confidential
STPM 2017 TERM 2 TRIAL
Physics 960/2
1 hour 30 minutes

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Ke Arah Kecemerlangan Pendidikan

STPM 2017 TERM 2

TRIAL EXAMINATION

PHYSICS

PAPER 2

(1 hour and 30 minutes)

Instructions to candidates:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

Answer **all** *questions in Section A. Marks will not be deducted for wrong answers. For each question, four suggested answers are given. Choose the correct answer and shade the corresponding letter on the objective answer sheet provided.*
Answer **all** *questions in Section B. Write your answers in the spaces provided.*
Answer any **two** *questions only in Section C. All essential working should be shown. For numerical answers, unit should be quoted wherever appropriate. Begin each answer on a fresh sheet of foolscap paper and arrange your answers in numerical order.*
Values of constants are provided on last page in this question paper.

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Guru Physics Tkn 6	Ketua Panitia Physics Tkn 6	PK Tingkatan 6

This question paper consists of 11 printed pages.

Section A [15 marks]

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

Indicate the correct answer on the Multiple-choice Answer sheet provided.

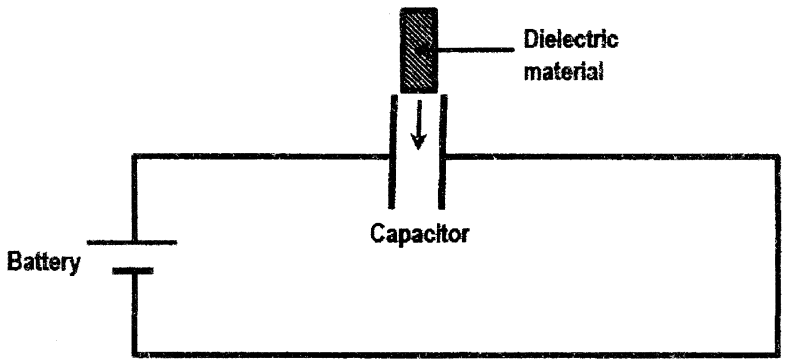
1. Which of the following statements concerning electric field strength is **not** true?

   A The electric field strength of a point charge is inversely proportional to the square of the distance from the charge.
   B Electric field strength is a vector quantity.
   C The electric field strength at a point in an electric field is the force experienced by a positive unit charge at the point.
   D The electric field strength is zero when the electric potential is zero.

2. An oil drop with charge q is stationary in a vertical electric field E. What is the mass of the oil drop?
   [g is the acceleration due to gravity]

   A qE B $\frac{q}{E}$ C $\frac{g}{qE}$ D $\frac{qE}{g}$

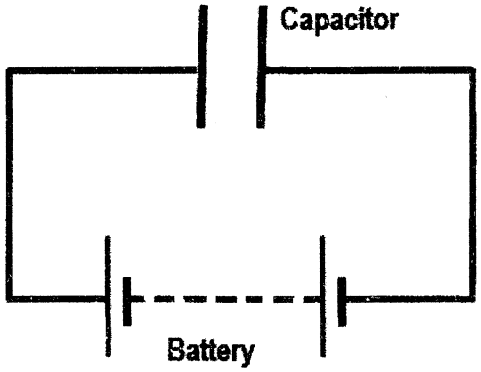
3. A dielectric material is inserted between the parallel plates of a capacitor in the circuit as shown in the diagram below.



   Which of the following correctly summarizes the change, if any, in the potential difference and capacitance of the capacitor?

	Potential difference	*Capacitance*
A	Does not change	Increases
B	Increases	Increases
C	Does not change	Decreases
D	Decreases	Decreases

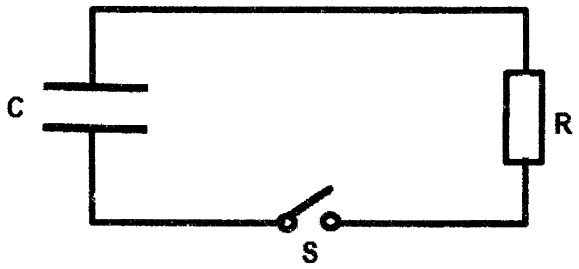
4. The diagram below shows a parallel plate capacitor which is connected to a battery. The electric energy stored in the capacitor is E.



If one of the plates of the capacitor is moved so that the separation between the plates becomes half of the initial separation, the electric energy stored in the capacitor becomes

A $\frac{1}{2}E$ B $\frac{1}{4}E$ C E D $2E$

5. The diagram below shows a capacitor C with capacitance 2 μF, connected to a resistor R of resistance 10Ω.



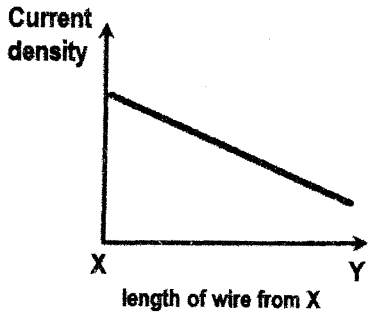
If the capacitor has an initial charge of 4×10^{-5} C, what is the current that flows through the circuit immediately after the switch S is closed?

A 0.1 A B 0.2 A C 1 A D 2 A

6. When the potential difference of a copper wire increases, which of the following concerning the drift velocity v and number of electrons per unit volume n is correct?

	n	v
A	Does not change	Does not change
B	Does not change	Increases
C	Increases	Does not change
D	Does not change	Decreases

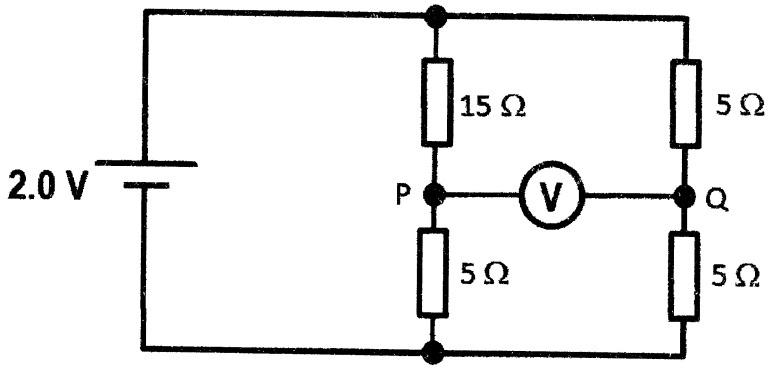
7. The current flows through an insulated wire XY with variation of current density as shown in the diagram below.



Which of the following statements is correct?

A End X of the wire is thinner than end Y of the wire.
B End Y of the wire is thinner than end X of the wire.
C The electric potential gradient along the wire is uniform.
D The current at end X is more than the current at end Y.

8. A battery, with e.m.f. 2.0 V and internal resistance which can be neglected, is connected to four resistors as shown in the diagram below.



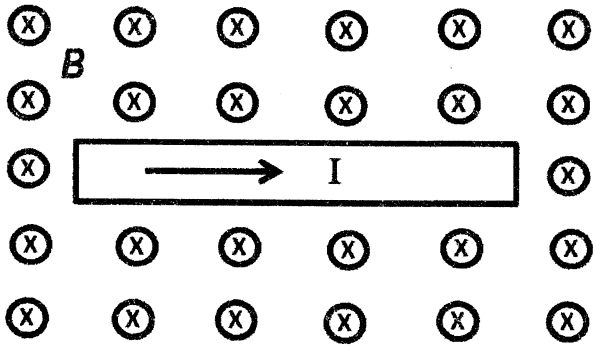
What is the potential difference between point P and point Q in the circuit?

A 0 V B 0.50 V C 0.75 V D 1.00 V

9. Which of the following statements about a potentiometer wire is not true?

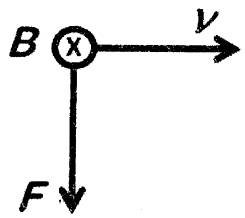
A The potential difference across a potentiometer wire is directly proportional to the length of the potentiometer wire.
B The resistance of a potentiometer wire is directly proportional to the length of the potentiometer wire.
C. The potentiometer circuit can be used to compare resistances between two resistors.
D. The potentiometer circuit can be used to measure the capacitance of a capacitor.

10. A copper rod which carries current I is placed perpendicularly in a uniform magnetic field B as shown in the diagram below.

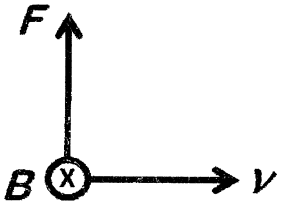


Which of the following shows correctly the orientation of the directions of magnetic field B, the velocity v of the electron in the rod and the force F exerted on the electrons?

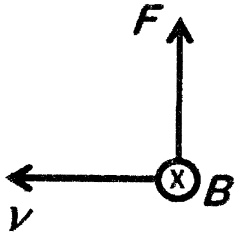
A



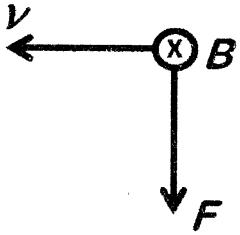
B



C



D



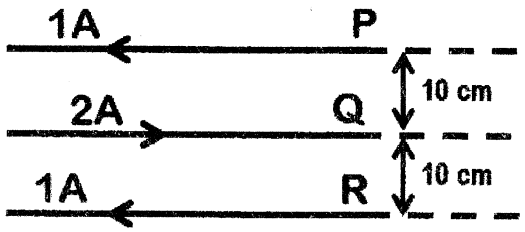
11. Two concentrate circular coils P and Q are placed in the same plane. Coil P has 10 turns of radius 4 cm and carries a current of 1.0 A. Coil Q has 20 turns of radius 12 cm and the magnitude and direction of the current in this coil are adjusted so that the resultant magnetic field in the common centre of both coils is zero.
What is the current in the coil Q?

A 0.75 A B 1.5 A C 2.25 A D 4.5 A

12. . Lenz Law concerning electromagnetic induction is the result of the conservation of

A mass B charge C energy D momentum

13. Three long wires P, Q and R are arranged parallel with one another in a vacuum as shown in the diagram below.



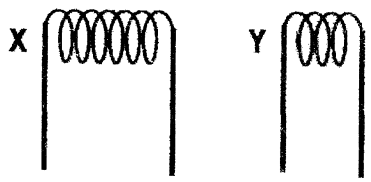
Given that the force per unit length between two wires, each carrying currents of 1A and separated by 10 cm is 2×10^{-6} N m^{-1}. What is the magnitude and direction of the resultant force per unit length experienced by wire R?

	Magnitude	direction
A	3×10^{-6} N m^{-1}	upward
B	3×10^{-6} N m^{-1}	downward
C	6×10^{-6} N m^{-1}	upward
D	6×10^{-6} N m^{-1}	downward

14. A coil of wire which has n turns and cross sectional area A is placed in a magnetic field B, with its plane perpendicular to the magnetic field. The coil is then turned at frequency f about its diameter, at right angles to the magnetic field.
What is the maximum e.m.f. induced in the coil?

A $2\pi nfBA$ B $2\pi nBA$ C $\pi nfBA$ D πnBA

15. A mutual inductor consists of two coils X and Y as shown in the diagram below, where one quarter of the magnetic flux produced by X is linked to Y and produces mutual induction M.



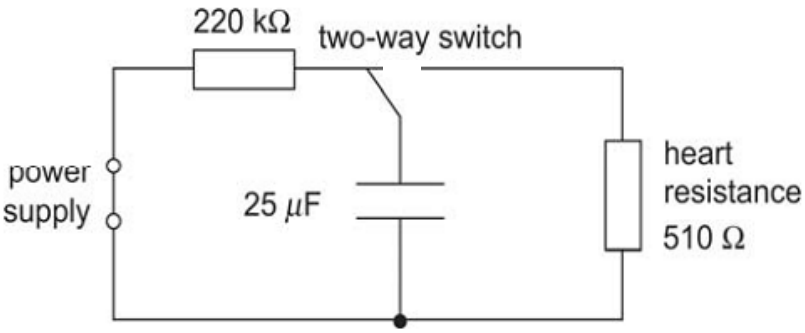
What is the mutual induction when Y is used as the primary coil?

A $\frac{M}{4}$ B $\frac{M}{2}$ C M D $2M$

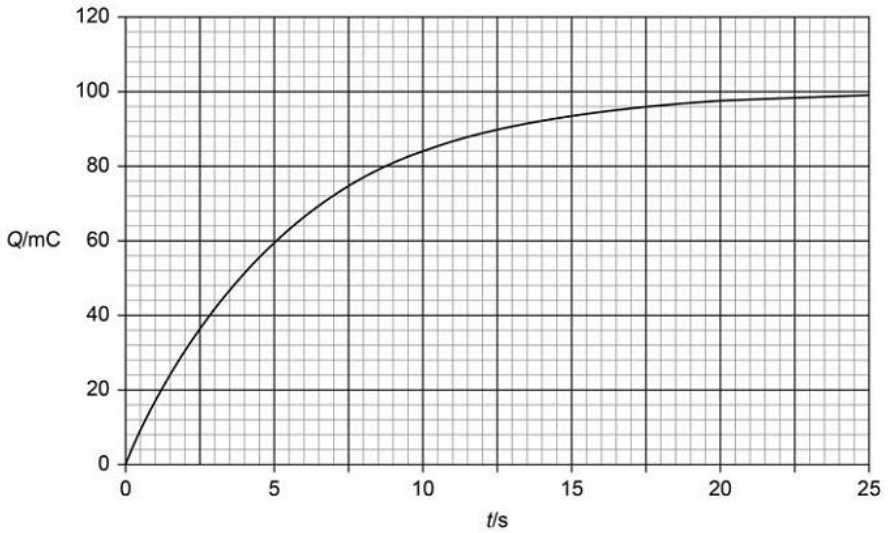
<u>Section B:</u> Answer all the questions in this section in the space provided.

16. (a) Explain briefly the mechanism of charging a parallel plate capacitor. [2]

(b) Figure below shows a circuit that is used in a defibrillator in which a short pulse of charge is used to revive a patient who suffers a cardiac arrest in which their heart stops beating.



The graph below shows how the charge on the capacitor varies with time when the capacitor is charging.

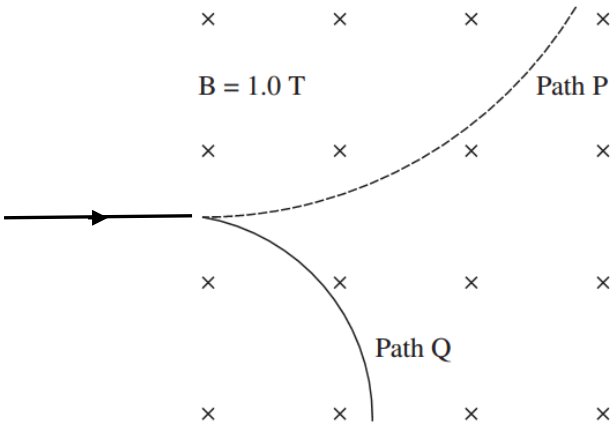


(i) Determine the emf of the power supply. [2]

(ii) Calculate the maximum energy stored in the capacitor. [2]

(iii) Determine the energy it delivers to the heart in first 6.0 ms during discharge. [2]

17. The diagram shows the paths taken by two moving charged particles when they enter a region of uniform magnetic field of 1.0 T perpendicularly with the same velocity of 2.0×10^6 m s^{-1}.



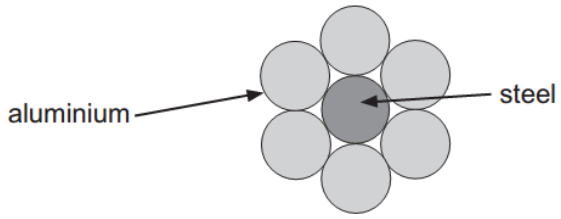
(a) Determine the types of charge (positive or negative) of the particles. [2]

(b) Given the radius of curvature of the path P is 4.15 cm and the mass of particle P is 6.64×10^{-27} kg, determine the charge of particle P. [2]

(c) Determine the magnitude and direction of an electric field which should be applied to the region so that both particles will travel through the region without any deflection. [3]

Section C : Answer **any two questions only** from this section on answer sheets.

18. (a) A cable used in high-voltage power transmission consists of six aluminium wires surrounding a steel wire. A cross-section is shown in diagram below.



The resistance of a length of 1.0 km of the steel wire is 3.3 Ω. The resistance of a length of 1.0 km of **one** of the aluminium wires is 1.1 Ω. The steel wire has a diameter of 7.4 mm.

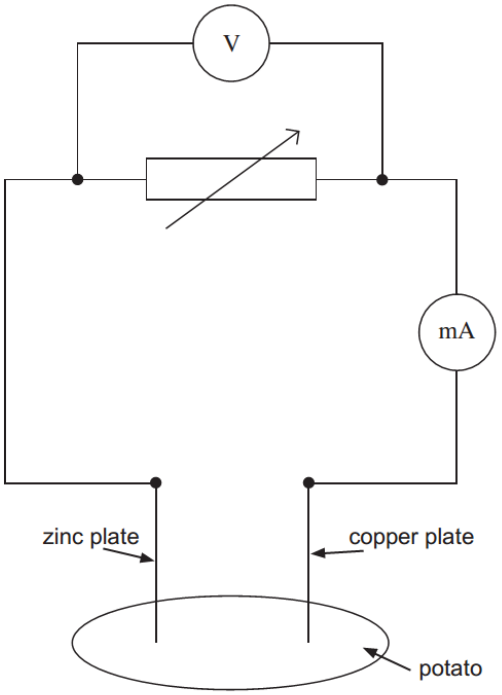
(i) Calculate the resistivity of steel. [3]

(ii) Explain why only a small percentage of the total current in the cable passes through the steel wire. [2]

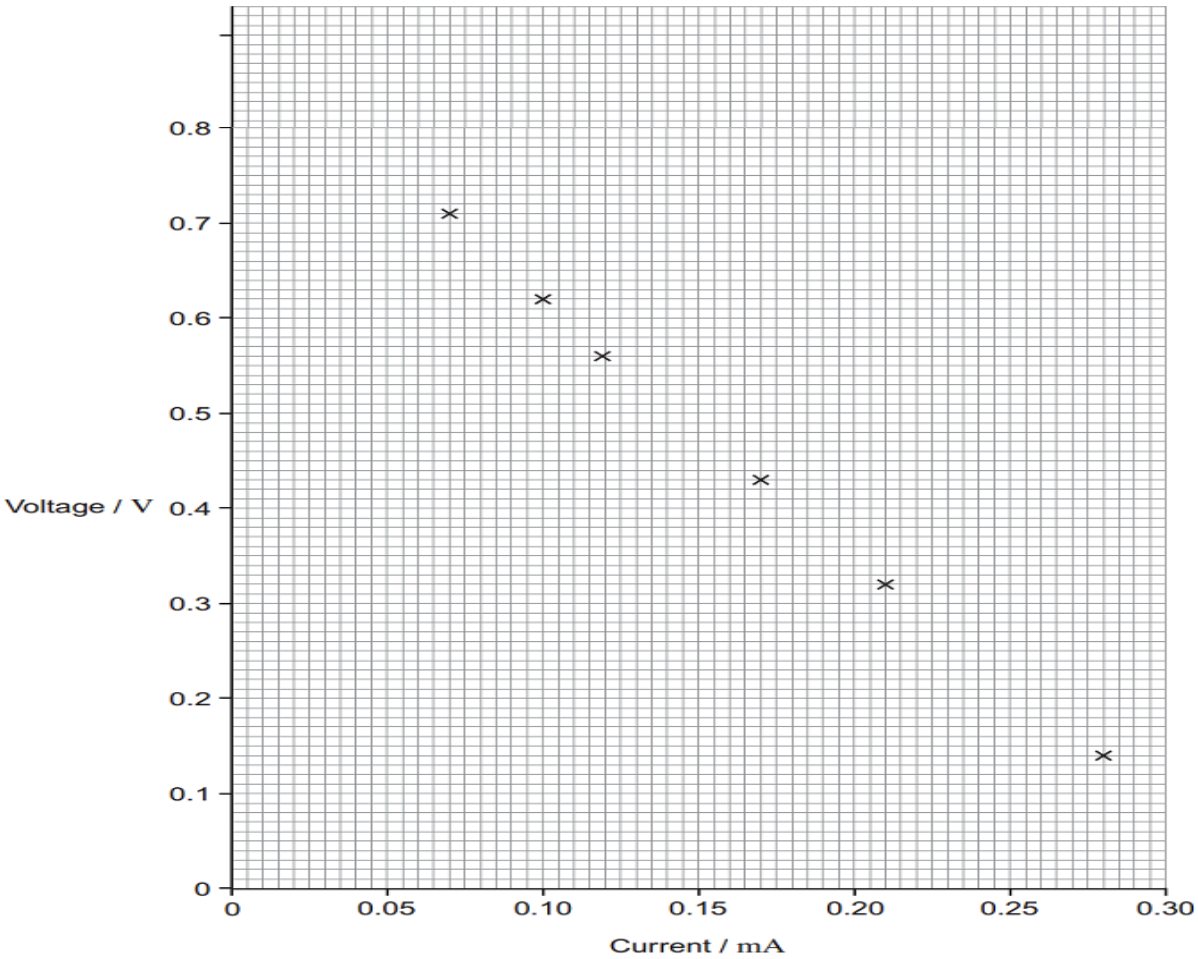
(iii) The potential difference across a length of 1.0 km of the cable is 75 V. Calculate the total power loss for a 1.0 km length of cable [3]

(iv) State one way to reduce the power loss in the cable. [1]

(b) A ‘potato cell’ is formed by inserting a copper plate and a zinc plate into a potato. The circuit shown below is used in an investigation to determine the electromotive force and internal resistance of the potato cell.



The plotted points on the graph below show the data for current and voltage that were obtained in the investigation.



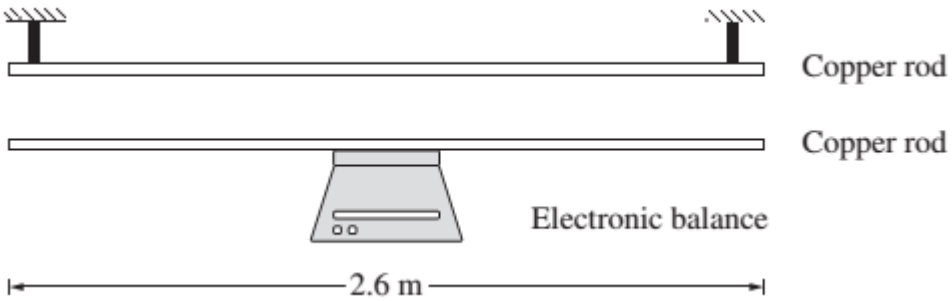
(i) Write an equation to show the relationship between the voltage V and the current I. [1]

(ii) From the graph above, determine the emf of the pototo cell. [1]
(iii) Determine the internal resistance of the cell. [2]
(iv) A student decides to use two potato cells in series as a power supply for a light emitting diode (LED). In order for the LED to work as required, it needs a voltage of at least 1.6 V and a current of 20 mA. Explain whether the LED will work as required. [2]

19. (a) (i) Explain the existence of force between two long straight parallel wires which carry currents I_1 and I_2 in the same direction when separated at distance r apart. [2]
(ii) State whether the force is attraction or repulsion. [1]
(iii) Derive an expression for the force per unit force on each wire. [3]

(b) (i) Define the unit Ampere. [2]
(ii)From the definition of Ampere, deduce the value of the permeability of vacuum. [1]

(c) A balance was used to investigate the relationship between current and force. The balance was set up with one copper rod fixed to it and a second rod fixed above it, as shown in the diagram below. Each rod was connected to a source of current. The diagram is not to scale.



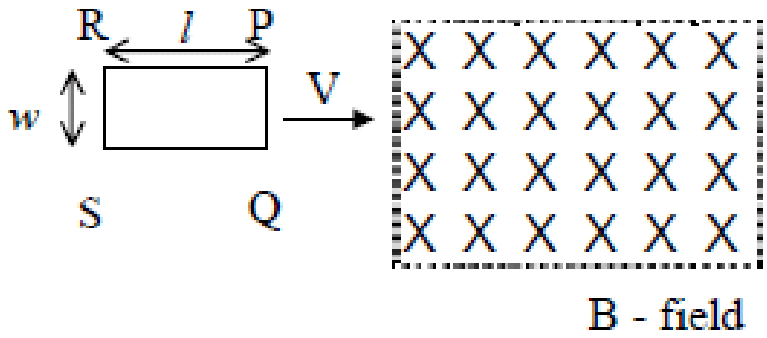
The copper rods were rigid, each was 2.6 m long, and they were parallel. The current in the upper rod was kept constant at 50 A. Different currents were passed through the lower rod and the balance reading recorded for each current. The readings are given in the table below.

Current in lower rod (A)	*Balance reading* (kg)
2.8	0.5485
8.0	0.5480
12.2	0.5474
16.8	0.5470
20.0	0.5465

(i) State the relative directions of the currents in both rods. [1]
(ii) Plot a graph of the balance reading against the current in the lower rod. [2]
(iii) Determine the mass of the copper rod on the balance. [1]
(iv) Determine the distance between the copper rods. [2]

20. (a) State the laws of electromagnetic induction. [2]

(b) The resistance of a rectangular conducting coil of size 20 cm (w) by 50 cm (l) is 5.0 Ω. The coil moves at a constant speed v into a region of uniform magnetic field of 1.5 T as shown in the diagram below. It is given that v = 2.00 ms^{-1} and the length of the region with magnetic field is 2.00 m.



(i) What is the magnetic flux linkage Φ of the coil when a length x of the coil has entered the region of uniform magnetic field? [2]

(ii) Find the magnitude and direction of the current induced in the coil when it is entering the magnetic field. [4]

(iii) What should be the external force applied to maintain the uniform speed of the coil when it is entering the magnetic field? [2]

(iv) Calculate the total work done to move the coil through the region with magnetic field and state the energy conversion. [3]

(v) State with brief explanation whether there would be any induced current flowing in the coil when the entire coil is moving in the uniform magnetic field. [2]

960 PHYSICS
Values of constants

Acceleration of free fall	g	=	$9.81\ \text{m s}^{-2}$
Avogadro's constant	N_A	=	$6.02 \times 10^{23}\ \text{mol}^{-1}$
Boltzmann's constant	k, k_B	=	$1.38 \times 10^{-23}\ \text{J K}^{-1}$
Gravitational constant	G	=	$6.67 \times 10^{-11}\ \text{N m}^2\ \text{kg}^{-2}$
Magnitude of electronic charge	e	=	$1.60 \times 10^{-19}\ \text{C}$
Mass of the Earth	M_E	=	$5.97 \times 10^{24}\ \text{kg}$
Mass of the Sun	M_S	=	$1.99 \times 10^{30}\ \text{kg}$
Molar gas constant	R	=	$8.31\ \text{J K}^{-1}\ \text{mol}^{-1}$
Permeability of free space	μ_0	=	$4\pi \times 10^{-7}\ \text{H m}^{-1}$
Permittivity of free space	ε_0	=	$8.85 \times 10^{-12}\ \text{F m}^{-1}$
		=	$\left(\frac{1}{36\pi}\right) \times 10^{-9}\ \text{F m}^{-1}$
Planck's constant	h	=	$6.63 \times 10^{-34}\ \text{J s}$
Radius of the Earth	R_E	=	$6.38 \times 10^{6}\ \text{m}$
Radius of the Sun	R_S	=	$6.96 \times 10^{8}\ \text{m}$
Rest mass of electron	m_e	=	$9.11 \times 10^{-31}\ \text{kg}$
Rest mass of proton	m_p	=	$1.67 \times 10^{-27}\ \text{kg}$
Speed of light in free space	c	=	$3.00 \times 10^{8}\ \text{m s}^{-1}$
Stefan-Boltzmann constant	σ	=	$5.67 \times 10^{-8}\ \text{W m}^{-2}\ \text{K}^{-4}$
Unified atomic mass unit	u	=	$1.66 \times 10^{-27}\ \text{kg}$