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2009 Past GCE Advanced Level Paper 2

JUNE 2009

SECTION I (One hour)

Answer all questions

1. a) State the principle on which the optical fiber operates.
State any two uses of optical fiber
Draw a labeled diagram of an optical fiber and show on the diagram how a ray of light is transmitted through the optical fiber.

2. a) State the assumptions used in deriving the kinetic theory equation, $\frac{1}{3}\rho\bar{C}^2$where p is the pressure exerted by the particles, is the density of the gas and $\bar{C}^2$the root mean square velocity.

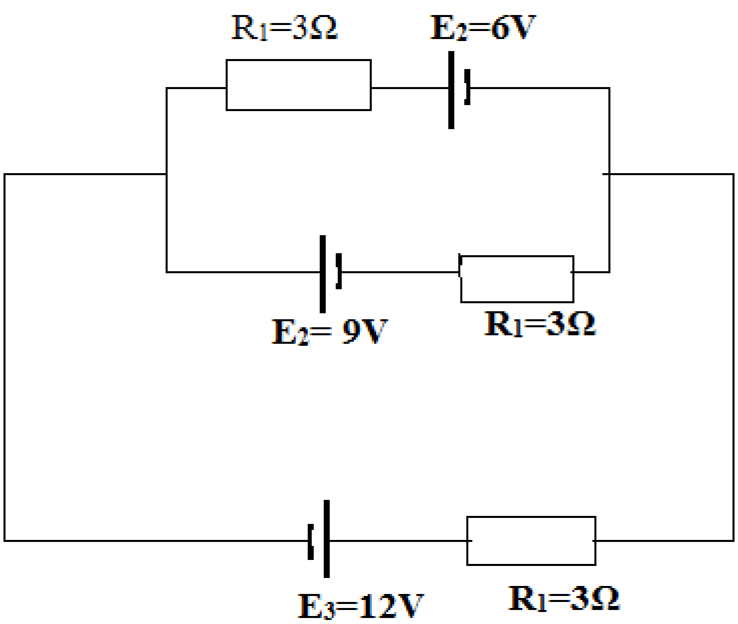


Figure 1

3.
Figure 1 is a circuit diagram showing how dc power sources (E_1, E2, and E3) are connected with loads of resistances R_1, R_2 and R_3
Calculate the currents through R_1, R2, and R3

5. Distinguish between solids liquids using

(a) Intermolecular forces
(b) Molecular motion
(c) Molecular arrangement
(d) Intermolecular spacing
(e) Bulk shape.

6. a) Draw two separate diagrams to show a p-n junction connected in the forward bias and reserved bias.
b) When a p-n junction diode is connected in a circuit and is reserved bias, there is a very small leakage current across the junction. Explain the source of this current. How does the size of this current depend on temperature of the diode?

7.A tennis player drives a ball at 60m s-1;100 to the horizontal and 50cm above a tennis court.

(a) Calculate the velocity at which the ball hits the court.
(b) Sketch the velocity – time graph for the velocity of the ball.

(i) on the values obtained.

SECTION II (One and a half hours)
Answer all questions

Answer either 8(a),(b)and(c) or 8(d),(e)(f)and(g)
Either 8(a),(b),and(c)
8.(a) Define simple harmonic motion
(b) Describe an experiment of measure acceleration of free fall, using a simple pendulum. Your description should include a diagram, procedure, precautions, observations and conclusion.
(c) A small mass M is attached to the free end of a coiled spring on a smooth table .the other end of the spring is fixed and the mass pulled through a distance of 8mm and then released. If the spring constant is 10N m^{-1}.
(i) Prove that the motion of the mass at the end of the sprint is simple harmonic
(ii) If the mass oscillates at frequency of 30 Hz. Calculate the value of M and the kinetic energy of the body when the extension is 3.0 mm.
(iii) State any assumption made in your calculations.

Or 8(d), (e),(f)and(g)
8. (d) Define specific heat capacity
(e) Describe an experiment to determine the specific heat capacity of a metal
Your description should include a diagram, procedure, precaution, observation and conclusions.
(f) An engine is used of raise an 800 kg block of iron at a speed of 6.7m s^{-1}. 0.5kg of glycerin initially at a room temperature of 23^0C is required every second to maintain the temperature of the engine bearing at θ. The power developed by the engine is 1.0 $\times 10^5$W. If the specific heat capacity of glycerin is 2.5 $\times 10^3$ J.Kg^{-1} k^{-1}. Calculate the value of θ
(g) A well lagged aluminum calorimeter of mass 80kg contains 150g of water and 100g of ice all at 0^0C. A heating coil rated 1.0kw is put in the calorimeter and the mixture stirred until its temperature is 33^0C.calculation how much ice is left one minute. State any assumption you have made.

Answer either 9a, b, c or 9, d, e, f
9a, b, c
9. a) Define the term resistivity.
b) The graph in figure 3 below shows how the resistance of a copper wire varies with its length at 20^0C

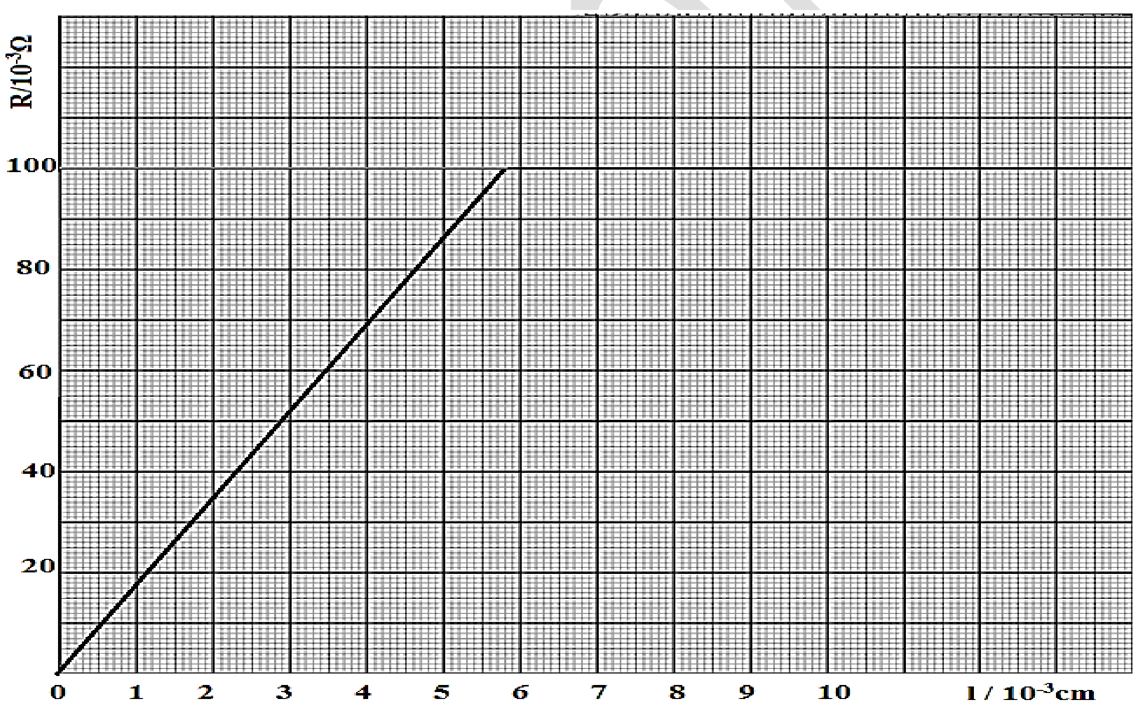


Figure 3

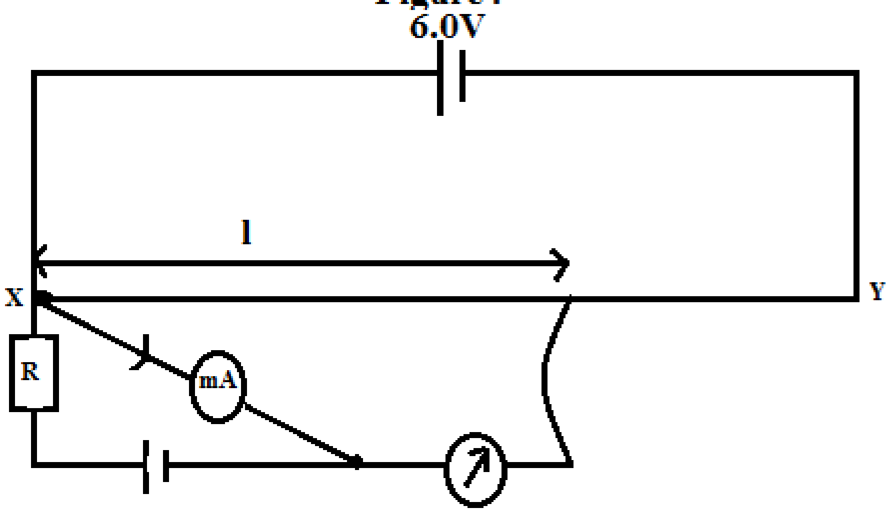
The wire has a thickness of 1.00mm. Use the graph to determine.
(i) The resistivity of the wire
(ii) The conductivity of copper wire. If the experiment were carried out at 30°C. How would this affect the conductivity of the copper wire?
(iii) The length of the copper wire that has a resistance of 56 mΩ
(a) A millimeter has a resistance of 10ohm and a full deflection of 10 m A. how would you convert it into

(i) An ammeter reading up to 10A
(ii) A voltmeter reading up to 10V.

Or 9d, e,f

9 d) state two conditions that must be satisfied for a balance to be obtained with a slide wire potentiometer

Figure4



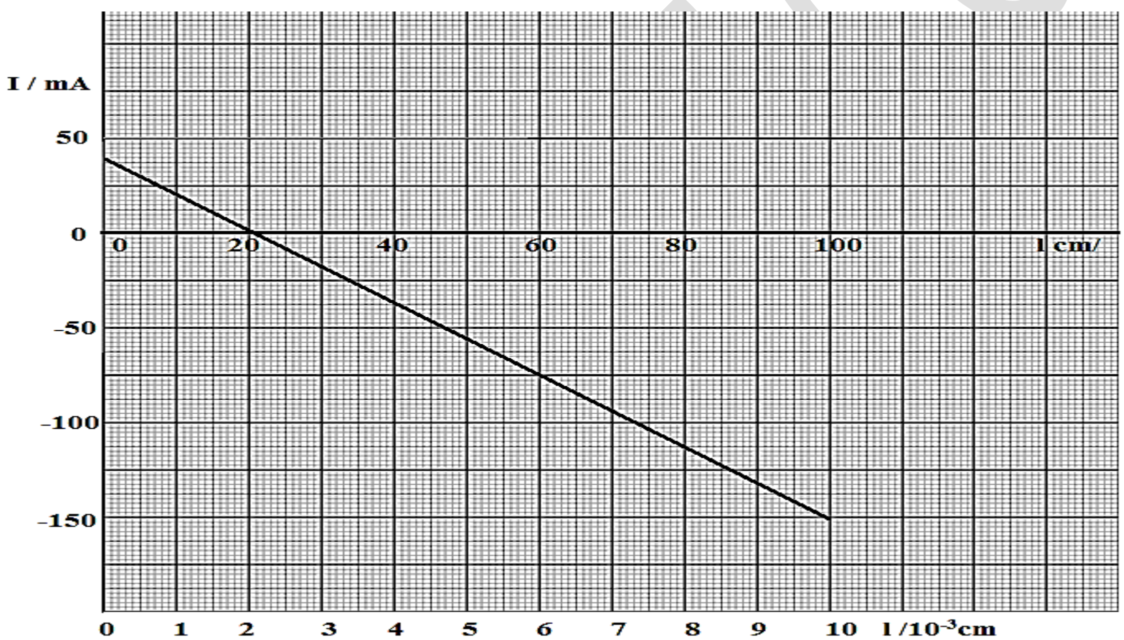


Figure 5

The circuit of figure 4 is used to obtain data from which a graph of current. I against balance length L, is drawn as in figure 5. The internal resistance of the cell is negligible.

(i) Explain why for different values of L , the current I can be positive, zero or negative
(ii) Using the graph, calculate the resistance of R. what assumption have you made in your calculations?
(iii) Hence, deduce the emf of the cell.

(b) The flux density between the poles of a powerful electromagnet if 2.5T. what is the force exerted on 15mm of wire carrying a current of 3.0A when the wire is
(i) At right angles to the field
(ii) Parallel to the field

(iii) At an angle of 30^0 to the field.

Answer either 10 a, b, c or 10, d and c either 10(a), (b) and(c)

a) A communication satellite revolves round the earth in a circular orbit at a height of 36.000 km above the earth's surface. Find the satellite's period of revolution in hours. Comment on the result.
b) Distinguish between electric and gravitational fields.
Or 10 d, and e

10. d) (i) Distinguish between photoelectric emission and thermionic emission

(ii) State four observations obtained from experiment on photoelectric emission.

(iii) Choose any two of the observations and account for them in terms of the quantum theory of light.

(c) The $^{212}_{84}P0$nucleus emits α particle when it decays.

(i) What is the significance of 212 and 84 in the $^{212}_{84}Po$.

(ii) Write out and complete the equation below representing this decay.

$$^{212}_{84}Po \rightarrow {}^{4}_{2}\alpha +$$

(iii) Calculate the energy that is emitted in the decay process of $^{212}_{84}Po$ in joules

Atomic mass: polonium =211.9890U

Alpha particle =4.0026U

Lead =207.9767U

IU = 931 MeV