232/2
PHYSICS
PAPER 2
JULY 2017
2½ HOURS

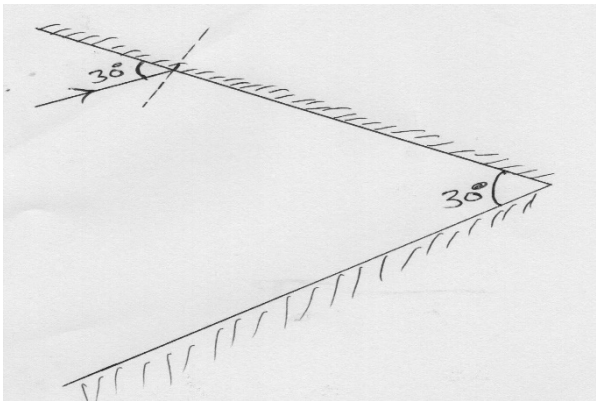
END OF TERM II EXAMINATION
MARKING SHEME

232/2
PHYSICS
PAPER 2

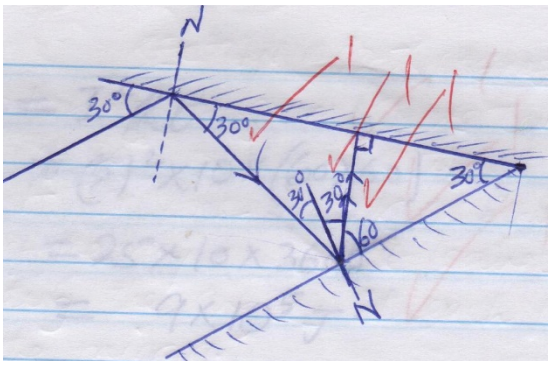
SECTION A (25 Marks)

Answer all the questions in this section in the spaces provided

1. The following diagram alongside shows two mirrors at an angle of 30° to each other. A ray of light is incident on one mirror at 30^0 as shown. Sketch the path of the ray until it leaves the mirrors indicating the angles at each point of contact with the mirrors. (3mks)

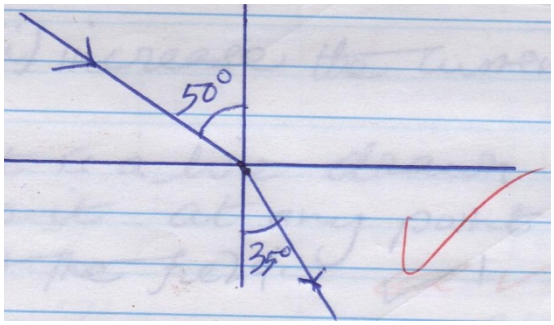


ANS:



2. A ray of right passes from air into a certain liquid at an angle of 50^0 to the normal. The ray is refracted such that the angle of refraction is 35^0 as it enters the liquid. Calculate the refractive index of the liquid. (3mks)

ANS:



$$\frac{\sin i}{\sin r} = \eta$$

$$\eta = \frac{\sin 50^0}{\sin 35^0}$$

$$= \frac{0.7660}{0.5736}$$

$$= 1.34$$

3. State the necessary conditions for total internal reflection to take place. (2mks)
   - Light must travel from a denser medium to a less dense one.
   - The angle of incidence must be greater than the critical angle.
4. A wire of resistance 27Ω is cut into three equal lengths. If the three wires are connected in parallel, determine the effective resistance. (2mks)

   ANS: $\frac{1}{R} = \frac{1}{9} + \frac{1}{9} + \frac{1}{9} = \frac{3}{9} = \frac{1}{3}$

   R = 3Ω
5. Explain briefly how a P-type semiconductor is made. (1mk)

   ANS: An intrinsic semiconductor is doped with a trivalent (a valency 3 element.)
6. A current of 5A is passed through a conductor whose resistance is 10Ω. How much energy is converted to heat in one hour (3mks)

   ANS: $E = I^2Rt$

   $= 5^2 \times 10 \times (60 \times 60)$

   $= 25 \times 10 \times 3600$

   $= 9 \times 10^5 J$
7. An electromagnet is made by winding insulated copper wire on an iron core. State two changes that could be made to increase the strength of the electromagnet. (2mks)
   - Increase in the number of turns.
   - Increase in the current in the coil.
8. Define the term 'line of force' as applied to magnetic fields. (1mk)

   ANS: It is a line drawn such that the tangent to it at any point gives the direction of the field.
9. A vibrator is sending out 8 ripples per second across a ripple tank. The ripples are observed to be 4cm apart. Calculate the velocity of the ripples. (2mks)

   ANS: f = 8Hz; λ = 0.04m.

   $V = f\lambda$

   $= 8 \times 0.04$

= 0.32m/s

10. Give a reason why x-rays but Not radio waves are used to detect fractured bones (1mk)

ANS: X – Rays have more penetration power than radio waves

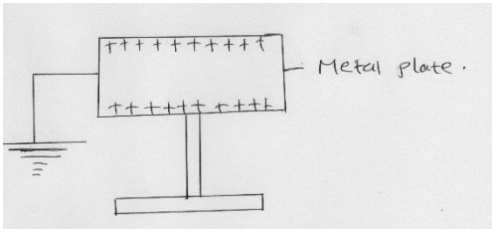
X – Rays have high frequency/ energy.

11. State two properties of cathode rays (2mks)

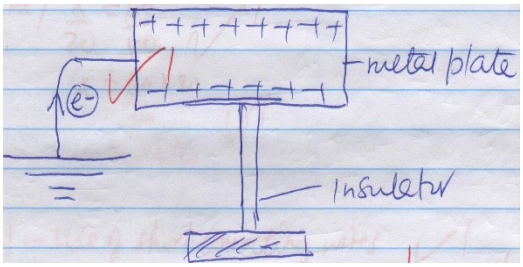
ANS:

- Travel in straight line.
- Charged.
- Deflected by magnetic and electric field.

12. The figure below shows a positively charged metal plate with an Earthing connection. Using an arrow, show the direction of charges through the earth connection and explain the final charge of the plate. (2mks)



ANS:

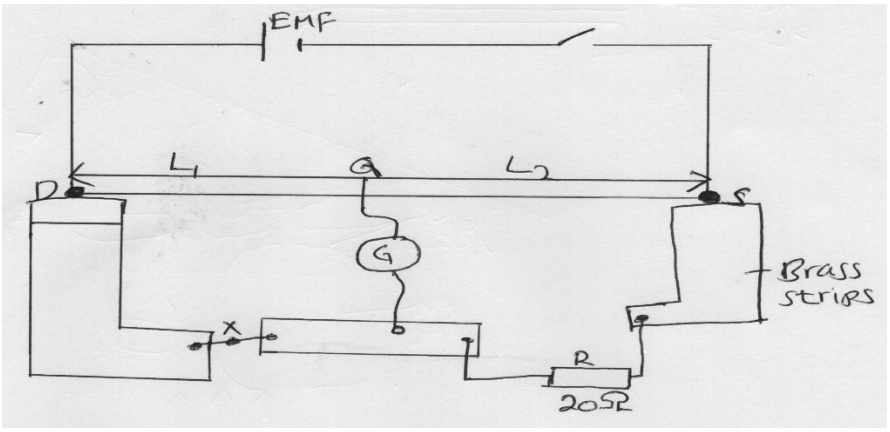


13. What is photoelectric effect? (1mk)

ANS: It is the emission of electrons from the surface of a metal when illuminated with electromagnetic radiation of sufficient frequency.

SECTION B (55Mks)

14. a) The diagram below represents a metre bridge used to determine the resistance of an electrical component x



From the diagram,

i) Explain why wide brass strips are used as terminals. (1mk)

ANS: To minimize resistance due to terminals.

ii) Explain why a cell of low e.m.f. is preferable. (1mk)

ANS: To minimize current and the resulting heating effect that would alter resistance.

iii) If null deflection was obtained when L_1 was 60.0cm. Calculate the resistance of component marked X. (2mks)

ANS: $\frac{x}{20}=\frac{60}{40}$

$x = \frac{60}{40} x\, 20$

$= 30\Omega$

iv) State three ways of ensuring that error are minimized during the experiment (3mks)

- Use of short connecting wires
- Use of a source with low emf.
- The value pf known resistance R should be comparable to x.

b) A uniform resistance wire of length 2.0m conducts a current of 0.25A when connected in series with a cell of e.m.f. 1.6V. How much current would be conducted if the wire is now cut into two equal lengths which are then arranged in parallel? (4 marks)

ANS: $R = \frac{v}{A} = \frac{1.6}{0.25} = 6.4\Omega$

Resistance of each piece $= \frac{6.4}{2} = 3.2\,\Omega$

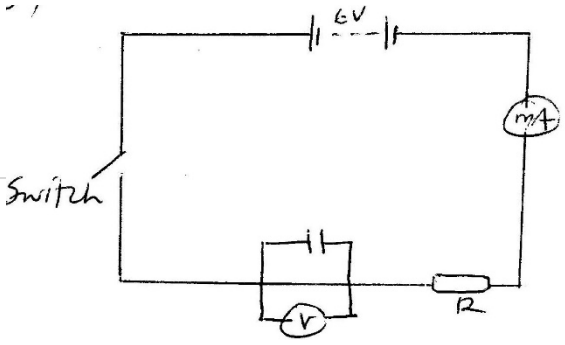
$R_T = \frac{R_1 R_2}{R_1 + R_2} = \frac{3.2\,x\,3.2}{3.2+3.2} = 1.6$

$I = \frac{V}{R} = \frac{1.6}{1.6} = 1A$

15. a) The distance of separation between the plates of a certain capacitor is reduced. State how this affects the capacitance of the capacitor. (1mk)

ANS: Capacitance increases.

b) You are provided with the following apparatus used for studying charging of a capacitor; an uncharged capacitor, voltmeter, milliameter, 6v battery, connecting wires, a switch and a load resistor R. (1mk)



i) Draw a circuit diagram that can be used to charge the capacitor. (2mks)

ANS:

ii) Use the circuit diagram drawn above to explain how the capacitor gets charged. (2mks)

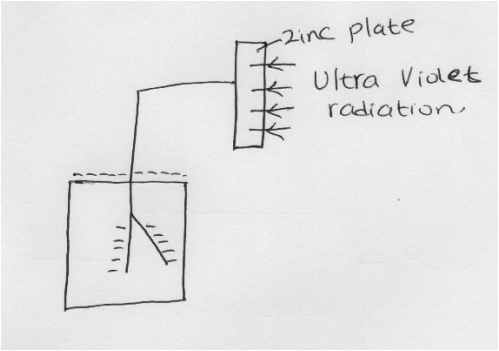
ANS:

- Negative charges flow from the negative terminal of the battery to the plate of the capacitor.
- Negative charges flow from the other plate of the capacitor to the positive terminal of the cell.
- Hence equal positive and negative charges gather on the plates opposing further flow of electrons when fully charged OR p.d across the plates is equal to that of the battery.

iii) State the purpose of resistors R. (1mk)

ANS: To slow down the charging process so that current and voltage are observed.

c) The zinc plate shown below is connected to a negatively charged electroscope and is exposed to ultra violet radiation.



i) Explain what happens to the leaf of the charged electroscope. (3mks)

ANS: The leaf falls.

When U.V falls on the zinc plate electrons are ejected/ photoelectric effect takes place.

The negative charges in the zinc plate and cap of the electroscope are repelled hence leaf falls

ii) If the same experiment is repeated using a positively charged electroscope, explain the observation (3mk)

ANS: There is no effect on the leaf of the electroscope.

The electrons liberated by the U.V light are attracted back by the positive charges on the zinc plate/cap of electroscope hence no effect on leaf divergence.

16. a) State one difference between transformers and an induction coil. (1mk)

ANS: A transformer uses alternative current while an induction coil uses interrupted direct current.

b) State two way through which energy is lost in a transformer. (2mks)

- Flux leakage.
- Eddy currents.
- Hysteris loss.
- Resistance of coil.

c) A transformer has 1000 turns in its secondary coil and 10 turns in its primary coil. An alternating current of 2.5A flows in the primary circuit when it is connected to a 12V a.c supply.

i) State the type of transformer (1mk)

ANS: Step up transformer.

ii) Calculate the power input to the transformer. (1mk)

ANS: $P = I_p \times V_p$

$= 2.5 \times 12$

$= 30w$

iii) Calculate the e.m.f across the secondary coil. (3mks)

ANS: $V_s = \frac{N_s}{N_p} x V_p$

$= \frac{1000}{10} \times 12$

$= 1200V$

iv) Determine the maximum current that could flow in a circuit connected to the secondary coil if the transformer if its 80% efficient. (Use the e.m.f in secondary as calculated in (iii) above). (3mks)

ANS: $P_s = \frac{80}{100} \times 30 = 24w$

$24 = I_s \times 1200$

$$I_s = \frac{24}{1200}$$

$= 0.02A$

v) In transmitting power, why is it necessary to step up voltage before transmission? Explain.

(2mks)

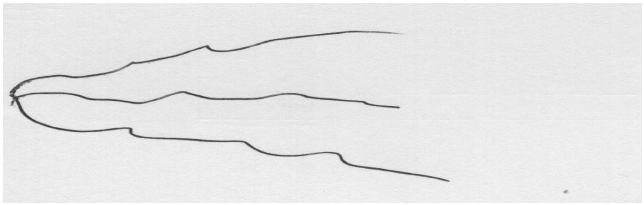
ANS:

- Minimizing energy losses.
- Stepping up lowers the current hence minimizing energy losses.

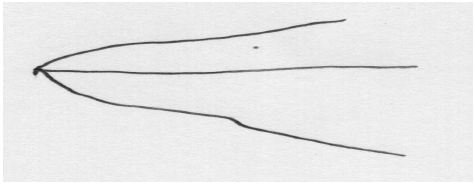
17. a) Define radioactivity. (1mk)

ANS: Disintegration of unstable nucleus.

b) Identify the radiations of tracks in the figures below. (2mks)

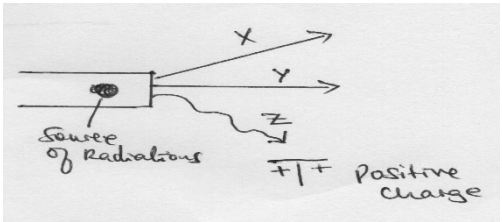
i) 

ANS: Beta (β) particles.

ii) 

ANS: Alpha (α) particles.

c) Identify radiations X and Y using the figure below. (2mks)



ANS: x – alpha (α) particles.

y – Gamma (γ) rays.

z – Beta (β) particle.

d) The following reaction is part of radioactive series.

$^{210}_{83}X$ h $^{210}_{84}Y$ α $^{C}_{b}Z$ ⟶ ⟶

Identify radiation h and find figures of b and c.

ANS: h – Beta (β) particles.

b = 82

c = 206

18. a) State Ohm's law. (2mks)

ANS: The current flowing through a metal conductor is proportional to the potential difference between its ends, provided the temperature and other physical conditions of the conductor remain constant.

b) State two factors that affect heating by electric current (2mks)

- Magnitude of current.
- Resistance of conductor.
- Length of time the current passes through the conductor.

c) Determine the power of a motor which has a p.d of 240v applied across it when a current of 0.30A passes through it. (2mks)

ANS: Power = VI
= 240 x 0.30
= 72w

d) Explain why a fuse is always connected to the line wire in an electrical appliance (1mk)

ANS: In case of an electrical fault, the fuse cuts of the circuit (no current flows)