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2011 Past GCE Advanced Level Paper 2

JUNE 2011

SECTION I (One hour)

Answer all questions

1. A) Explain the fact that homogeneity of physical equation is not sufficient for the correctness of the equation.
2. (b)

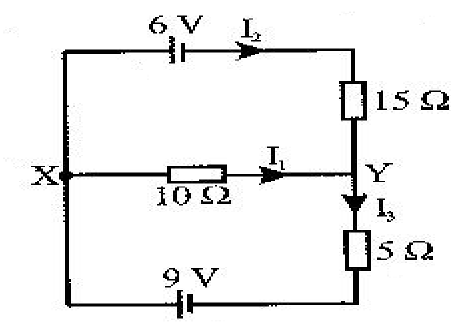

Figure 1

Figure 1 shows how resistors and cells may be connected in an electrical circuit.

Calculate values for

a) I_1,$I_2$and I_3.

b) Pd across XY

3.i) Distinguish between elastic and inelastic collision.

ii) A ball of mass m, falls vertically from a height h1, to the ground and rebounces to a height h2.

Calculate the change in momentum of the ball in terms of m, h_1 and h_2.

4 A cathode ray oscilloscope has its Y-sensitivity set at 20vcm^{-1}. a sinusoidal input is suitably applied to give a steady trace with time-base so that the electron beam takes 10^{-2} s to traverse the screen. If the trace has a peak to peak of 4.0 cm and has 4 complete cycles. Estimate the values for

i) r.m.s. voltage

ii) Frequency of the input signal.

5

6.

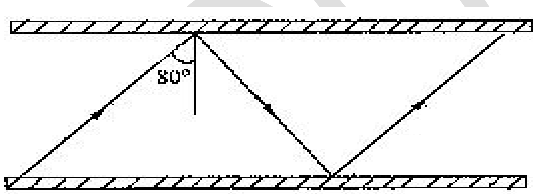

Figure 3

Figure 3 shows a cross section of an optical fiber used for telecommunication.

a) State and explain two reasons why the optical fibre is preferred to the copper cable for this purpose.

b) The speed of light in the core is 1.95×10^{8} m s^{-1} while the smallest angle of incidence in the core is 80^{0}.

Calculate the refractive indices for

i) The core

ii) The cladding

7 a) Explain why the specific heat capacity of a gas at constant pressure, c_p, is greater than the specific heat capacity at constant volume c_v.

c) Explain why a distinction between specific heat capacity at constant pressure and a t constant volume is important for gases but not for solids and liquids.

SECTION II (One hour)

Answer all questions

Answer 8(a), (b)and(c) or 8(e), (e) and (f)

Either 8(a), (b) and (c)

8. a) i) Define surface tension

ii) Describe an experiment to show how the surface tension of a liquid varies with temperature.

b) i) A soap bible of radius 8.0 cm is blown on the end of a tube which is connected to a U-tube containing water. Calculate the difference in the water levels.

(ii) If another soap bubble of radius of curvature 2.0 cm is now allowed to make contact with the first so that the radius of curvature of the common surface tension for soap solution is 3.5×10^{-2} N m^{-1}, calculate r

c) i) The net force, F, between two particles in a solid varies with their separation. r, according the equation.

$$\cdot F = \frac{8.0\times10^{-20}}{r^2} - \frac{2.0\times10^{-96}}{r^{10}}$$

Calculate, r_0 the equilibrium separation

iii) Sketch a graph showing how the force, between two adjacent particles varies with their separation.

Or 8(d),(e)and(f)

d) i) Define capacitance.

ii) Describe an experiment to show how the capacitance of a parallel plate capacitor varies with the area between the plates.

e) A tiny pith ball of mass 5.0×10^{-4} kg is suspended by a light thread of negligible mass. The ball is electrically charged and placed in a uniform horizontal electric field strength 4.0×10^2 N C^{-1}.

Calculate the charge q when it is deflected through an angle of 10^0.

f) i) Sketch a graph showing how the electric field strength E varies with distance, r, from the centre of a uniform solid metal sphere of radiusr , from the centre of a uniform solid metal sphere of radius, r_0, which is positively shagged.

ii) Explain the shape of your graph when $r<r_0$ and when $r>r_0$.

Answer 9a, b, and c or 9 d, e, and f

Either 9a, b and c

9. a) i) Explain what is meant by the half-life of a radioactive nuclide.

ii) Living wood has an activity of 16 counts min^{-1} g^{-1} which is due to the disintegration of carbon -14 atoms in the wood. The half-life of carbon -14 is 5.6×10^3 years.

Calculate the age of ship with a sample of wood of mass 0.5 g from the ship whose activity is 6.5 counts min^{-1}.

b) Natural Uranium contains 0.7 % U-235. When U-235 undergoes fission, 200MeV of energy is released.

Calculate

i) The number of U-235 nuclei contained in 1kg of natural uranium.

ii) The cost to be paid to AES-SONEL at the rate of 60 francs per unit when the U-235 content in 1 kg completely undergoes fission.

c) Sketch a block diagram of a nuclear reactor and explain the functions of

i) The coolant

ii) The moderator

iii)the control rods

Or 9d, e and f

d) i) Explain what meant by simple harmonic motion

ii) Sketch graphs how the following quantities vary with the period of oscillation for one complete cycle.

-Kinetic Energy

- Potential Energy

- Total Energy

e) Pendulum of length 1.2 cm has a bob of mass 0.2 g. the bob is pulled aside a horizontal distance of 20.0 cm and then released. Calculate

i) The velocity of the bob at is lowest point.

ii) The maximum kinetic energy of the job.

(a) i) Mechanical systems may undergo **free, damped and forced** oscillations.

Explain the meaning of the underlined words.

ii) A string has a length of 2.0 m and a density of 8.0 $\times 10^3$ kg m^{-3}

When the string is vibrating in the fundamental mode with a frequency of 200Hz the tension in the string produces a strain of 2 %. Calculate the young's modulus for the string.

SECTION III (30 minutes)

A student investigates the variation of potential difference, and the current, I, through a semiconductor diode. The corresponding values of the potential difference and the current are displayed in table 1.

V/Mv	$I/10^{-4}$A
255	0.004
315	0.016
345	0.036
385	0.089
410	0.182
455	0.552
475	0.903
495	1.400
505	1.820
515	2.230
530	3.100

Table 1

a) i) Plot a suitable graph from which the values of I_0 and B could be obtained.

ii) Determine the value of I_0 and B

b) Another equation linking I and V is $I=I_0(e^{BV}-1)$

What physical approximation could be considered for $I=I_0e^{BV}$.