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2008 Past GCE Advanced Level Paper 2

JUNE 2008

SECTION I (One hour)

Answer all questions in this section.

(a) Figure 1 shows a graph of image distance, v, versus magnification, m, for a convex lens.

(i) Use the graph to find a value for the focal length of the lens.

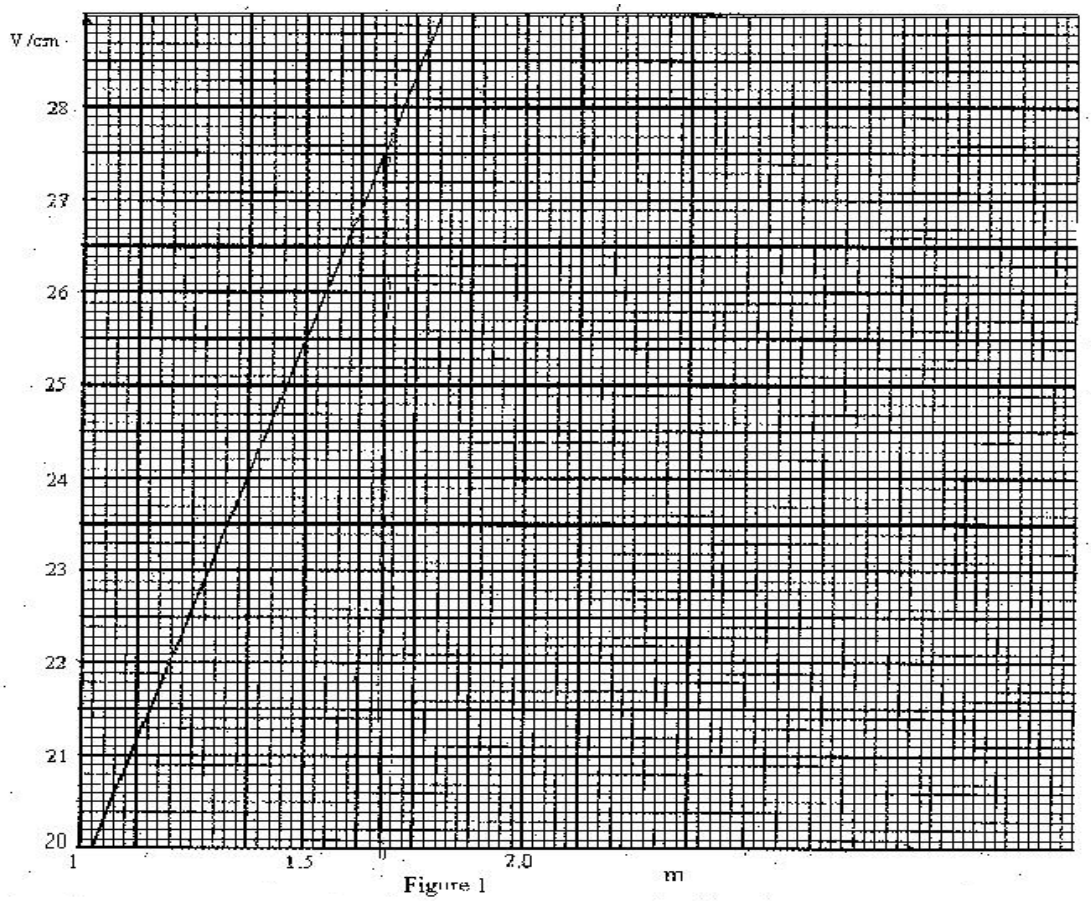

Figure 1

(b) list two advantages which optical fibres have over copper cables when used in telecommunication

3. A charged capacitor of capacitance, c, can be discharged through a resistor R. At a time t after the start of discharge the charge, Q, remaining on the capacitor can be be given by the expression.

$Q = Q_0 e^{\frac{-t}{CR}}$ where Q_0 is the initial charge on the capacitor.

i) use the above equation to obtain an expression for the half-life ,$T_{1/2}$, of the discharge process.

ii) Use the equation to define the time constant, τ, of the discharge.

iii) Compare the values of $T_{1/2}$ and τ.

4.Define simple harmonic motion (SHM)

For a body executing SHM the displacement y, is given by the equation y=rsinwt

What do r, w and t represent in the above equation?

5. Light is incident normally on a diffraction grating of 5000 lines per centimeter and a second order image is obtained at an angle of 36^0 .

(a) Calculate the wavelength of the light used.

(b) Determine whether a third order image can be obtained with light of the same wavelength.

(c) State and explain a way in which the number of order could be increased.

6.(a) Sketch the stress-strain curve for a specimen of rubber when it is loaded within the elastic limit and then unloaded.

(b) Explain in molecular terms the shape of the graph during the loaded within and unloading process, station clearly the energy changes involved.

7.(i) Draw a block diagram for a radio transmitter and receiver.
(ii) Differentiate between FM and AM transmission.

SECTION II (one and a half hours)
Answer either 8(a), (b)and (c) and or 8(d), (e)and (f).
Either 8(a), (b)and (c).
8(a) (i) state Coulomb's law.
In an experiment to determine the permittivity, ε, of a medium , a series of values of force,F, and corresponding separation r, between similar charges,Q, each of value $3{,}8\times 10^{-3}$ C were obtained. A graph of $1/r^2$ versus F was plotted as shown on figure 2.

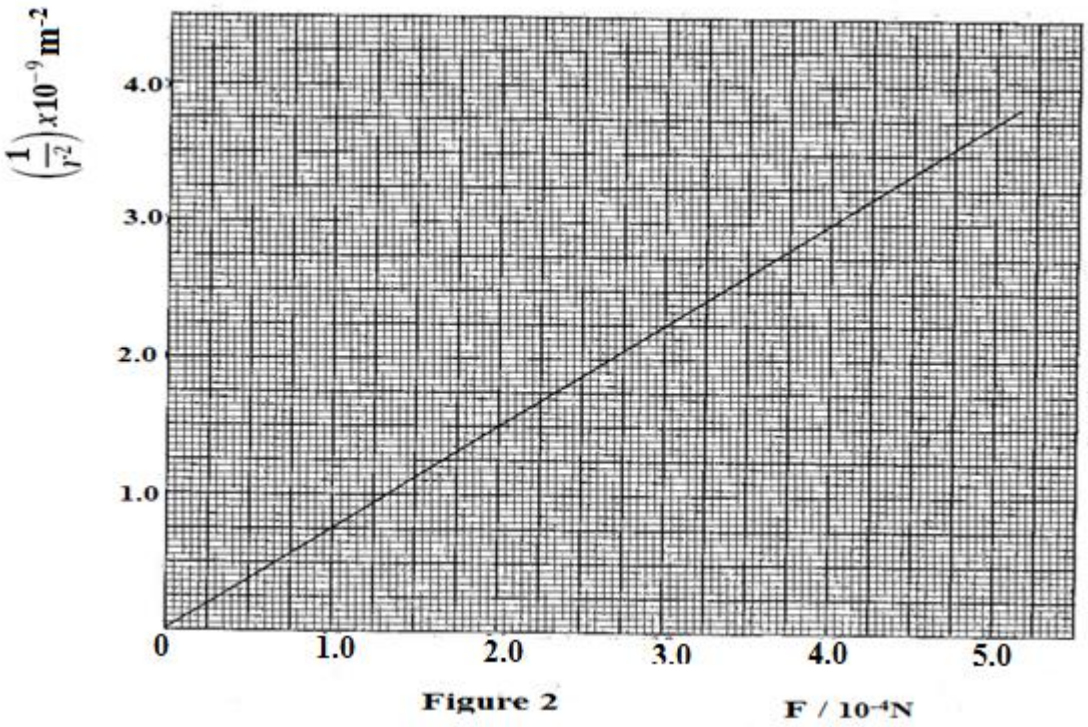

Figure 2

(ii) From the graph obtained a value for the permittivity, ε, of the medium.
(iii) From the value of ε obtained from the graph, in what type of medium do you think the charges were found.
(b) Lightining occurred in a forest and a tree standing vertically in the forest provided a path along which the lightning passed.
(c) Suppose 600×10^{-3}C of charge is conducted through the tree in 1.0 μs
(i) calculate the average current.
(ii) Sketch the temporary magnetic field created by this current.
(iii) what will the magnetic field strength be 10 cm from the tree.

Or 8d, e, and f.
(d) (i) state Newton's law of gravitation.
(ii) suppose a planet of mass m is moving in a circular orbit of radius, r, above the sun of mass M. prove that the periodic time, T, of the round the sun is given by the expression.
$T^2=4\pi^2r^3/GM$
(iii) if the universal gravitational constant G is 6.7×10^{-11} N m^2 kg^{-2} , the radius of the moon's orbit is 3.5×10^8 m and mass of the earth is 6.0×10^{27} kg . Calculate the period of rotation of the moon round the earth.
(e) Figure 3 shows how r^3 varies with T^2 for a planet of mass m. Use the graph(figure 3) to obtain the mass m of the planet given that $G=6.7\times10^{-11}$ N m^2 kg^{-2} .

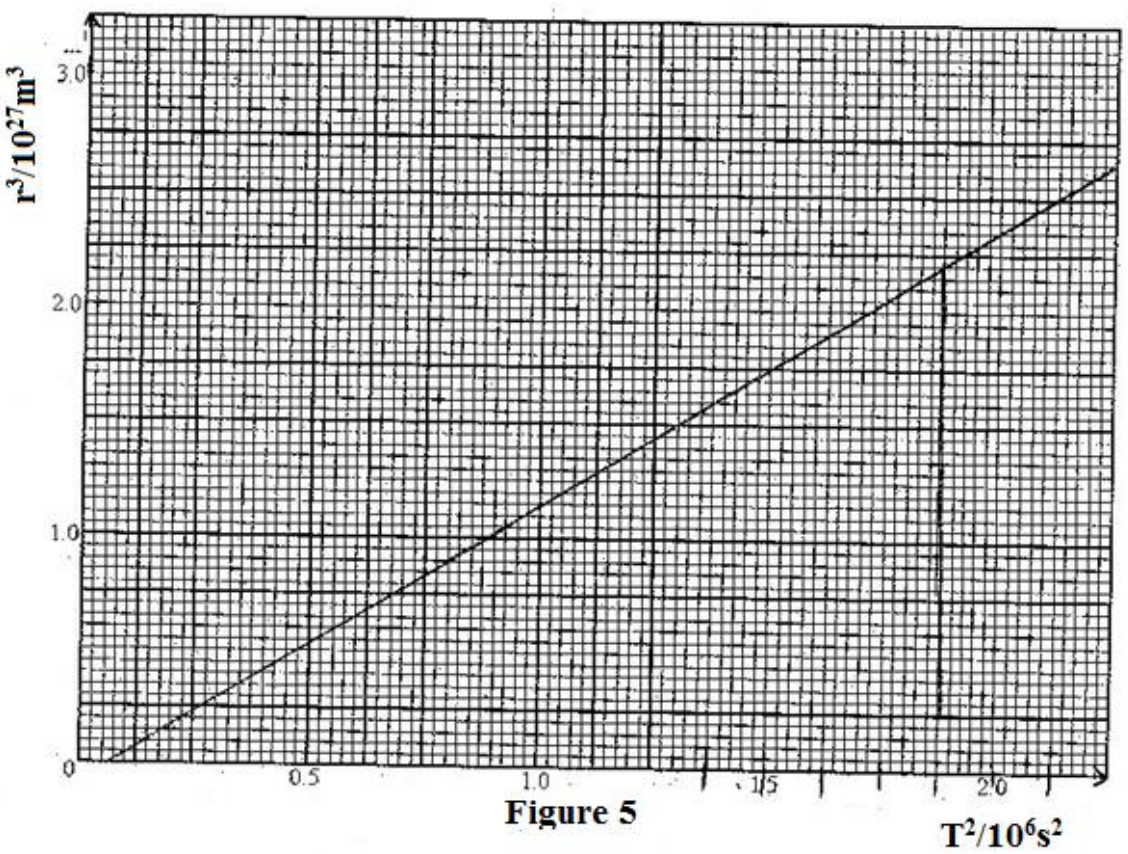

Figure 5

(f) Sketch a graph to show how the field strength, g, varies with distance from the centre of the earth to some point outside the earth assuming that the density of the earth is uniform.

Answer Either 9(a),(b)and(c) OR (d),(e)and(f) Either 9(a),(b)and()c
9.(a)

(c). what is a collision?
Distinguish between elastic and inelastic collisions.

OR 9 (d),(e)and(f)
(d) (i) State the principle of conservation of energy. Give a mathematical form of this law stating clearly each term of the equation. (First law of thermodynamics may be used).
(ii) Give an example of a situation in which the principle of conservation of energy applies.
(e) (i) Differentiate between renewable and non-renewable energy sources giving an example of each.
(ii) To harness tidal power a dam is built across the tidal region of water. Water is trapped at high tides and released at low tides. Suppose the water trapped during high tides is in a basin of area $40\times10^6 m^2$. If the maximum height of water is 10m.
ii) a) Calculate the gravitational potential energy change from high to low tide given that density of water is 100kg m^{-3}.
ii) b) Calculate the average power obtained if the flow from high to low tide took 6 hours.
f) How can
(i) Wind
(ii) Oil, as an energy sources be derived from the sun.

Answer Either 10 (a), (b) and(c) OR 10 (d), (e) and (f)
10(a), (b) and(c)
10 (a) Describe an experiment to measure the specific charge, e/m, of an electron

(b) The element uranium $_{92}^{238}U$ undergoes radioactivity to give an alpha particle and the element Thorium (Th).
(i) Explain the meaning of the underlined words.
(ii) Write the equation of the decay

(c) A certain radioactive material contains 10^{10} atoms. The half-life of this radioactive material is 20 days.
(i) Calculate the number of disintegrations after 1 s
(ii) After how long will the material take to reduce to 10^4 radioactive atoms.

OR 10 (d),(e)and(f)

(d) (i) Define temperature coefficient of resistance.
(ii) Describe an experiment to determine the temperature coefficient of resistance foe conductor.

(e) Distinguish between the following
(i) Ohmic and non-ohmic conductors.
(ii) Potential difference and electromotive force.

(f)

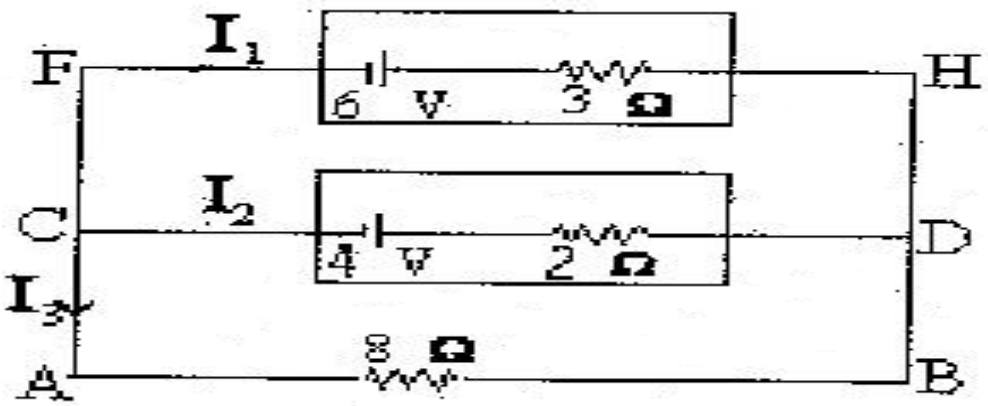

Figure 5 shows a load of resistance R=8Ω connected across two cells in parallel. The cells have internal resistances as shown on figure 5

i) Determine the values of I_1 ,I_2 andI_3
(ii) Comment on the values obtained.