Name:	ANSWERS	Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Term 3 Class Test
Year 4 (Integrated Programme)

PHYSICS

Moments, Energy, Work and Power, Current of Electricity, DC Circuits, Practical Electricity, Magnetism, Electromagnetism, Electromagnetic Induction

11 Aug 2022
40 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work that you hand in.
Write in dark blue or black pen.
Do not use paper clips, glue or correction fluid.
The use of an approved scientific calculator is expected, where appropriate.
At the end of the examination, fasten all your work securely together.

Section A: Multiple Choice
There are **ten** questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice **in the table** provided at the end of this section.

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.

Section B: Structured
You may use an HB pencil for any diagrams or graphs.

Answer **all** questions.

Candidates are reminded that **all** quantitative answers should include appropriate units.
Candidates are advised to show all their workings 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.

For examiner's use only:

Section A	/ 10
Section B	/ 25
formula s.f.	□ □
Total	**/ 35**

Section A

Answer **all** the questions in this section. Record your choice **in the table** below.

Answers for Section A

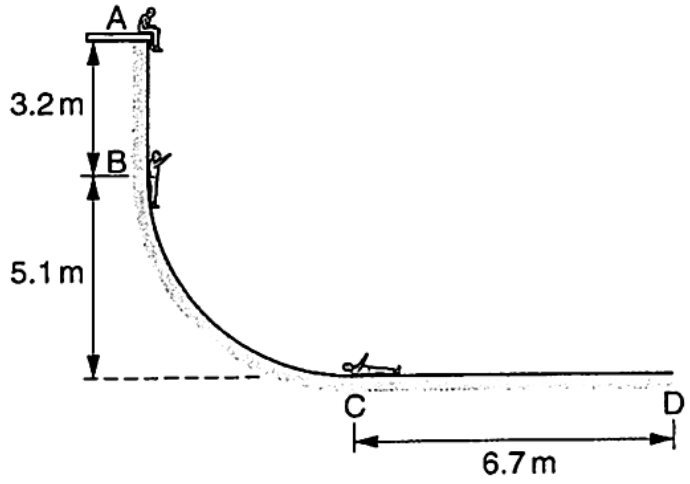
1		**2**		**3**		**4**		**5**	
6		**7**		**8**		**9**		**10**	

1 A student would like to conduct a plumb line experiment to determine the centre of gravity of a cardboard.

Which of the following steps is **not** needed in determining the cardboard's centre of gravity?

A ensuring that the cardboard can oscillate freely.
B hanging a plumb line from the pivot.
C pivoting the cardboard near its centre of gravity.
D tracing the plumb line on the cardboard.

2 The figure below shows a drop slide where the first part of the fall is vertical. A child of mass 30 kg uses the drop slide, slides down to C and then stops at D. The child is initially at rest at A.



Assuming there is no friction acting on the child during his fall from A to C, what is the average frictional force acting on the child as he slides between C and D?

A 37 N **B** 140 N **C** 370 N **D** 740 N

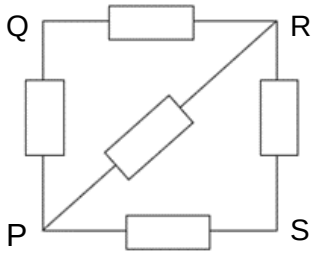
3 A power station provides 2.0 MW of total power and produces 900 kW of wasted energy in its operations. What is the useful electrical energy produced by the power station in two hours?

A 1.8 MWh **B** 2.2 MWh **C** 132 MWh **D** 7920 MWh

4 A wire has a resistance of 10 Ω. A second wire, made of the same material, has 4 times the length and twice the diameter. What is the resistance of the second wire?

A 2.5 Ω **B** 10 Ω **C** 20 Ω **D** 40 Ω

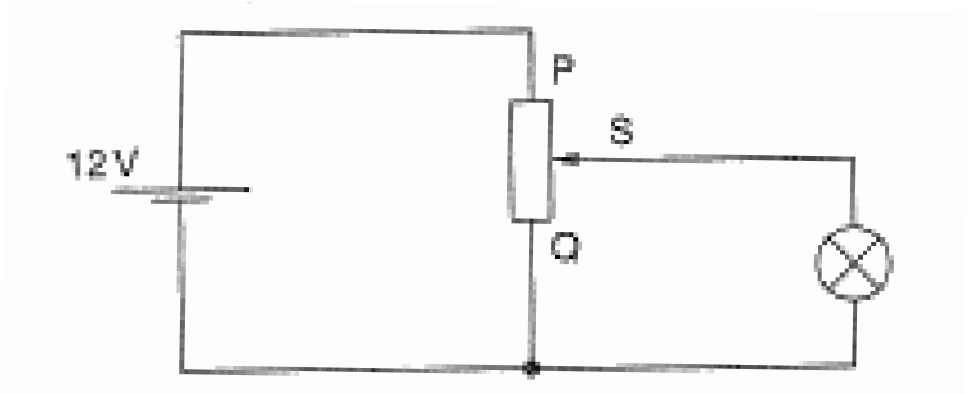
5 Five identical resistors of resistance 3 Ω each are arranged as shown.



Given that the potential difference between points P and R is 1.0 V, which values are correct?

	effective resistance between P and R / Ω	potential difference between Q and S / V
A	0.67	0.0
B	0.67	0.5
C	1.50	0.0
D	1.50	0.5

6 The diagram shows a variable potential divider connected to a power supply and a lamp.



What happens to the brightness of the lamp and the potential difference across PS as the sliding contact S moves from P to Q?

	brightness of lamp	potential difference across PS
A	brighter	decreases
B	brighter	increases
C	dimmer	decreases
D	dimmer	increases

7 An electrical cable contains three wires: live, neutral and earth. The cable is correctly wired to a plug which contains a 3 A fuse at the live wire. The insulation becomes damaged and the wires are exposed.

Which event causes a short circuit and the fuse to blow?

A A person touches the earth wire.
B A person touches the live wire.
C A person touches the neutral wire.
D The live wire touches the earth wire.

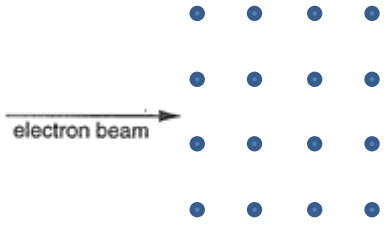
8 The steps to demagnetise a magnet using electrical method are shown below.

1. Connect a solenoid to _____ supply.
2. Place the magnet into the solenoid and switch on the circuit.
3. Slowly withdraw the magnet in the _____ direction until it is far away from the solenoid.

Which of the following options in step 1 and 3 is correct?

	blank in step 1	blank in step 3
A	alternating current	east-west
B	alternating current	north-south
C	direct current	east-west
D	direct current	north-south

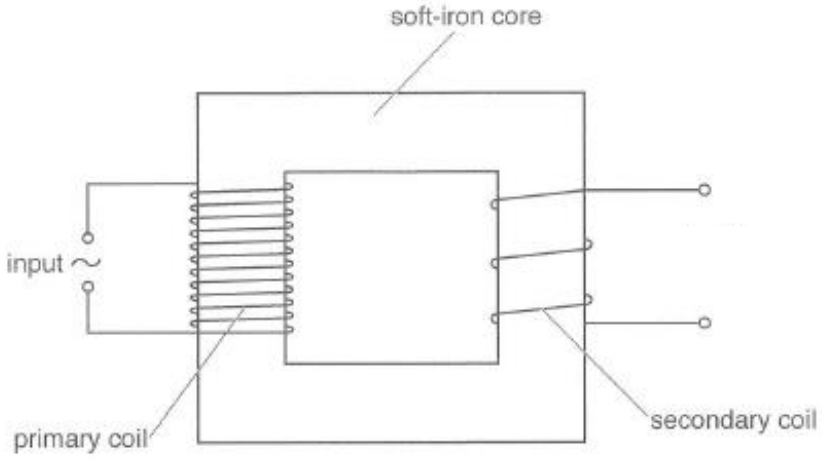
9 The diagram shows a beam of electrons entering a magnetic field. The direction of the field is out of the page.



What is the initial direction of the deflection of the electrons as the beam passes through the electric field?

A into the page
B out of the page
C towards the bottom of the page
D towards the top of the page

10 The diagram shows a transformer. A 12 V, 24 W lamp is connected to the output of the secondary coil.



Given that the input source is 24 V, which setting allows for the lamp to operate at normal brightness?

	ratio of N_s / N_p	current in primary coil / A
A	0.5	1.0
B	0.5	2.0
C	2.0	1.0
D	2.0	2.0

Section B

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

11 Fig 11.1 shows a lighting circuit of a house. All the bulbs in the circuit are labelled "240 V, 60 W".

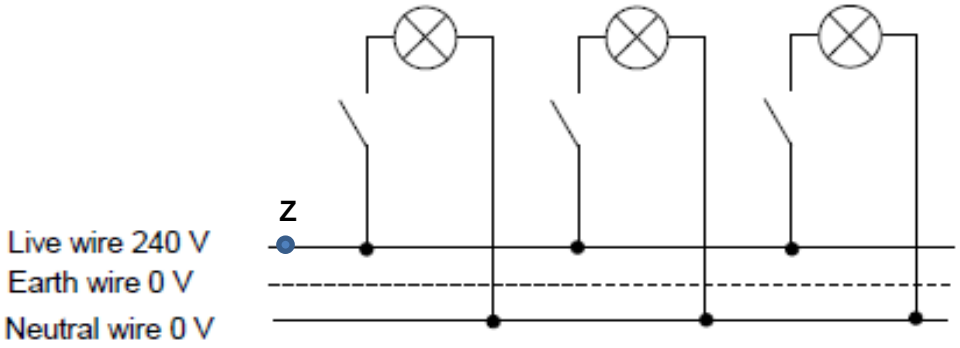


Fig. 11.1

(a) Describe what is meant by "240 V, 60 W".

It means that when a potential difference of 240 V is applied across the bulb, it will convert 60 J of electrical energy to light and thermal energy *per second.* [1]

(b) State and explain what happens to the brightness of the other light bulbs if one bulb blows.

The brightness of the other light bulbs will remain the same [B1] as the potential difference/current across them remains the same [B1]. [2]

(c) Determine a suitable rating of a fuse at position Z.

I = P / V = 60 / 240 = 0.25 A [B1]
Main current = 3I = 0.75 A
Suitable rating = 1 A [B1]

fuse rating = _____ [2]

12 Fig. 12.1 shows the current-potential difference (p.d) graphs for a resistor and a thermistor.

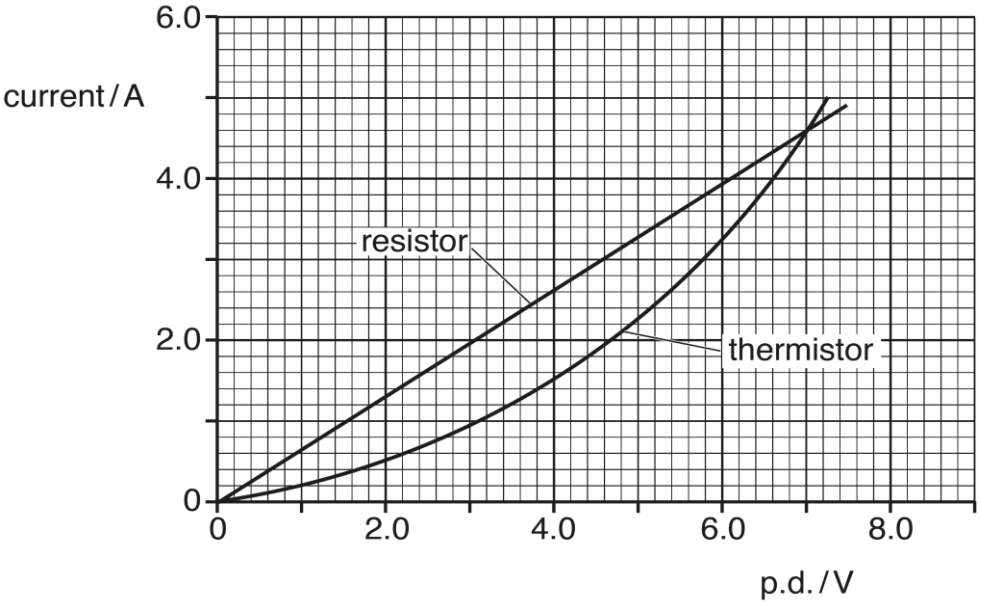


Fig. 12.1

(a) Calculate the resistance of the thermistor when the potential difference across it is 7.0 V.

From graph, current = 4.6 A

R = V / I

= 7.0 / 4.6 [M1]

= 1.52 Ω [A1]

resistance = _____ [2]

(b) The potential difference across the thermistor and resistor is increased from 0 V to 7.0 V. State the effect of this on their respective resistances.

	effect on resistance
Thermistor	Decreases
Resistor	Same/No change

[2]

(c) The thermistor and resistor are connected in parallel to a 7.0 V supply.

Calculate the current from the supply.

From the graph, I = 4.6 A [B1, allow ecf from part a]

Current from supply = I + I = 4.6 + 4.6 = 9.2 A [A1]

current = _____ [2]

13 Fig. 13.1 shows a U-shaped electromagnet.

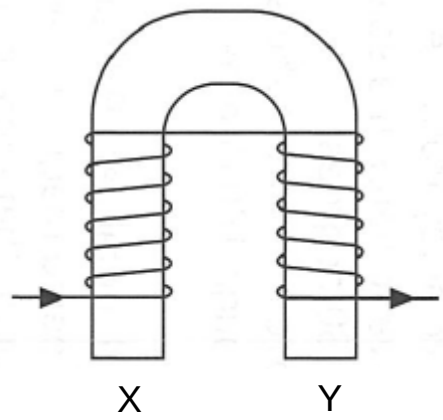


Fig. 13.1

(a) Determine the polarities of X and Y.

	polarity
X	South
Y	South

[1]

(b) Without changing the magnet, suggest one way to increase the magnetic field strength of the electromagnet.

Increase magnitude of current by increasing emf OR

Increase number of turns of coil per unit length [B1] [1]

14 Fig. 14.1 shows a direct current motor.

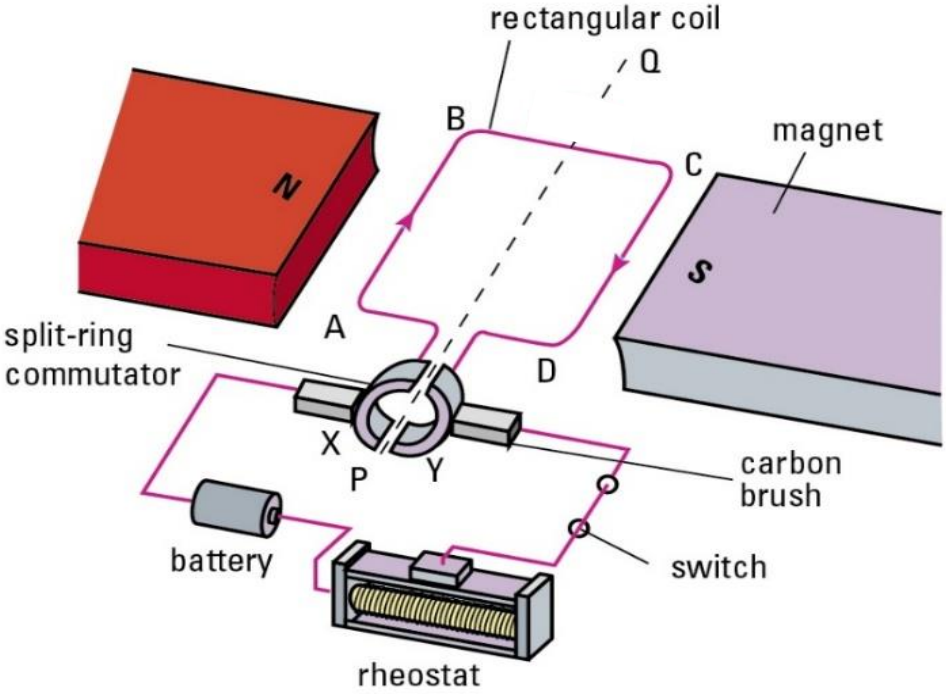


Fig. 14.1

(a) State the purpose of the spilt-ring commutator.

To reverse the direction of the current in the coil every time it passes the vertical position [B1]. This will ensure that the coil always turns in the same direction [B1] otherwise the coil will stop turning at the vertical position [2]

(b) It is observed that both sides AB and CD of the coil experience a turning effect. Explain why the coil experiences a turning effect.

The magnetic fields of the current-carrying coil and of the magnet interact with each other [B1].

This interaction creates a pair of forces [B1] which act on opposite directions at the ends of the coils [B1] which resulted in a turning effect/couple.

[3]

(c) Given that the magnitude of the force acting on each end of the coil is 50.0 N and that the lengths AB and BC are 28.0 cm and 20.0 cm respectively, calculate the magnitude and direction of the moment generated.

Moment = Force x perpendicular distance
= (50 x 0.1) + (50 x 0.1) [M1]
= 10.0 Nm [A1]

magnitude of moment = 10.0 Nm [2]

direction of moment = anticlockwise [1]

15 Fig. 15.1 shows a device used to measure the flow of air. The flow of air refers to the volume of air passing through a point per unit time.

The turbine is made to rotate by the air that flows through it. The rim of the turbine contains small magnets. An alternating electromotive force (e.m.f.) is induced in the coil which connects to an output circuit.

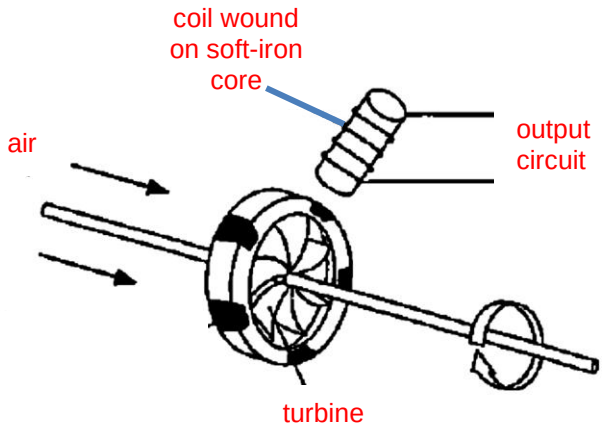


Fig. 15.1

(a) Explain why an alternating e.m.f. is induced in the coil.

When the turbine rotates, the magnetic fields of the magnets cut the coil. [B1]

The coil experiences a change in magnetic flux linkage, inducing an e.m.f [B1] in the coil by Faraday's Law.

As the magnets moves toward and then away from the coil, the e.m.f. induced in the coil becomes alternating due to Lenz's Law. [B1] [3]

(b) State what will happen to the alternating e.m.f. if the turbine rotates at twice its original frequency due to an increase in flow of air per unit time.

Magnitude of e.m.f. will be doubled and

The frequency of e.m.f. will also be doubled [B1] [1]