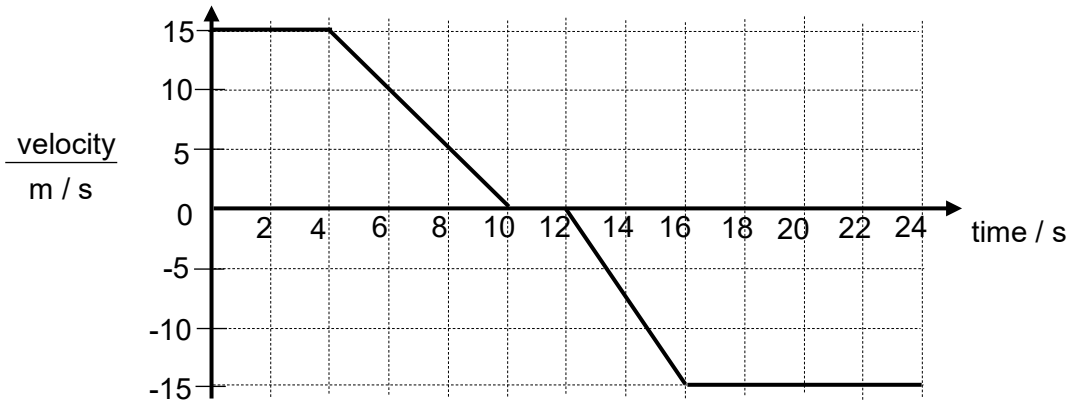
C m / s^2 K

D m^2 / s^2 K

2 Which row shows the correct order of magnitude for diameter of a typical atom and diameter of Earth?

	diameter of typical atom	diameter of Earth
A	0.01 nm	1 Mm
B	1 nm	1000 Mm
C	0.001 μm	0.1 Gm
D	0.000 1 μm	0.01 Gm

3 The diagram shows the velocity-time graph of an object.



Which statement is **incorrect**?

A The average speed of the object is 10.6 m/s.

B The displacement of the object is -45 m.

C The object decelerated at 2.5 m/s^2 to rest.

D The total distance travelled by the object is 250 m.

4 The motion of an object is represented by the displacement-time and velocity-time graph.

Which statement describes the motion of the object?

A The object is moving from decreasing acceleration to constant acceleration.

B The object is moving from decreasing acceleration to constant velocity.

C The object is moving from increased acceleration to constant acceleration.

D The object is moving from increased acceleration to constant velocity.

5 The diagram shows the spacecraft OSIRIS-REx. It collected rock samples from the asteroid Bennu and returned the samples to Earth for analysis.

NAS

Spacecraft OSIRIS-REx

NAS

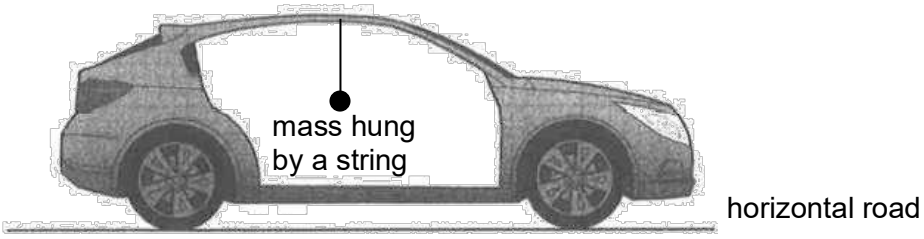
Asteroid Bennu

Bennu has a surface gravity of 6.27 x 10^{-6} times that of Earth. A mass of 121.6 g sample of rocks was returned to Earth.

What is the weight of the sample taken from Bennu given that the gravitational field strength on Earth is 9.81 N/kg?

	weight of sample on Bennu / N	weight of sample on Earth / N
A	7.48 x 10^{-6}	1.19
B	7.48 x 10^{-3}	1190
C	7.62 x 10^{-7}	1.19
D	7.62 x 10^{-4}	1190

6 The diagram shows a mass hanging freely from a string suspended inside a car.



What would happen to the mass hung by a string in the car if the car was moving forward towards the right at constant speed and at constant acceleration?

	car moving forward at constant speed	car moving forward at constant acceleration
A	mass remain vertical	mass swing to left side of the vertical
B	mass remain vertical	mass swing to right side of the vertical
C	mass swing to left side of the vertical	mass swing to left side of the vertical
D	mass swing to right side of the vertical	mass swing to right side of the vertical

7 Two objects of the same size and shape, but one with greater mass, were dropped from rest in air.

Why does the object with the greater mass have higher terminal velocity?

A The object with the greater mass would take a longer time to reach terminal velocity since less air resistance is required to balance the heavier weight.

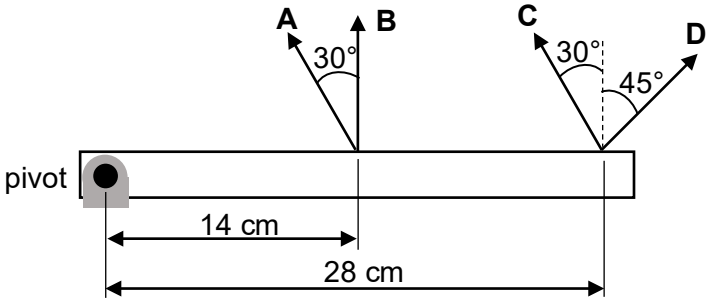
B The object with the greater mass would take a longer time to reach terminal velocity since more air resistance is required to balance the heavier weight.

C The object with the greater mass would take a shorter time to reach terminal velocity since less air resistance is required to balance the heavier weight.

D The object with the greater mass would take a shorter time to reach terminal velocity since more air resistance is required to balance the heavier weight.

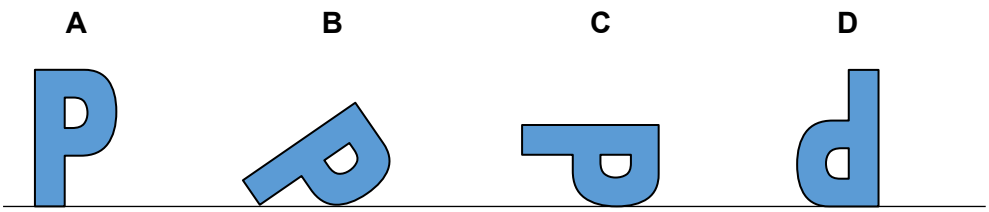
8 The diagram shows a 30 cm long uniform steel bar pivot at its left end. The steel bar can rotate about freely about the pivot. Four pulling forces (**A**, **B**, **C** and **D**) are applied to rotate the steel bar about the pivot.

Which force will rotate the bar with the **least** amount of force?



9 The diagram shows four positions of an object shape of letter 'P'.

Which position would object be the most stable?



10 A bottle contains 500 cm^3 of a liquid. The density of the liquid is 1500 kg/m^3.

What is the mass of the liquid?

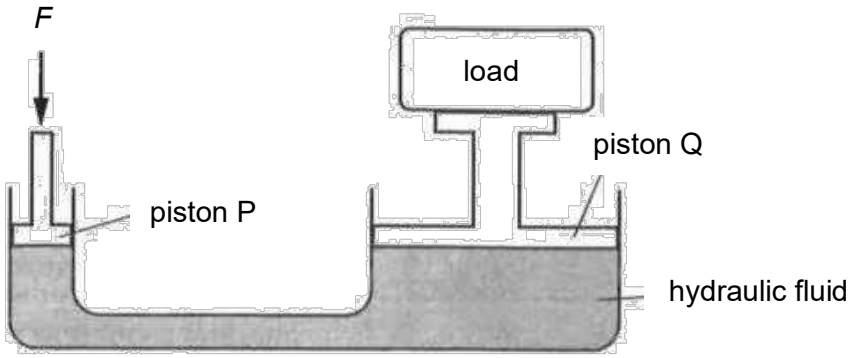
A 300 g

B 750 g

C 3 kg

D 750 kg

11 A hydraulic jack is used to lift a load of 2000 N by applying a force *F* to piston P.

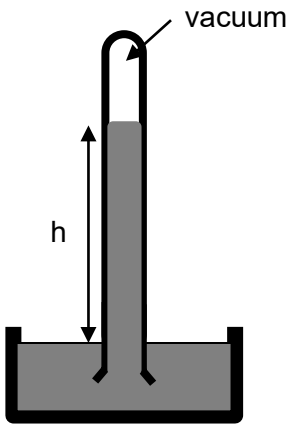


The cross-sectional area of piston P is 300 cm^2.

Which row shows the correct applied force *F* and cross-sectional area of piston Q?

	applied force *F* / N	cross-sectional area of piston Q / cm^2
A	300	1200
B	300	1500
C	500	1200
D	500	1500

12 The diagram shows a barometer. A scientist used it to measure the atmospheric pressure as he climbed a tall mountain.



Which statement is correct?

A The mercury column height h decreases as atmospheric pressure decreases at higher height of the mountain.

B The mercury column height h decreases as atmospheric pressure increases at higher height of the mountain.

C The mercury column height h increases as atmospheric pressure decreases at higher height of the mountain.

D The mercury column height h increases as atmospheric pressure increases at higher height of the mountain.

13 A car is travelling at a constant speed of 90 km/h with a forward force of 4000 N.

What is the work done by the forward force for each kilometre travelled?

A 100 kJ

B 360 kJ

C 800 kJ

D 4000 kJ

14 A 70 kg man walks at a speed of 2 m/s. He then started running at 5 m/s.

What is his increase in kinetic energy?

A 105 J

B 315 J

C 735 J

D 1015 J

15 A gas in a fixed volume container is heated.

Which statement explaining why pressure of the gas increases is **incorrect**?

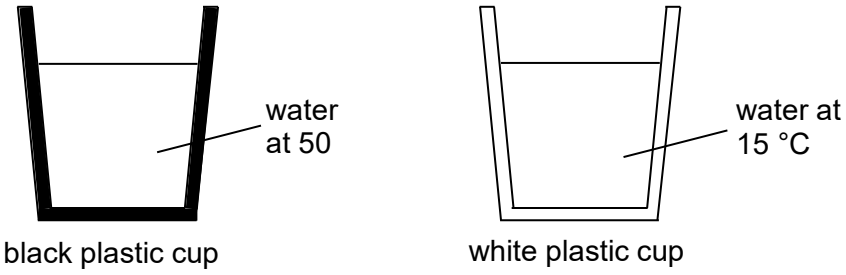
A Pressure of the gas increases as the force acting on the container walls increases.

B Pressure of the gas increases as the space between the gas particles decreases.

C Pressure of the gas increases as the speed of gas particles increases.

D Pressure of the gas increases as there are more collisions of the gas particles on the walls of the container.

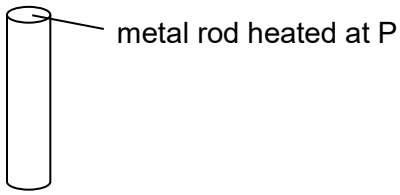
16 The diagram shows a black plastic cup containing water at 50 °C and a white plastic cup containing water at 15 °C.



What is the direction of energy transfer to the surrounding air if both cups are placed in a room at 30 °C?

	black plastic cup with water at 50 °C	white plastic cup with water at 15 °C
A	air to cup	air to cup
B	air to cup	cup to air
C	cup to air	air to cup
D	cup to air	cup to air

17 The diagram shows a metal rod. It is heated at P.



Which statement is correct?

A Metal rod at P becomes denser and heat is conducted downwards.

B Metal rod at P becomes denser and heat remains at P.

C Metal rod at P expands and heat is conducted downwards.

D Metal rod at P expands and heat remains at P.

18 Two bottles contains the same type of oil at 50 °C. Bottle X contains more oil than Bottle Y.

Which statement explains why oil in Bottle Y cools faster than Bottle X?

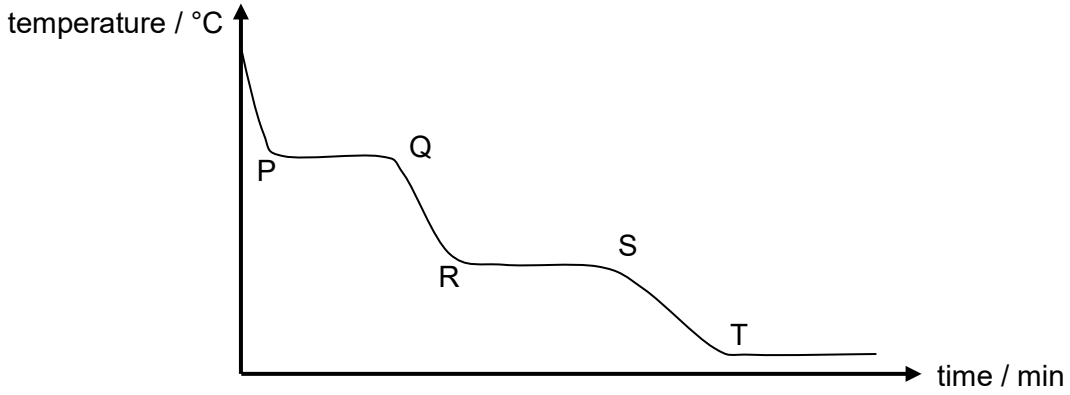
A Bottle Y has a higher heat capacity than Bottle X.

B Bottle Y has a higher specific heat capacity than Bottle Y.

C Bottle Y has a lower heat capacity than Bottle X.

D Bottle Y has a lower specific heat capacity than Bottle X.

19 The graph shows a cooling curve of a tank of a substance in its gaseous state cooled into its solid state.



Between which two points on the graph does the tank contain the substance in liquid state?

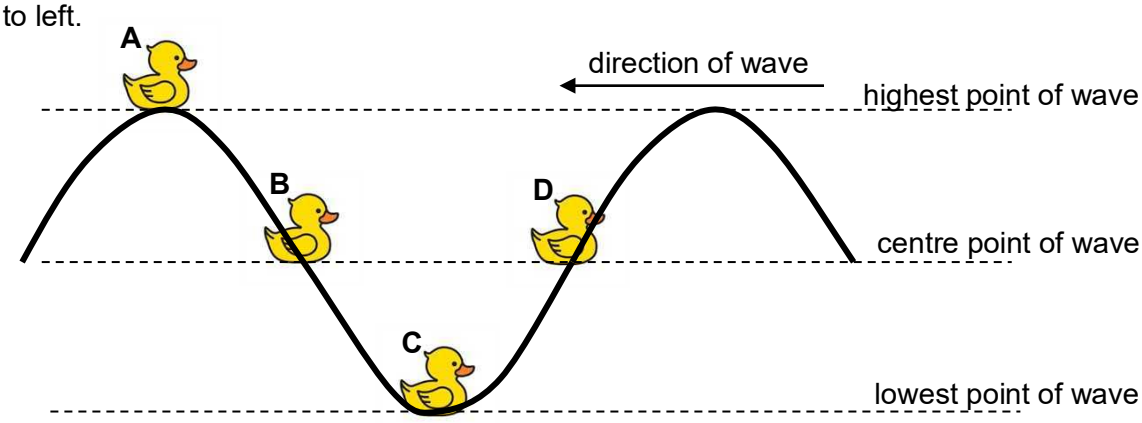
A P and Q

B Q and R

C R and S

D S and T

20 The diagram shows four toy ducks sitting on a pond. A wave moves across the pond from right to left.



Which toy duck would move upwards and then downwards during the next half cycle of the wave?

21 A ship sending ultrasound signals to detect fish found a large school of fish 200 m below the ship. The speed of sound in seawater is 1500 m/s.

How long did the ultrasound signal take to return to the ship after being transmitted?

A 0.067 s

B 0.13 s

C 0.20 s

D 0.27 s

22 Which statement about electromagnetic waves used in television communication and electromagnetic waves used to disinfect medical equipment is **correct**?

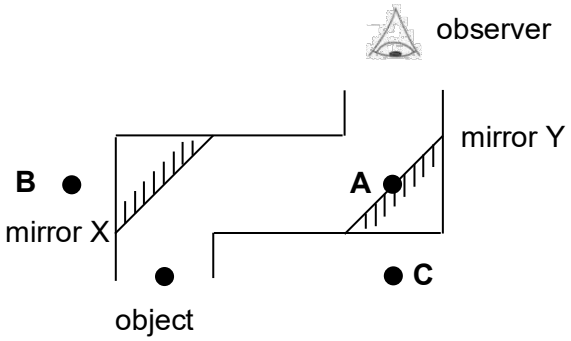
A Electromagnetic waves used in television communication has higher frequency than electromagnetic waves used to disinfect medical equipment.

B Electromagnetic waves used in television communication has higher wavelength than electromagnetic waves used to disinfect medical equipment.

C Electromagnetic waves used in television communication has higher energy than electromagnetic waves used to disinfect medical equipment.

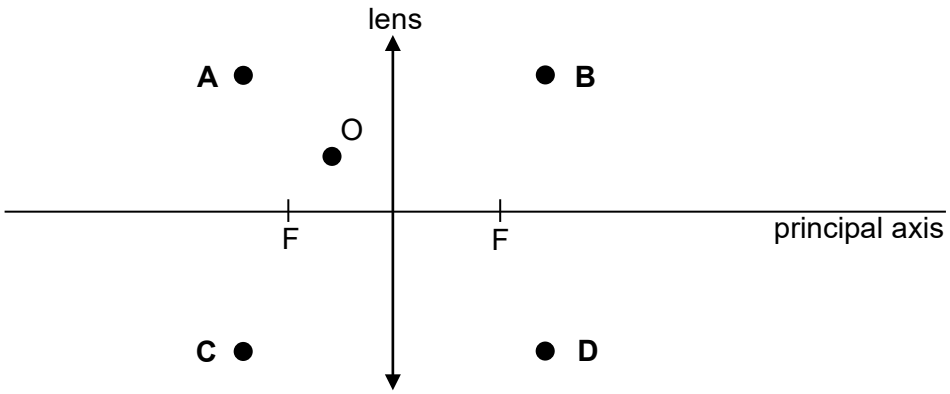
D Electromagnetic waves used in television communication has lower speed than electromagnetic waves used to disinfect medical equipment.

23 The diagram (drawn to scale) shows an object viewed using two mirrors.



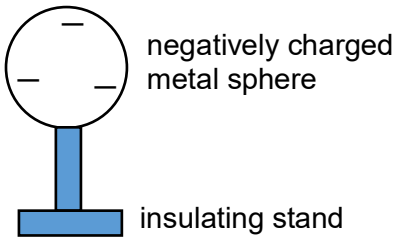
An observer looks into the mirrors as shown.
At which position is the image of the object seen?

24 The diagram (drawn to scale) shows an object O placed in front of a converging lens with its focal points F indicated.



Which is the position of the image of the object?

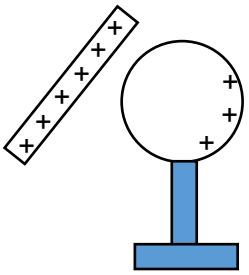
25 The diagram shows a negatively charged metal sphere placed on an insulating stand.



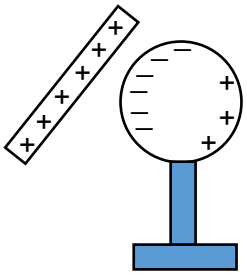
A positively charged rod is brought near to the metal sphere.

What diagram shows the charge distribution on the sphere?

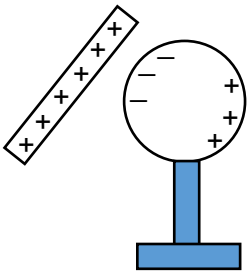
A



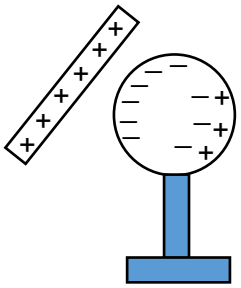
B



C

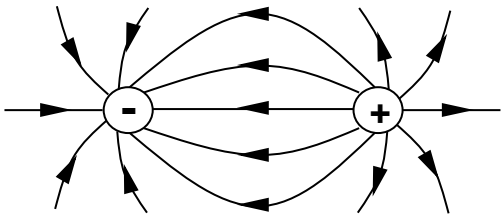


D

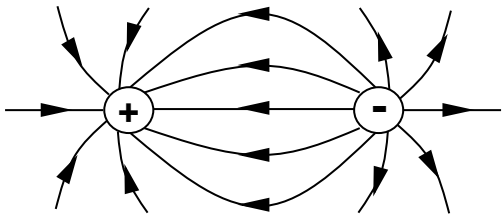


26 Which shows the correct electric field?

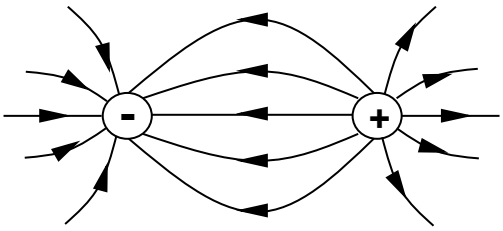
A



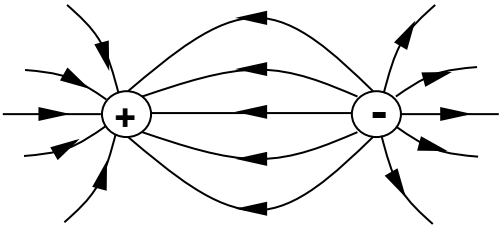
B



C



D



27 A heating element has a potential difference of 15 V when 120 C flows through it.

What is the electrical energy dissipated by the heater?

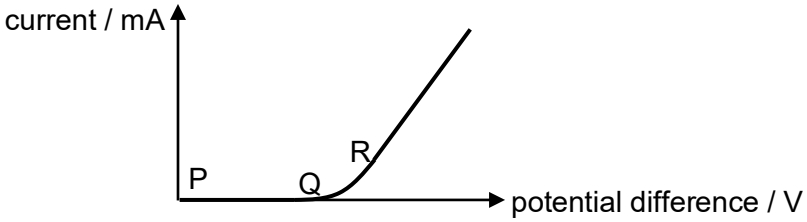
A 0.13 J

B 7.5 J

C 8.0 J

D 1800 J

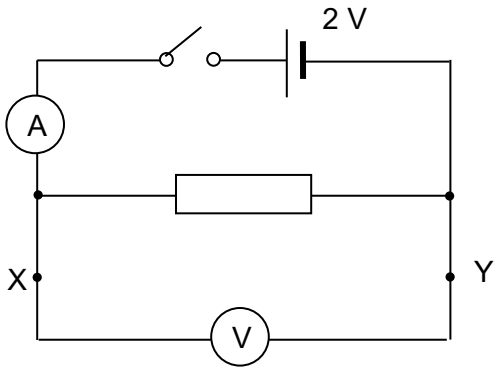
28 The graph shows the relationship between current and potential difference across a diode.



Which row describes the resistance of the diode?

	between P and Q	between Q and R
A	infinity	decreasing
B	infinity	increasing
C	zero	decreasing
D	zero	increasing

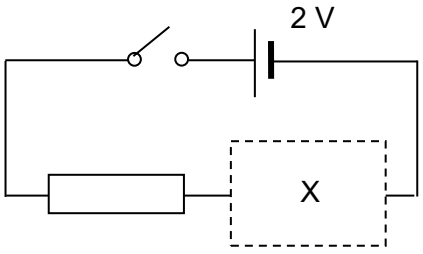
29 The diagram shows a fixed resistor connected to a 2 V cell and a switch. An ammeter and a voltmeter is connected to measure the current flow and potential difference across the resistor.



Which row describes the changes, if any, to the ammeter and voltmeter reading when a conducting wire is added between X and Y?

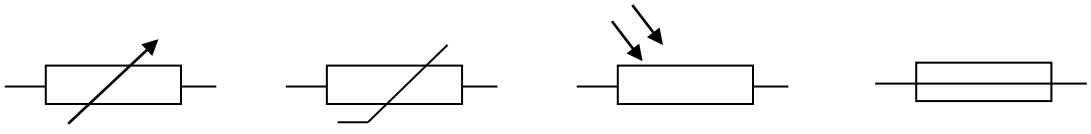
	ammeter	voltmeter
A	decrease	no change
B	decrease	zero
C	increase	no change
D	increase	zero

30 The diagram below shows a fixed resistor connected to a 2 V cell and a switch.

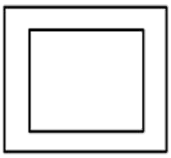


What component should be connected in series at X to the fixed resistor to vary the resistance of the circuit at varying lighting conditions?

A **B** **C** **D**



31 Which statement is **incorrect** for an appliance with the symbol shown?



A All appliances with the symbol do not require a fuse.

B All appliances with the symbol do not require an earth wire.

C All appliances with the symbol has an outer casing that is insulated.

D All appliances with the symbol has internal components insulated from the external casing.

32 An electrical heater requires 240 V supply and a 10 A fuse.

What would be a suitable resistance of the heater?

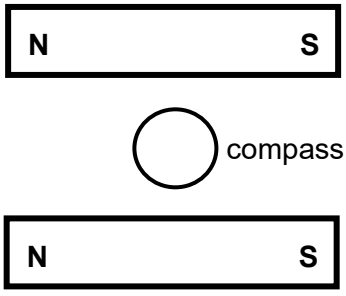
A 20 Ω

B 24 Ω

C 32 Ω

D 64 Ω

33 The diagram shows two identical magnets arranged in parallel to each other. A compass is placed between the two magnets.



What should be the direction of the needle of the compass?

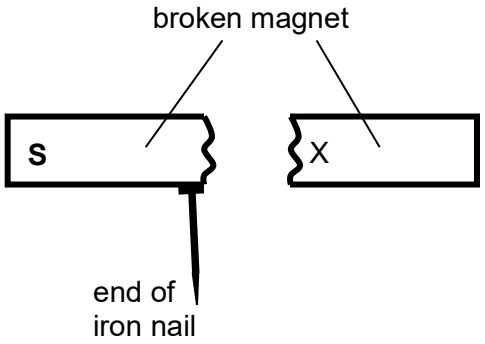
A 

B 

C 

D 

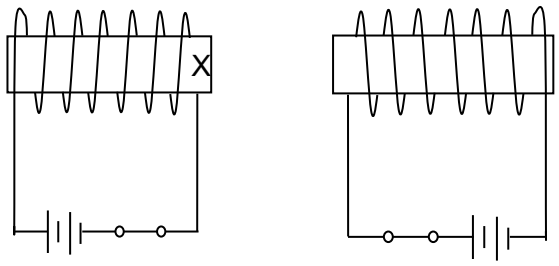
34 The diagram shows a bar magnet broken at its centre. An iron nail is placed at one end of the broken magnet.



Which row is correct?

	pole at end of iron nail	movement of end of iron nail
A	north	attracted to X
B	north	repelled from X
C	south	attracted to X
D	south	repelled from X

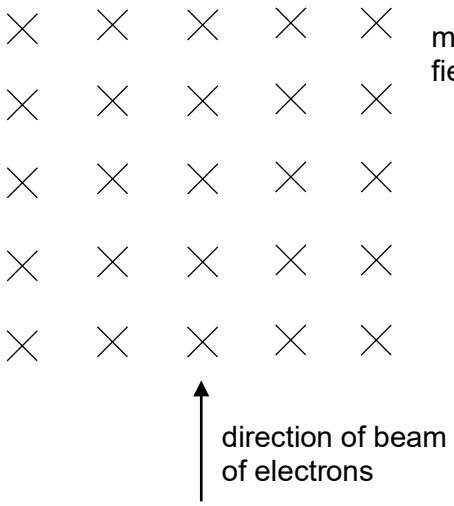
35 The diagram shows two iron bars magnetized by solenoids when current is switched on.



What is the magnetic pole at X and the movement of the two iron bars?

	pole at X	movement of iron bars
A	north	attract to each other
B	north	repel from each other
C	south	attract to each other
D	south	repel from each other

36 The diagram shows a beam of electrons entering a magnetic field.



Which statement describes the movement of the electrons as they enter the magnetic field?

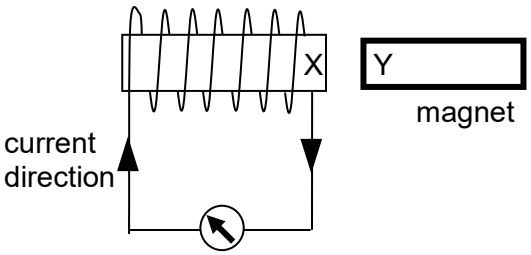
A The electrons are deflected into the paper.

B The electrons are deflected out of the paper.

C The electrons are deflected to the left.

D The electrons are deflected to the right.

37 The diagram shows an iron bar in a solenoid connected to a galvanometer. A permanent magnet is at the right of the solenoid.



Which direction of magnet movement and pole at end X and Y will cause current to flow and deflect the galvanometer needle as shown?

	movement of magnet	pole at X	pole at Y
A	away from the solenoid	south	south
B	towards the solenoid	south	south
C	away from the solenoid	north	north
D	towards the solenoid	north	north

38 What happens when a simple a.c. generator doubles the number of turns in its coil?

A The amplitude of induced e.m.f. is doubled and frequency does not change.

B The amplitude of induced e.m.f. is doubled and frequency is halved.

C The amplitude of induced e.m.f. is doubled and frequency is doubled.

D The amplitude of induced e.m.f. is halved and frequency does not change.

39 $^{35}_{17}Cl$ is a common isotope of chlorine.

What is the correct description of this isotope?

A The isotope has atomic number of 35.

B The isotope has 35 electrons.

C The isotope has 18 neutrons.

D The isotope has 18 protons.

40 Uranium (U) nucleus decays into Thorium (Th) nucleus with an alpha particle emitted.

Which is the correct nuclide equation for this decay?

A $^{238}_{92}U \longrightarrow {}^{234}_{94}Th + {}^{4}_{2}He$

B $^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}He$

C $^{238}_{92}U \longrightarrow {}^{237}_{93}Th + {}^{0}_{-1}e$

D $^{238}_{92}U \longrightarrow {}^{237}_{92}Th + {}^{0}_{-1}e$

End of Paper

O

JURONGVILLE SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2024
Secondary 4 Express

STUDENT NAME			
CLASS		INDEX NUMBER	

PHYSICS 6091/02

Paper 2 Theory **12 August 2024**

Candidates answer on the Question Paper. **1 hour 45 minutes**
No additional materials are required.

READ THESE INSTRUCTIONS FIRST
Do not open this booklet until you are told to do so.

Write your Name, Index number and Class in the spaces at the top of this page.
Write in dark blue or black ink.
You may use an HB soft pencil for any diagrams or graph.
Do not use staples, paper clips, glue or correction fluid.

Section A:
Answer **all** the questions in the spaces provided.

Section B:
Answer only **one** of the two questions from this section.

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 the 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 the brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	/ 70
Section B	/ 10
Total	/ 80

Setter: Mr Lam Seng Tat

This document consists of 18 printed pages.

Section A (70 marks)

Answer **all** the questions in this section.

1 A student releases a rubber ball from rest. It hits the ground with a velocity of +6.0 m/s. The acceleration due to gravity is 10.0 m/s^2.

(a) Calculate the time taken for the ball to hit the ground after the student drops it.

time taken = …….. [2]

(b) The ball bounced immediately without loss of energy. The ball reaches back to its original height before it was caught by the student.

On Fig. 1.1, draw the velocity-time graph for the ball. [2]

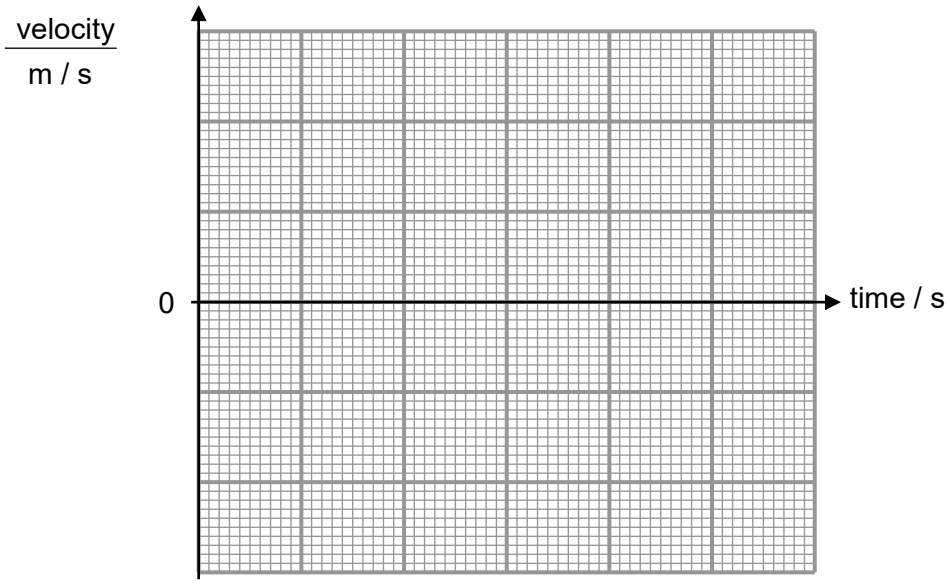


Fig. 1.1

(c) Calculate the height at which the rubber ball was released.

height = …….. [2]

[Total:6]

2 Fig. 2.1 shows a kite flown by a student. The kite has a weight of 5 N and is held in position by a string with tension of 40 N.

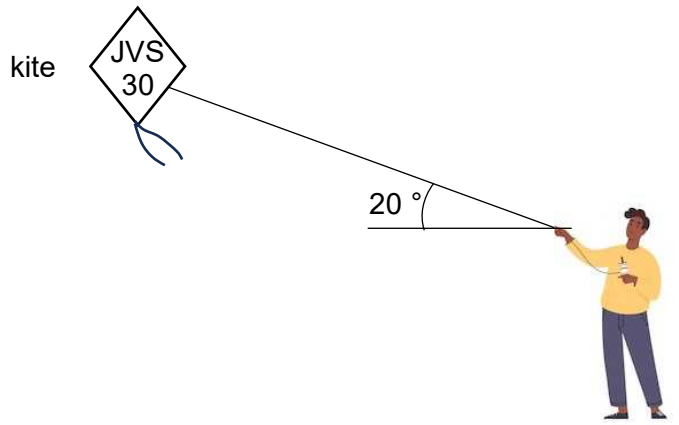


Fig. 2.1

(a) In the space below, draw a scaled and labelled diagram to determine the resultant force of the weight of the kite and the tension of the string acting on the kite. Determine the force due to the wind acting on the kite to keep the kite in position. [1]

magnitude of force due to wind = …….. [1]

direction of force due to wind = ……..…….. [1]

(b) Calculate the acceleration of the kite if the kite is allowed to fly in the direction of the wind force. Assume the same force due to wind as in **(a)** and take gravitational field strength to be 10 N/kg.

acceleration = …….. [2]

[Total:5]

3 Fig. 3.1 shows a 2 m uniform plank kept in a horizontal position by two supports, A and B. The plank has a weight of 24 N. A 76 N load is placed vertically above support B.

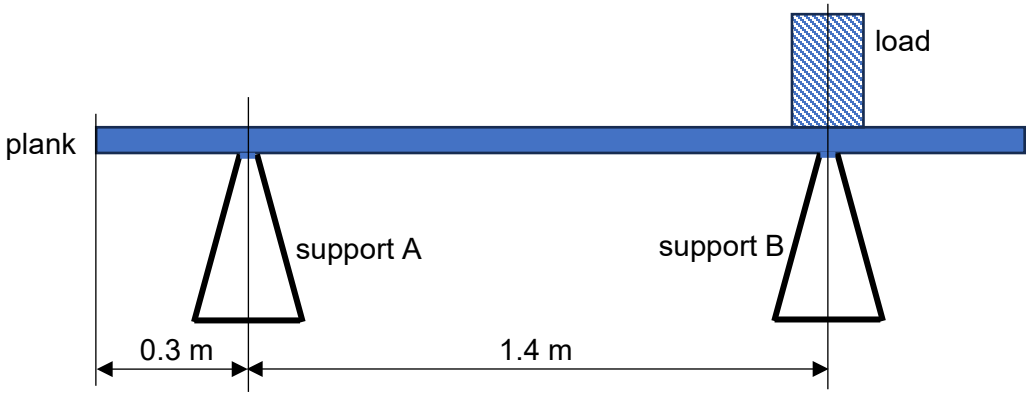


Fig. 3.1

(a) Explain why the load does not produce a moment about support B.

……

……

……[1]

(b) Calculate the force acting at support A when the load is placed vertically above support B.

force at support A = …….. [2]

(c) Calculate the maximum distance that the load can be moved to the right of support B such that the plank does not lift from support A.

distance moved = …….. [2]

[Total:5]

4 Fig. 4.1 shows a 29 kg gas cylinder placed on a horizontal floor. The gas cylinder exerts 2.3 kPa on the floor.

Fig. 4.1

(a) Define pressure.

……..

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

(b) Calculate the base area of the gas cylinder.

area = ……………………… [2]

(c) Fig. 4.2 shows a manometer used to measure the pressure inside the gas cylinder.

Calculate the pressure in the gas cylinder. The atmospheric pressure is 1.0 x 10^5 Pa. The density of mercury is 13 600 kg/m^3.

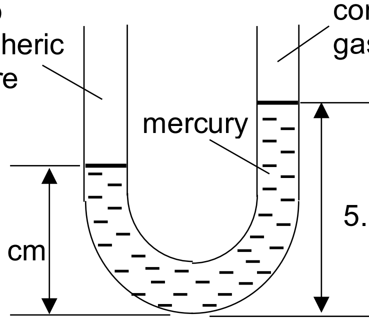


Fig. 4.2

pressure in gas cylinder = ……………………… [2]

[Total:5]

5 **(a)** Dust particles in an enclosed container were observed to move faster after some time.

Describe how this observation relates to the change in energy and temperature of the gas in the container.

……

……

……

……[2]

(b) Explain why an electric heater used to heat air in a room is placed on the floor.

……

……

……

……[2]

(c) Fig. 5.1 shows a steel pot used to boil water. The 1.2 kg pot contains 3.0 kg of water at 30 °C room temperature. Steel has a specific heat capacity of 445 J/kg K. Water has a specific heat capacity of 4200 J/kgK and specific latent heat of vaporisation of 2.3 x 10^6 J/kg.

Fig. 5.1

(i) Define specific latent heat of vaporisation.

……

……[1]

(ii) A 2000 W induction cooker is used to boil water. The steel pot reaches a temperature of 120 °C while water is boiling at 100 °C.

Calculate the time taken to boil 0.5 kg of water. Assume no energy loss to the surroundings.

time taken = …… [2]

[Total:7]

6 Fig. 6.1 shows a boy playing a violin.

Fig. 6.1

(a) Explain how sound from the violin is produced and transmitted.

……

……

……

……[2]

(b) Fig. 6.2 shows a representation of a violin note.

Sketch on Fig. 6.2 another note twice the pitch and twice the loudness. [2]

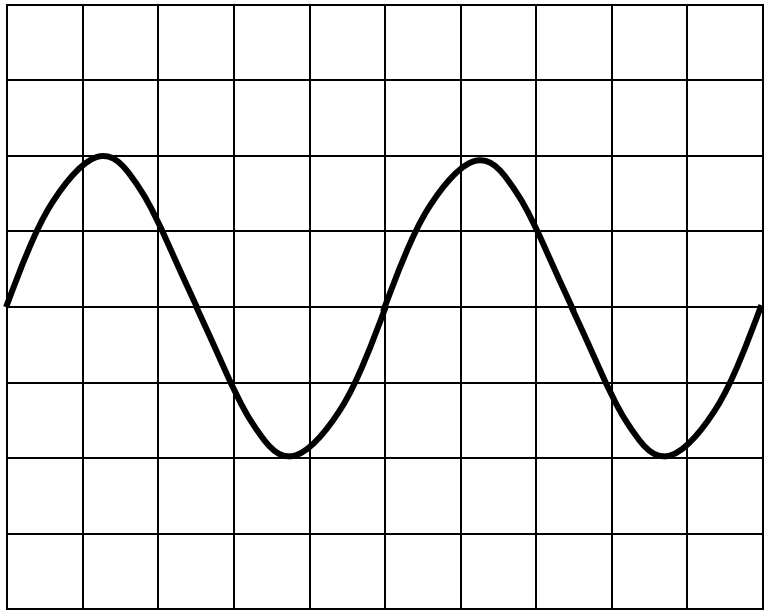


Fig. 6.2

(c) A violin note with wavelength of 1.2 m and period of 0.002 s is transmitted through a liquid.

Calculate the speed of sound in the liquid.

speed = …… [2]

[Total:6]

7 Fig. 7.1 shows a circuit diagram with two fixed resistors, a light-dependent resistor (LDR) and a thermistor connected in parallel with a 12 V battery. Table 7.2 shows the resistance of the LDR and thermistor in different situations.

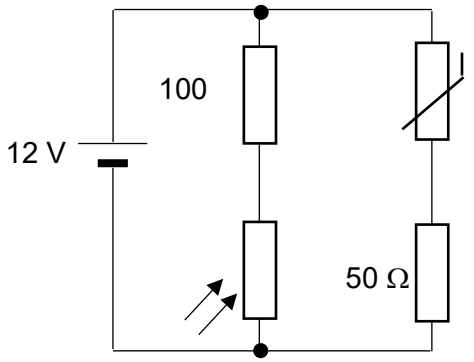


Fig. 7.1

Table 7.2

component	situation	resistance / Ω
light-dependent resistor (LDR)	bright	400
	dark	15 000
thermistor	hot	300
	cold	12 000

(a) Calculate the current flow in the battery when the circuit is in a dark and hot room.

current = …… [2]

(b) Without calculating, state the situation when the current flow in the battery is the largest. Explain your answer.

……

……

……

……

……[2]

(c) Calculate the potential difference across the LDR when the circuit is in a bright and cold room.

potential difference = …… [1]

(d) Explain why the potential difference across the LDR is the same as in **(c)** when the circuit is in a bright and hot room.

……

……[1]

[Total:6]

8 Fig. 8.1 shows an electric oven connected to the mains supply with a three-pin plug.

Fig. 8.1

(a) Explain why a three-pin plug is necessary to connect the electric oven to the main supply.

……

……

……

……

……[2]

(b) The plug has a fuse.
Explain the function of the fuse and how it is connected to the mains supply.

……

……

……

……

……[2]

(c) The electric oven is rated 800 W and the mains supply is 240 V.
Determine a suitable fuse for the oven. The available fuses are 1 A, 3 A, 5 A, 7 A, 10 A and 13 A.

fuse selected = …… [1]

[Total:5]

9 Fig. 9.1 shows the parts of a motor.

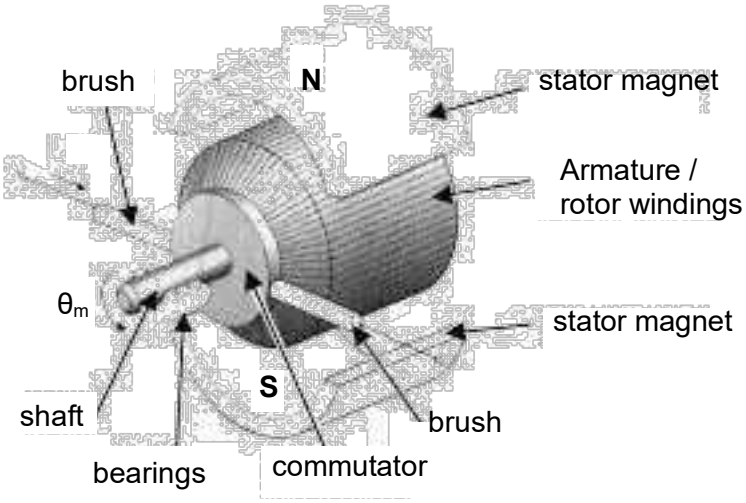


Fig. 9.1

(a) State what is meant by hard and soft magnetic materials in terms of their magnetic properties.

……

……

……

……

……[2]

(b) Rotor windings are coils of wires. The coils of wires are wound round soft iron.

Explain the function of the soft iron.

……

……

……[1]

(c) Describe the function of the commutator in the motor.

……

……

……

……

……[2]

[Total:5]

10 Fig. 10.1 shows some information about strontium-90.

Naturally occurring strontium is nonradioactive and nontoxic at levels normally found in the environment but strontium-90, is a radiation hazard. It is produced by nuclear fission. It undergoes nuclear decay into yttrium-90. Strontium-90 has applications in medicine and industry.

Symbol	**Sr**
Protons	**38**
Neutrons	**52**
Radioactive decay	**beta**
Decay product	**yttrium (Y)**

Fig. 10.1

(a) Write down strontium-90 in nuclide notation. [1]

(b) Explain what is meant by nuclear decay.

……..……..……..

……[1]

(c) Write down the equation in nuclide notation to represent the beta decay for strontium-90. [1]

(d) Strontium-90 is produced by nuclear fission.

Explain the difference between nuclear fission and nuclear fusion.

……

……

……

……

……[2]

(e) Table 10.2 shows the count rate of a sample of strontium-90 over a period of time.

Plot the data on Fig. 10.3 and use the graph to determine the half-life of strontium-90.

Table 10.2

time / years	count rate / count/s
0	1000
20	620
40	380
60	230
80	110
100	60

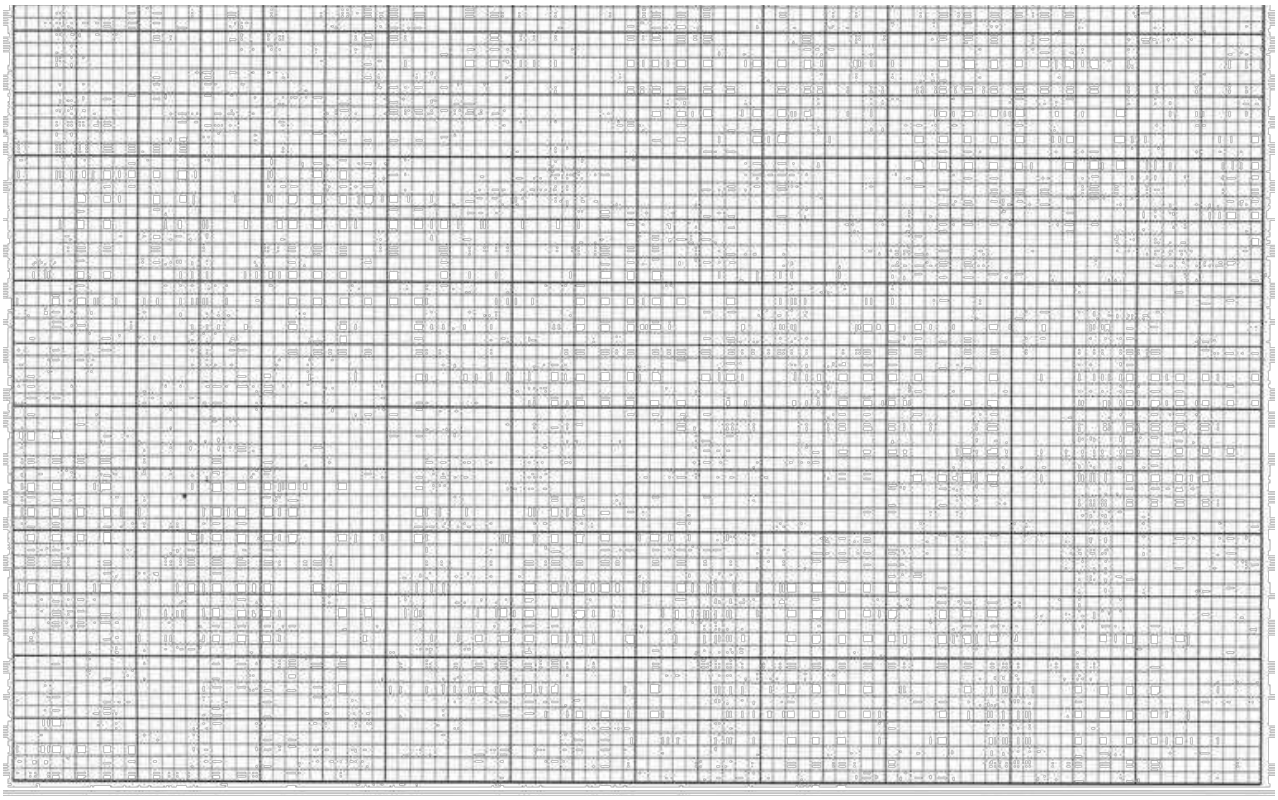


Fig. 10.3

Half-life = …… [3]

(f) One of the uses of strontium-90 is to determine the thickness of steel sheets. Fig. 10.4 shows the set-up in a steel sheet factory.

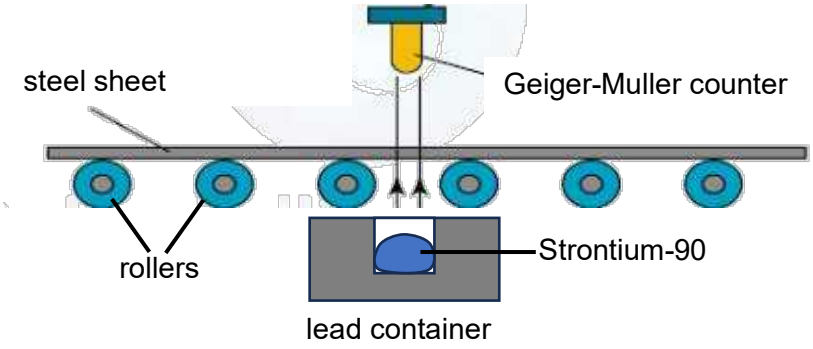


Fig. 10.4

(i) Explain how Geiger-Muller counter is used to determine the changes in the thickness of the steel sheet.

……

……

……

……

……[2]

(ii) Describe two ways to reduce being exposed to radioactive emissions.

……

……

……

……

……[2]

[Total:12]

11 Fig. 11.1 shows a box pulled up a slope with a string using a smooth pulley. The box has a weight of 25 N.

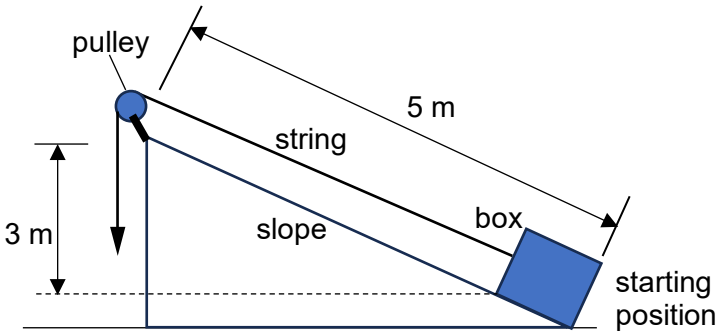


Fig. 11.1

(a) Calculate the gravitational potential energy store of the box when it reaches the highest point of the slope.

gravitational potential energy store = ... [2]

(b) Calculate the energy required to move the box up at constant speed if the frictional force between the box and slope is 12 N.

energy required = ... [2]

(c) The string was released when the box reached the highest point of the slope. The box moves down the slope with the same amount of friction of 12 N.

Calculate the speed of the box when it reaches the starting position.

speed of box = ... [2]

(d) A motor, with an efficiency of 85%, is used to pull the box up the slope.

Calculate the energy required by the motor to pull the box up to the highest point.

energy required by motor = ... [2]

[Total:8]

Section B (10 marks)

Answer only **one** of the two questions from this section.

12 Fig. 12.1 shows a beam of light incident on the surface of container of water. The refractive index of water is 1.34.

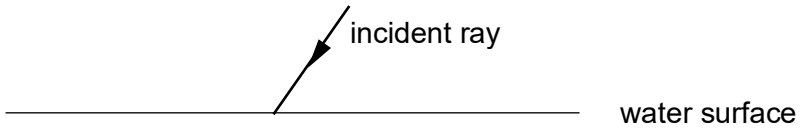


Fig. 12.1

(a) The beam of light is refracted in water.

On Fig. 12.1, draw the refracted ray in the water. Indicate clearly the angle of incidence with a ' **i** ' and angle of refraction with a ' **r** '. [2]

(b) Calculate the angle of incidence if the angle of refraction is 25.3°.

angle of incidence = …… [2]

(c) Define refractive index.

……..……..

……[1]

(d) The speed of light in vacuum is 3 x 10^8 m/s.

Calculate the speed of light in water.

speed of light in water = …… [2]

(e) State what is meant by critical angle.

……..……..

……[1]

(f) Calculate the critical angle for water.

critical angle = …… [2]

[Total:10]

13 Fig. 13.1 shows a setup showing electromagnetic induction.

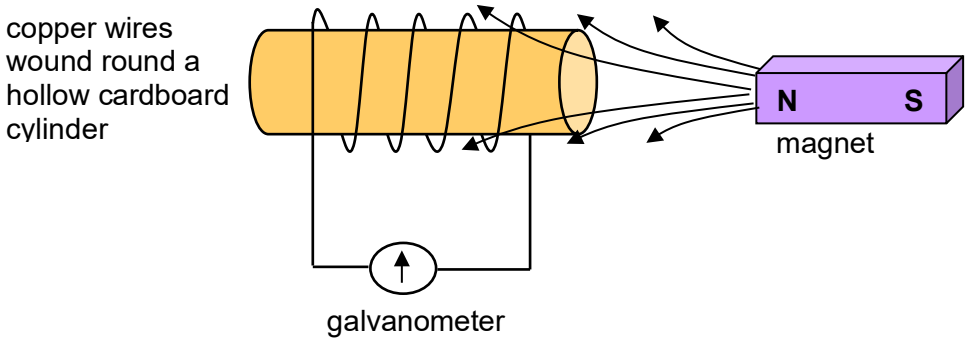


Fig.

(a) Describe **three** ways to increase the induced electromotive force in the above setup.

.....

.....

.....

.....

.....[3]

(b) Fig. 13.2 shows a simple a.c. generator.

(i) Complete the diagram by naming the parts F, G, H of the generator. [1]

(ii) Draw arrows to show the direction of the current flow in the coil and the resistor when the coil is rotating clockwise about the axle. [1]

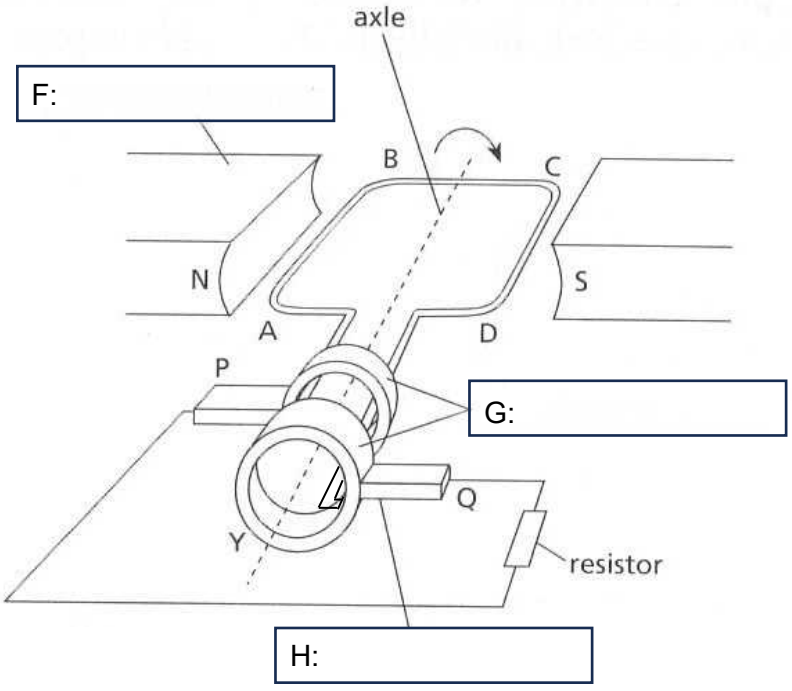


Fig.

(c) Fig. 13.3 shows a simple electrical power distribution from a power station to homes.

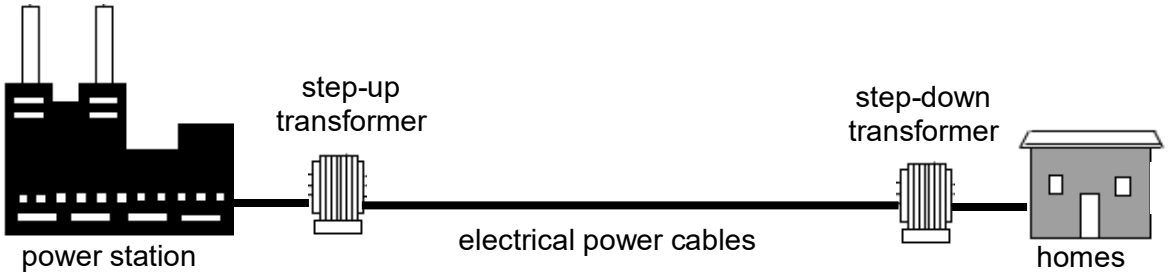


Fig.

(i) Explain the function of the two transformers in terms of the distribution of electrical supply.

……

……

……

……

……[2]

(ii) With the aid of a simple labelled diagram of a transformer, describe the structure and principle of operation of a simple iron-core transformer.

……

……

……

……

……[3]

[Total:10]

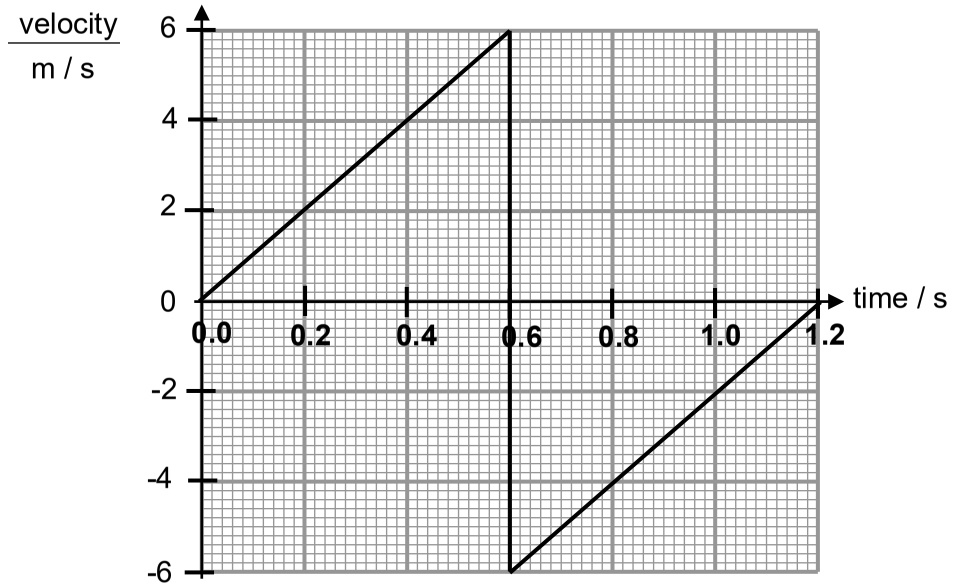
End of Paper

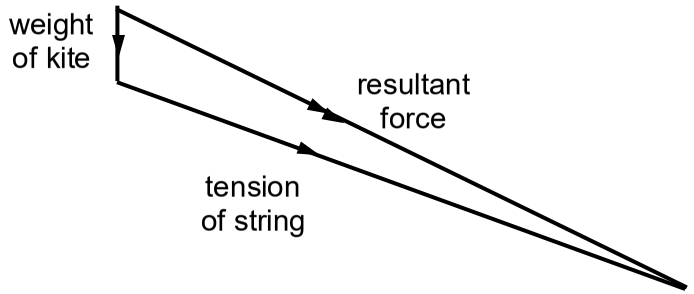
Jurongville Secondary School
Science Department 2024
Marking Scheme

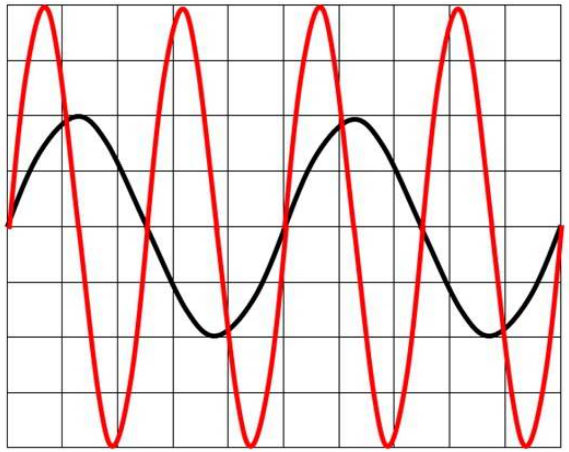
Assessment: Physics Preliminary Examinations **Level:** Sec 4 Exp

Paper 1

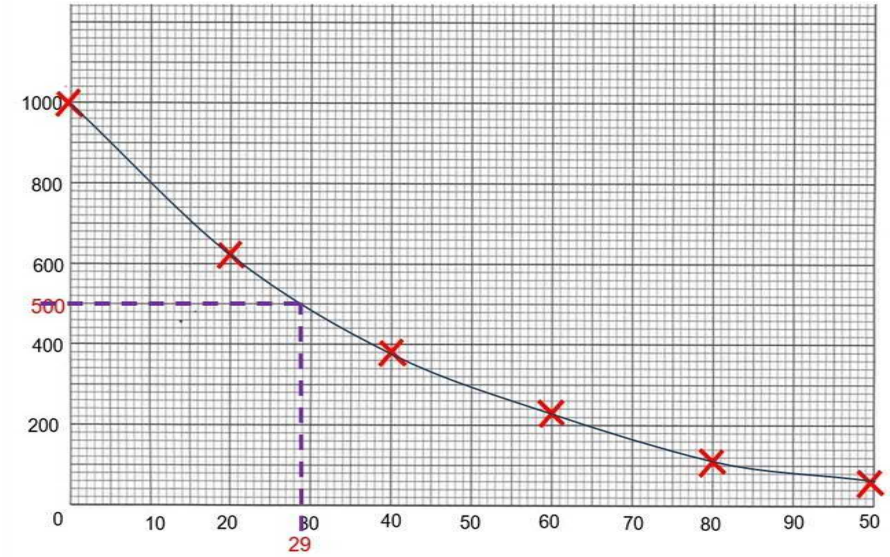
Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans	Qn	Ans
1	D	2	D	3	D	4	B	5	A	6	A	7	B	8	C	9	B	10	B
11	C	12	A	13	D	14	C	15	B	16	C	17	C	18	C	19	B	20	D
21	D	22	B	23	D	24	A	25	B	26	A	27	D	28	A	29	C	30	C
31	A	32	C	33	A	34	A	35	D	36	D	37	B	38	A	39	C	40	B

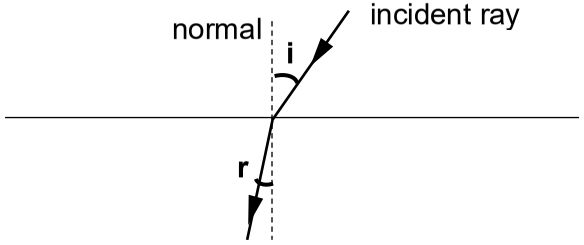
Qn	Marking Scheme	Remarks	Marks
1(a)	Acceleration due to gravity = 10.0 (6.0 – 0) / t = 10.0 t = 6.0 / 10.0 = 0.6 s	 Correct working Correct answer and unit	 C1 A1
1(b)		Each correct straight line Allow for ecf from (a)	B1, B1
1(c)	Height = Area under velocity-time graph = ½ (0.6)(6) = 1.8 m	Correct working Correct answer and unit Allow for ecf from (a)	C1 A1

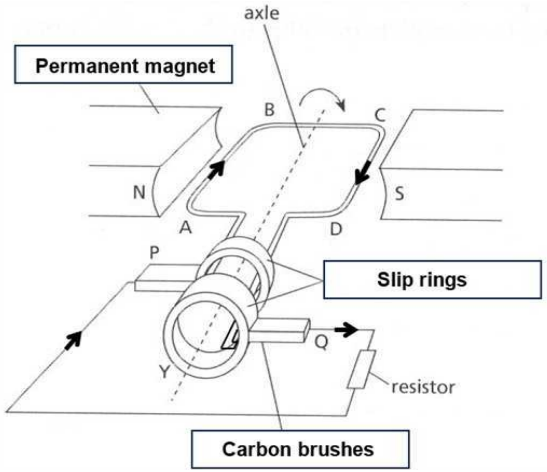
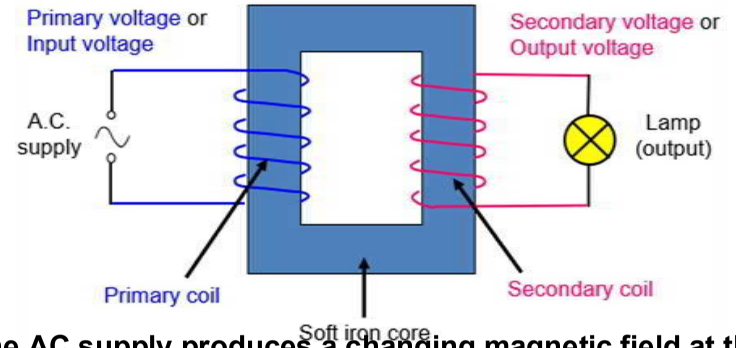
Qn	Marking Scheme	Remarks	Marks
2(a)	Scale 1 cm rep 5 N  	Correct diagram with arrows Appropriate scale	B1
	Magnitude of wind force = 42 N ± 0.5 N	Correct magnitude	B1
	Direction of wind force = 26° clockwise from the horizontal	Correct angle	B1
2(b)	Mass of kite = 5 / 10 = 0.5 kg		
	Resultant force = m a	Correct working	C1
	42 = 0.5 x a	Correct answer and unit	A1
	a = 42 / 0.5 = 84 m/s^2	Allow for ecf from (a)	
3(a)	The load is placed vertically above support B. The perpendicular distance between the load and support B is zero. Thus there is no moment about support B.	OWTTE	B1
	Taking moments about support B,		
3(b)	Force at support A x 1.4 = (24)(1.4 / 2)		
	Force at support A = 16.8 / 1.4 = 12 N	Correct working	C1
3(c)	For maximum distance that load can move to the right, the weight of plank just balance the load at support B and no force at support A.	Correct answer and unit	A1
	Taking moments about support B		
	76 x Maximum distance that load can move to the right = (24)(1.4 / 2)		
	Maximum distance that load can move to the right = 16.8 / 76	Correct working	C1
	= 0.22 m	Correct answer and unit	A1
4(a)	Pressure is the force per unit area.	OWTTE	B1
4(b)	Pressure = Force / Area		
	23000 = 29 x 10 / Area		
	Area = 290 / 23000	Correct working	C1
	= 0.126 m^2	Correct answer and unit	A1
4(c)	Pressure in gas cylinder + 13600 x 10 x (0.059 – 0.035) = 100000		
	Pressure in gas cylinder = 100000 – 3264	Correct working	C1
	= 96736 = 96700 Pa (3 s.f.)	Correct answer and unit	A1

Qn	Marking Scheme	Remarks	Marks
5(a)	There dust particles moving faster means that there is an **increase in its kinetic store/energy**.	OWTTE	B1
	This means that there is an **increase in the temperature of the gas**.		B1
5(b)	An electric heater used to heat room air is placed on the floor to ensure convection currents to take place in the room. The **air near the heater becomes hot and is less dense**. The hot air rises and cold air in the room sinks. This **causes convection current to take place**.	OWTTE	B1 B1
5(c)(i)	The specific latent heat of vaporization of a substance is the amount of energy required to change 1 kg of the substance from liquid to gas, or vice versa, without any change in temperature.	OWTTE	B1
5(c) (ii)	Power x time = energy gain by pot + energy gain by water $2000 \times t = 1.2 \times 445 \times (120 - 30) + 3.0 \times 4200 \times (100 - 30) + 0.5 \times 2.3 \times 10^6$ $t = (48060 + 882000 + 1150000) / 2000$ $= 1040$ s = 17.3 min	Correct working Correct answer and unit	C1 A1
6(a)	Sound is produced by the vibration of air particles around the vibrating violin string. A series of compression and rarefaction pressure regions forming longitudinal waves transmit sound by vibrating air particles.	OWTTE	B1 B1
6(b)		Wave is twice amplitude of original wave Wave frequency is twice of original wave	B1 B1
6(c)	Speed of sound = wavelength / period = 1.2 / 0.002 = 600 m/s	Correct working Correct answer and unit	C1 A1

Qn	Marking Scheme	Remarks	Marks
7(a)	Effective resistance when circuit is in a dark and hot room $= [1 / (100 + 15000) + 1 / (300 + 50)]^{-1} = 342\ \Omega$ Current in battery = 12 / 342 = 0.0351 A	Correct working Correct answer and unit	C1 A1
7(b)	The current flow in the battery will be largest when the circuit is in a bright and hot room. This is because the effective resistance of the circuit is the lowest.	OWTTE	B1 B1
7(c)	Potential difference across LDR = [12 / (100 + 400)](400) = 9.6 V	Correct answer and unit	B1
7(d)	The current flow in the LDR is not affected by the resistance of the thermistor since the LDR and thermistor are connected in parallel.	OWTTE	B1
8(a)	The three-pin plug is necessary because **the oven has exposed metal parts**. If there is a fault, the metal parts may become live and the **earth wire in the three-pin plug will provide a low resistance path for current to flow and protect the user**.	OWTTE	B1 B1
8(b)	The fuse has a resistance wire that only allows certain amount of current to flow through it. It will **melt and stop current flow if current exceed the allowed current in the fuse**. It is **connected in the live wire**.	OWTTE	B1 B1 B1
8(c)	Current = Power / Voltage = 800 / 240 = 3.33 A The 5 A fuse is selected as it is slightly above 3.33 A	Correct working Correct answer	B1
9(a)	**Hard magnetic materials is not easily magnetized but does not lose magnetism easily once it is magnetized** **Soft magnetic materials can be easily magnetized but loses magnetism easily**.	OWTTE	B1 B1
9(b)	This is because **soft iron would concentrate the magnetic field from the coils of wires for a stronger magnetic field.**	OWTTE	B1
9(c)	**The function of the commutator is the to change the contact from one brush to the other.** **This would reverse the direction of current in the coil and ensure the coil rotate in one direction.**	OWTTE	B1 B1

Qn	Marking Scheme	Remarks	Marks
10(a)	$^{90}_{38}Sr$	CAO	B1
10(b)	Nuclear decay is a random process which an unstable atomic nucleus loses its energy by emission of electromagnetic radiation or particles.	OWTTE	B1
10(c)	$^{90}_{38}Sr \longrightarrow {}^{90}_{39}Y + {}^{0}_{-1}e$	Correct nuclide notation of yttrium Correct nuclide notation for beta particle	B1
10(d)	Nuclear fission is a process in which the **nucleus of an atom splits** and releases a large amount of energy while nuclear fusion is a process in which **two atomic nuclei combine to form a heavier nucleus** and releases a large amount of energy.	OWTTE	B1
10(e)		Correct plotted points and best fit curve Line on graph to determine half-life	B1 B1
	Half-life = 29 years		B1
10(f)(i)	The Geiger-Muller counter will **detect the amount of strontium-90 that is able to pass through the steel sheet**. If **the counter detects too much radiation**, that means the **steel sheet is too thin**. If the **counter detects less than normal radiation**, that means the **steel sheet is too thick**.	OWTTE	B1 B1
10(f)(ii)	1. The radioactive substance could be contained in a thick lead / concrete container. 2. Remote controlled devices can be used to move the radioactive substances.	Any two suitable ways	B1 B1

Qn	Marking Scheme	Remarks	Marks
11(a)	Gravitational potential energy = m g h		
	= 25 x 3	Correct working	C1
	= 75 J	Correct answer and unit	A1
11(b)	Energy required = 75 + (12 x 5)	Correct working	
	= 75 + 60	Correct answer and unit	C1
	= 135 J	Allow for ecf for (a)	A1
11(c)	Energy required to overcome friction = 60 J		
	Kinetic energy at bottom of slope = ½ m v^2 = 75 – 60 = 15 J	Correct working	C1
	15 = ½ x (25 / 10) v^2 = 1.25 v^2	Correct answer and unit	A1
	Speed = √ (15 / 1.25) = 3.46 m/s (3 s.f.)	Allow for ecf for (a) and (b)	
11(d)	Efficiency = output energy / input energy	Correct working	
	Energy required by motor = 135 / 0.85	Correct answer and unit	C1
	= 159 J (3 s.f.)	Allow for ecf for (b)	A1
			Total: 70
12(a)		Normal line drawn with angle of incidence and angle of refraction shown clearly Refracted ray drawn at an angle closer to normal	B1 B1
12(b)	$n_i \sin i = n_r \sin r$		
	1 x sin i = 1.34 x sin 25.3°	Correct working	C1
	$i = \sin^{-1} 0.573 = 35.0°$	Correct answer and unit	A1
12(c)	Refractive index of a medium is the ratio of the speed of light in vacuum to the speed of light in medium.	OWTTE	B1
12(d)	1.34 = 3 x 10^8 / speed of light in water		
	Speed of light in water = 3 x 10^8 / 1.34	Correct working	C1
	= 2.24 x 10^8 m/s (3 s.f.)	Correct answer and unit	A1
12(e)	Critical angle is the angle of incidence in the optically denser medium for which the angle of refraction in the less dense medium is 90°.	OWTTE	B1
12(f)	Critical angle = $\sin^{-1}$ (1/n)	Correct working	C1
	= $\sin^{-1}$ (1/1.34) = 48.3 °	Correct answer and unit	A1

Qn	Marking Scheme	Remarks	Marks
13(a)	1. Move the magnet faster towards the coil of wires. 2. Increase the number of turns round the cylinder. 3. Wound the wires round a soft iron core instead of hollow cardboard cylinder.	Any three suitable answers	B1 B1 B1
13(b) (i)(ii)		Correct labelling of diagram Correct direction of arrows	B1 B1
13(c)(i)	**Step-up transformer increases the voltage in the transmission line while step-down transformer decreases the voltage supply to the homes. This would reduce power losses in the transmission wires.**	OWTTE	B1 B1
13(c) (ii)		Labelled diagram	B1
	The AC supply produces a changing magnetic field at the primary coil. This causes the secondary coil to induce emf to oppose the changing magnetic field. The difference in the number of turns in the primary coil and secondary coil will cause the primary voltage and secondary voltage to be different.	OWTTE	B1 B1
			Total: 10