MARKING SCHEME

MOMALICHE JOINT EXAMINATION

CONFIDENTIAL

232/2

PHYSICS PAPER 2

Name.....**Class**.....**Adm**.....

Candidate's signature.....**Date**.....**INDEX NO:**.....

Instructions to candidates:

(a) Write your name, index number in the spaces provided above.
(b) Sign and write the date of the examination in the spaces provided.
*(c) This paper consists of **TWO** Sections: **A** and **B**.*
*(d) Answer **ALL** the questions in section **A** and **B** in the spaces provided.*
*(e) All working **MUST** be clearly shown.*
(f) KNEC mathematical tables and silent non-programmable electronic calculators may be used.
(g) This paper consists of 12 printed pages.
(h) Candidate should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
(i) Candidates should answer the questions in English.

For Examiners Use Only

Section	Question	Maximum score	Candidate's score
A	1 – 12	25	
B	13	09	
	14	15	
	15	15	
	16	9	
	17	07	
	TOTAL SCORE	80	

M/ Scheme

SECTION A (25 MARKS)

Answer All the questions in this section in the spaces provided

1. **Figure 1** shows the path of a ray of light after striking two mirrors at an angle. Determine the angle between the two mirrors. **(Show your working)** **(1 mark)**

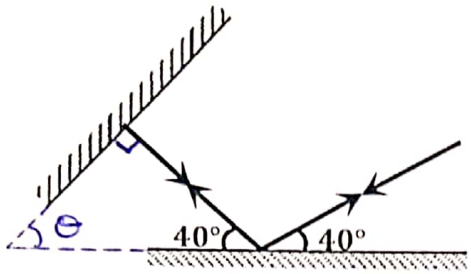

Figure 1

$\theta = 180 - (40+90)$

$\theta = 50^\circ$ ✓1

2. Polarization is a defect of a primary cell.
   (a) Define polarization **(1 mark)**

Accumulation of hydrogen gas bubbles around the copper plate (positive plate) ✓1

   (b) State the other defect. **(1 mark)**

Local action ✓1

3. Determine the time it will take a ray of light to traverse a transparent glass block of length 20 *cm* given that the velocity of light in air is $3.0 \times 10^8 ms^{-1}$. (Take the absolute refractive index of glass as 1.5) **(3 marks)**

$n = \frac{c}{v}$

$1.5 = \frac{3.0 \times 10^8}{v}$ ✓1

$v = 2 \times 10^8$ m/s ✓1

$t = \frac{d}{v} = \frac{0.2}{2 \times 10^8}$

$t = 1.0 \times 10^{-9}$ s ✓1

4. State one other factor that increases the speed of sound in solid a part from increase in temperature. **(1 mark)**

~~Density of the solid.~~

Increase in density ✓1

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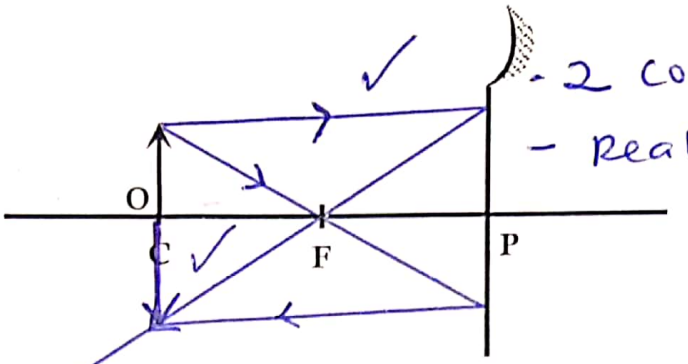
5. **Figure 2** shows an object placed at the center of curvature of a concave mirror. Draw a ray diagram to show how the image of the object is formed by the mirror.

(2 marks)



- 2 correct rays ✓
- Real inverted image & its position. ✓

Figure 2

6. A charge of 240 μC flows through a conductor of resistance 4 $k\Omega$ in 2 *minutes*. Determine the work done to move the charge through the conductor. **(3 marks)**

$W = I^2Rt = \left(\frac{Q}{t}\right)^2 \times R \times t$ ✓

$W = \frac{(240 \times 10^{-6})^2 \times 4000}{2 \times 60}$ ✓

$W = 1.92 \times 10^{-6}$ J ✓

(3)

7. State the reason why radio signals have clear reception than television signals in area that is surrounded by hills. **(1 mark)**

Radio signals are transmitted by longer wavelength radio waves which are easily ✓ diffracted over the hills than shorter wavelength Radio waves used to transmit TV signals.

8. A physics student dipped a bar magnet into iron fillings during an experiment in the lab. When the student lifted the bar magnet, the distribution of iron fillings around the bar magnet was as shown in **Figure 4**.

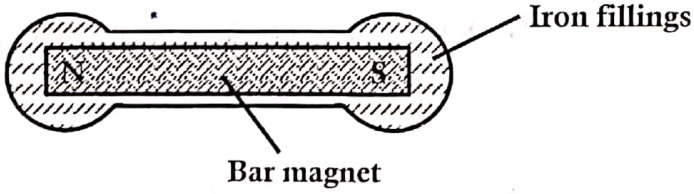


Figure 4

State the conclusion the student made. **(1 mark)**

Magnetic attractive forces ✓ is strongest at the poles

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9. **Figure 3** shows a copper rod AB lying across two metal rods L and M which are fixed onto a plastic support and also connected to a battery.

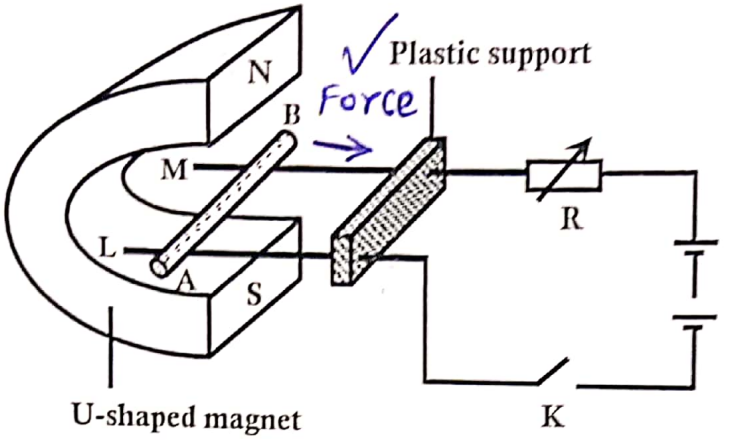

Figure 3

(i) Indicate on the diagram the direction of force experienced on the copper rod AB.

(1 mark)

(iii)State the direction of force on copper rod AB if the direction of both current and magnetic field are reversed simultaneously.

(1 mark)

Direction of force remains unchanged. Moves towards the plastic support.

(iv)State one way of increasing the force on the copper rod AB.

(1 mark)

- Increasing the amount of current.
- Using a stronger magnet.

10. State one advantage and one disadvantage of using a convex mirror ~~as a driving~~ over a plane mirror.

(2 marks)

Advantage:

Gives upright images regardless of the object distances.

Disadvantage: wide field of view

Gives diminished images giving a false impression that the object behind is far.

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11. Give a reason why a pinhole camera forms a blurred image of an object in front of it if the diameter of the pinhole is reduced to less than 1.00 *mm*. **(1 mark)**

Light is diffracted as it passes through the pinhole hence forming many overlapping images on the screen ✓

12. **Figure 5** below shows a ferromagnetic material PQ being magnetized.

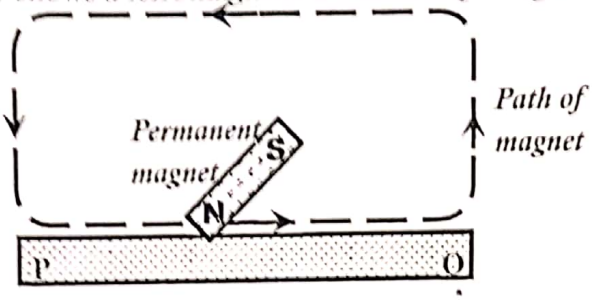


Figure 5

Touching method

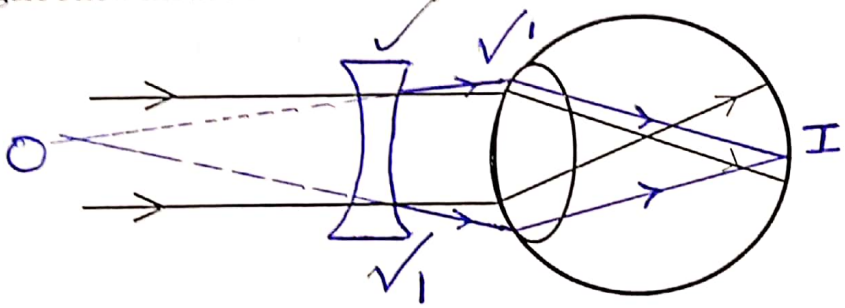
(a) (I)State the method of magnetization being used. **(1 mark)**

Single stroke method.

(II)State the pole acquired at P. **(1 mark)**

North pole.

(b) The figure below shows how a distant object is focused in a defective eye.



√1 √1

i) State the nature of the defect. (1mark)

Myopia ✓ Short Sightedness.

ii) On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of the lens. (2 marks)

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SECTION B (55 MARKS)

Answer All the questions in this section in the spaces provided.

13. (a) When current flows through a coil of nichrome wire in an electrical circuit, the wire becomes very hot.

(i) Give a reason why the nichrome wire becomes very hot. **(1 mark)**

Electrical energy is converted to ~~hit~~ heat by nichrome wire. - The kinetic energy of electrons is converted to heat energy as they collide with atoms in the wire.

(ii) Give a reason why heat is produced only across nichrome wire and not across other devices in the circuit. **(1 mark)**

Nichrome wire has higher resistance than the other devices hence more electrical energy is converted to heat energy.

(iii) State one factor that determines the amount of electrical energy converted to heat energy by nichrome wire. **(1 mark)**

- Time taken for current to flow
- Resistance of wire.
- Amount of current flowing through the wire.

(b) **Figure 6** shows a workman using a cordless electric drill.

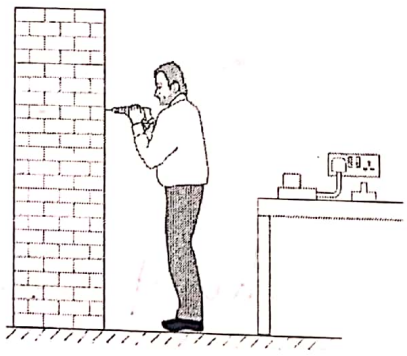

Figure 6

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The motor of the drill is powered by a rechargeable battery with an e.m.f. of 23 V. When the drill is used, the power supplied to the motor is 550 W. The workman uses the drill for 1 hour and 30 minutes. Calculate;

(i) The electrical energy supplied to the motor. ✓ **(3 marks)** (3)

$E = Pt$ ✓ $= 550 \times 90 \times 60$

$= 2.97 \times 10^{6}$ J ✓

(ii) The charge that the battery supplies. **(3 marks)** (3)

$W = QV$ | $\frac{2.97 \times 10^{6}}{23}$ ✓ | $Q = 1.291 \times 10^{5}$ C ✓

$Q = \frac{W}{V}$ ✓

14. (a) (i) Distinguish between a transverse wave and a longitudinal wave. **(1 mark)**

Transverse wave is a wave whose displacement of particle is perpendicular to the direction of wave motion while longitudinal wave is a wave whose displacement of particles is parallel to the direction of wave motion. ✓

(ii) State one example of a transverse wave and a longitudinal wave. **(2 marks)**

Transverse wave: Any electromagnetic wave ✓ like light

Longitudinal wave: sound waves ✓ (2)

(b) **Figure 7 (a)** shows a wave profile for a pendulum bob X released from point P and allowed to swing through Q to R and back a number of times as shown in **Figure 7 (b)**.

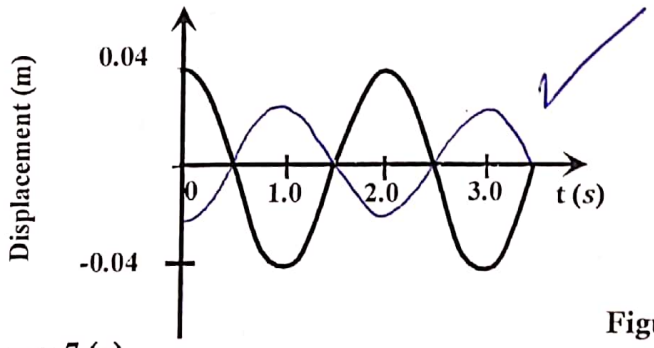

Figure 7 (a)

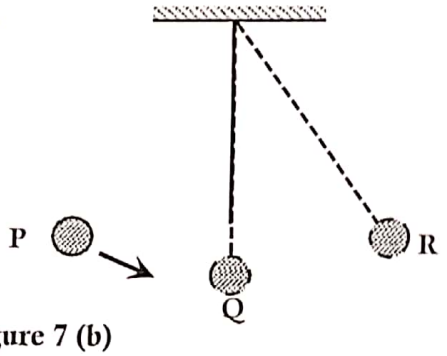

Figure 7 (b)

- Showing $\frac{1}{2}$ amplitude.
- Showing out of phase.

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(i) Determine the amplitude of the wave. (1) **(1 mark)**

0.04m ✓

(ii) Calculate the frequency of the wave. **(3 marks)**

$f = \frac{1}{T}$ ✓ | $f = \frac{1}{2}$ ✓ $= 0.5\,Hz$ ✓ (3)

(iii) Sketch a wave profile on the same axes for a similar pendulum bob Y released from point R and oscillating on its own path through Q to P and back a number of times at the same frequency but with half-amplitude as the pendulum bob X.

(2 marks)

(c) In an experiment to observe the interference of light waves, a double slit was placed close to the source of monochromatic light as shown in **Figure 8**.

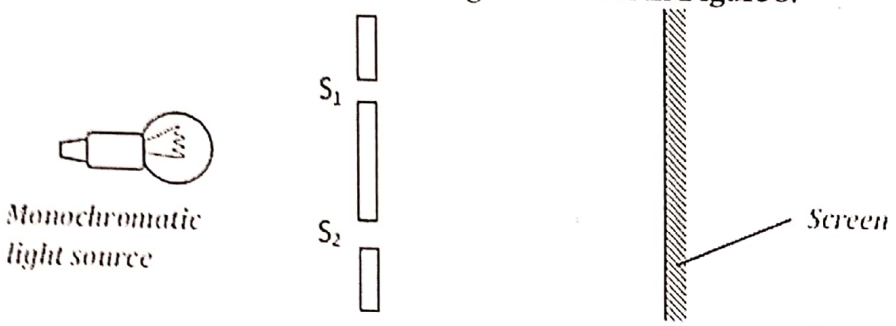

Figure 8

(i) State one condition for interference to occur. **(1 mark)**

The two waves must be coherent ✓

(ii) State the function of the double slit. **(1 mark)**

Acts as coherent sources of light. ✓

(iii) State the observation made on the screen. **(1 mark)**

Alternate bright and dark fringes are seen on the screen. ✓

(iv) Explain the observation made on the screen. **(2 marks)**

~~The angle of~~ Bright fringes are formed when two light waves in phase undergo constructive interference ✓ while dark ~~fringes are formed~~ when two light waves out of phase undergo destructive interference ✓

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(v) State what would happen if the monochromatic light source was replaced with white light source. **(1 mark)** ①

Interference pattern would disappear. ✓
Reject: No interference occur.

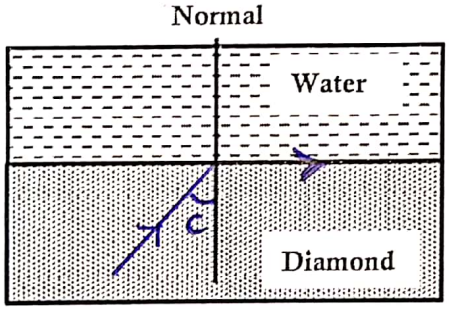
15. (a) Define critical angle. **(1 mark)**

Angle of incidence in the optically denser medium for which the angle of refraction in optically less dense medium is 90°. ✓

(b) There are two conditions necessary for total internal reflection to occur. One is that the ray of light must be moving from an optically denser medium to a rarer medium. State the other condition. **(1 mark)**

Angle of incidence in the optically denser medium must be greater than critical angle. ✓

(c) **Figure 9** shows the interface between water and diamond.



Correct path of ray showing angle C ✓ ✓

Figure 9

(i) Draw on the figure a ray diagram to illustrate the critical angle C. **(2 marks)**
(ii) Calculate the critical angle C given that $n = \frac{4}{3}$ and $\mu = 2.42$. **(3 marks)**

$_{w}n_{d} = \frac{n_d}{n_w}$

$= \frac{2.42}{\frac{4}{3}}$

$_{a}w_{n_d} = 1.815$ ✓

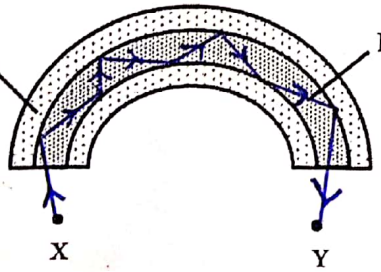
$\sin C = \frac{1}{n}$

$\sin C = \frac{1}{1.815}$

$C = \sin^{-1}(0.5510)$

$C = 33.43^{\circ}$ ✓

(d) **Figure 10** shows a small piece of an optical fibre cable.



✓ complete path

Figure 10

- optical fibre.
- They are secure since the information on transit cannot be tapped.

(i)State which material has a higher refractive index. **(1 mark)**

Material B ✓ (1)

(ii)A ray of light enters the optical fibre at X and emerges from Y.

I. Sketch the path of the ray through the optical fibre. **(1 mark)**

II. State the reason why light travels through the fibre as in (I) above. **(1 mark)**

Light undergoes repeated total internal reflection ✓

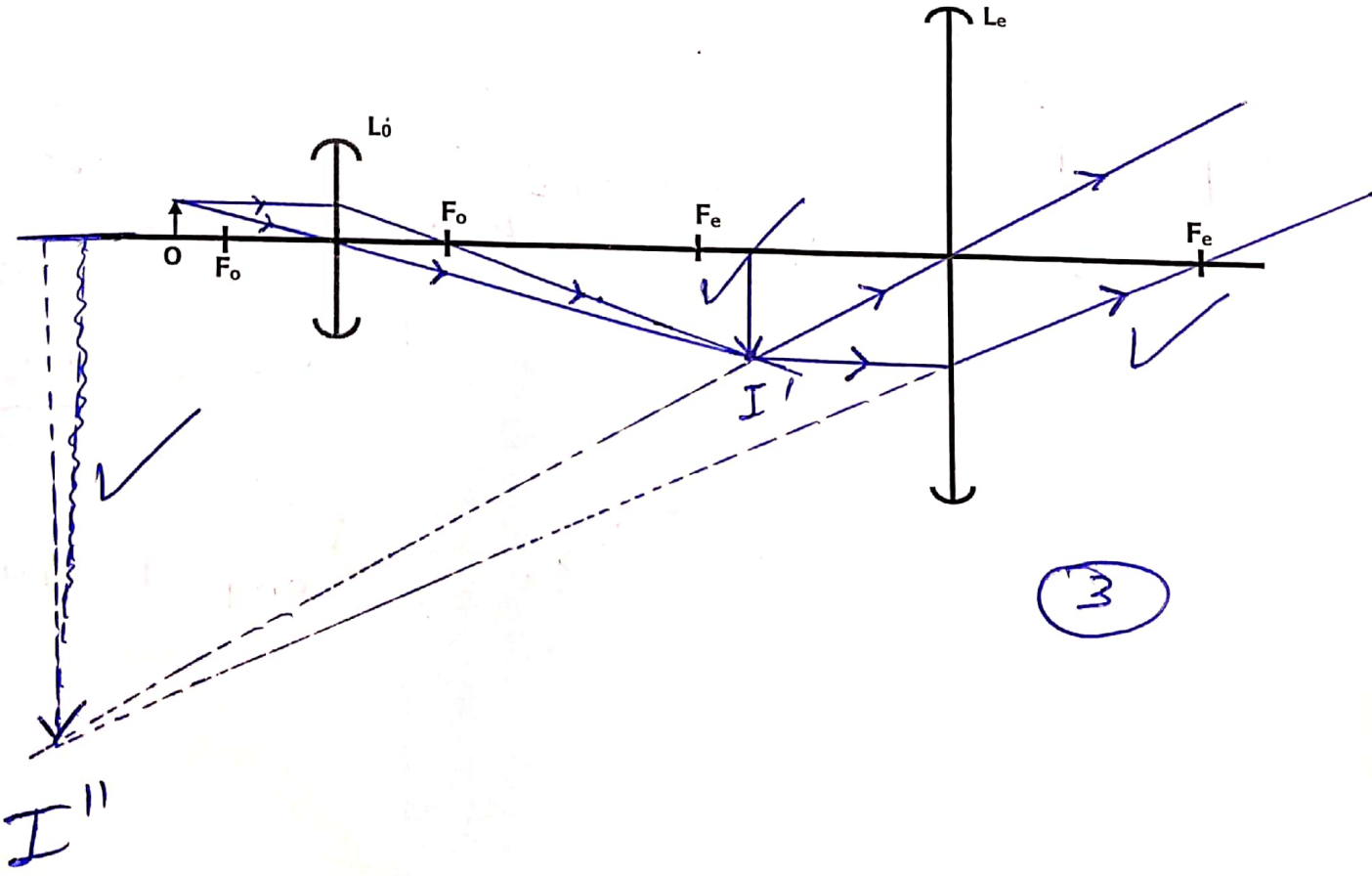
(iii) State one advantage of optical fibre over conventional copper cables as used in telecommunication. **(1 mark)**

- Have a higher carrying capacity ✓
- They a lighter and thinner than copper cables hence easy to install.

(iv)Apart from its use in telecommunication, state any other application of optical fibre cable. **(1 mark)** ✓

Used in medicine to view internal organs of the body as with the endoscope.

(e) The diagram shows an arrangement of lenses, L_o and L_e used in a compound microscope F_0 and F_e principal foci of L_0 and L_e respectively. Draw the rays to show how the final image is formed in the microscope. **(3 marks)**



(3)

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16.(a) Define electromotive force (e.m.f) of a cell. (1 mark)

e.m.f is the voltage across the terminals of a cell in an open circuit (i.e when the cell is not supplying current) ✓ ①

(b) **Figure 11** shows ammeters, resistors and a voltmeter connected to a battery of e.m.f E and internal resistance r of 0.25 Ω. The reading of ammeter A_2 is 2.0 A.

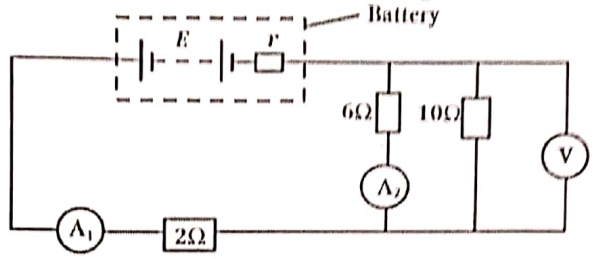

Figure 11

Calculate the;

(i) Total resistance of the circuit. (3 marks)

$R_T = r + R_1 + \frac{R_2 R_3}{R_2 + R_3}$ ✓

$R_T = 0.25 + 2 + \frac{6 \times 10}{6+10}$ ✓

$R_T = 0.25 + 2 + 3.75$

$R_T = 6\ \Omega$ ✓

(ii) Voltmeter reading. (3 marks)

$V = IR$ ✓

2×6 ✓

$12\ V$ ✓

(iii) Reading of ammeter A_1. (2 mark)

$I_{10\Omega} = \frac{12}{10} = 1.2\ A$

Total current $= 2.0 + 1.2$ ✓

$3.2\ A$ ✓ ✗

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(iv)e.m.f, E of the battery. **(2 marks)**

$E = I(R+r)$ ✓

$E = 3.2 \times 6$

$E = 19.2\,V$ ✓ (2)

17 (a) Define capacitance of a capacitor. **(1 mark)**

is the charge stored per ✓ unit voltage. (1)

(b) **Figure 12** shows three capacitors connected to a battery of voltage 12 V.

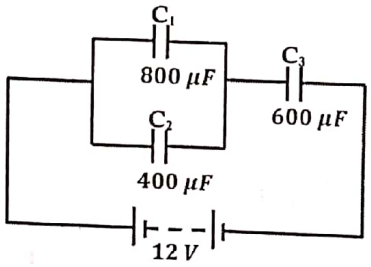

Figure 12

600 μF

(i) Calculate the effective capacitance of the arrangement. **(2 marks)**

Parallel Combination

$800 + 400 = 1200\,\mu F$ ✓

$C_T = \frac{1200 \times 600}{1200 + 600}$ ✓

$C_T = 400\,\mu F$ (2)

(ii) Calculate the charge on the 6 μF capacitor. **(2 marks)**

600 μF

$Q = C_T V$ ✓

$= 400 \times 10^{-6} \times 12$ ✓

$4800\,\mu C$ ✓

or $4.8 \times 10^{-3}\,C$ (3)

(c) The conductors A and B in **Figure 13** are positively charged and each placed on insulating stands. Show the distribution of charges on conductors A and B. **(2 marks)**

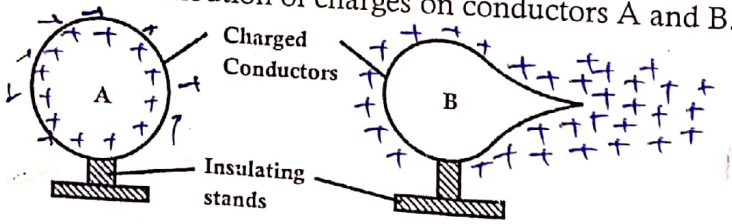

Figure 13

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