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2003 Past GCE Advanced Level Paper 2

JUNE 2003

SECTION I(One hour)

Answer all questions in this section

1. Waves may be classified on the basis of their medium of transmission or mode of propagation.
   (a) Which are thus classes in terms of
      (i) Medium of transmission
      (ii) Mode of propagation
   (b) Give one example of wave in each case
2.

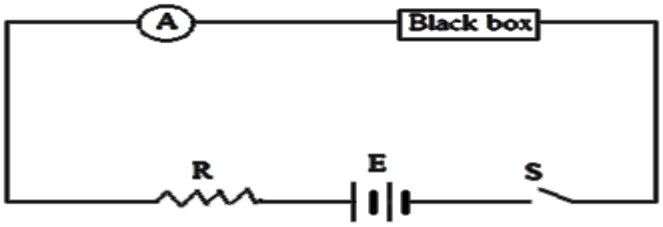

Figure 1

Figure 1 shows a circuit which can be used to establish the 1- V characteristics for three conductors copper, a tungsten filament lamp and a junction diode.

   (i) Copy the diagram and insert the missing component
   (ii) Sketch separate 1 – V characteristics for the three conductors

3. A nucleide $^{220}_{86}X$ decays to new nucleide Y by emission s of two α-particles and two β-emissions.
   (i) Write down the equation for this decay process.
   (ii) The activity of radioactive carbon -12 in living wood is 19 counts per minute per gram. Measuring the activity of the isotope in a piece of ancient wood gave on activity of 7 counts per minute per gram.
      Given that the half-life of the isotope is about 6000years.
      Estimate the age of the piece of ancient wood.
4. A grating has 6000 lines per mm and is illuminated by light of wavelength 5.9 x 10^{-7}m which is incident normal to the grating.
   (a) Find the direction the first order diffraction image?
   (b) Is it possible to obtain a third order image with this diffraction grating for this wave length?
   (c) What would be the effect on the number of oders, if the wavelength of the wave is increase?
5. (a) Calculate the root mean square speed for the molecules of nitrogen at S.T.P, if the density of nitrogen at these conditions is 2.6kg.m^{-3}.
   (b) The speed of sound at S.T.P is about 330ms^{-1}.
      Explain how this is related to the root mean square speed of nitrogen.
6. (a) Distinguish between crystalline, amorphous and polymeric solids.
   (b) Give examples of each type of solids.

SECTION 2(one and a half hour)

Answer all questions in this section.

Answer either 8(a),8(b) and (c) OR (d), (e) and (f)

7. EITHER
   (a) (i) Distinguish between specific (latent) heat of vaporization and latent heat of vaporization.
      (ii) Describe an experiment to determine the specific (latent) heat of vaporization of water.
   (b) An electric heater rated at 2.0kW is used to heat 15g of water in a kettle. The initial temperature of the water is 20°C.
      (i) What time does it take to heat the water to its boiling point?
      (ii) Calculate the mass of water that would have boiled away in five minutes.

(c) Estimate how long it would take all the water to evaporate. State any assumptions that you make in your calculations.
Specific heat capacity of water is $4200Jkg^{-1}k^{-1}$
Specific heat capacity of copper is $400Jk^{-1}$
Specific latent heat of water is $2.0x10^{6}J\ kg^{-1}$
OR

(d) (i) state the law of conservation of linear momentum
(ii) Describe an experiment to verify the law of conservation of linear momentum.

(e) Two bodies A and B with masses, 2m and m, respectively, make a head collision. The bodies move in the same direction with a velocity of
$5.0ms^{-1}$ and B a velocity of $2.0ms^{-1}$. If the velocity of A after collision with B is $3.0ms^{-1}$.
(i) Calculate the velocity of B after collision?
(ii) Is this classic or inelastic. Explain.

(f) A particle of mass m hits a rigid wall and bounces back with the same speed. Explain whether the law of conservation of linear momentum is satisfied or not?

Answer either 9(a),(b) and (c) or 9(d), (e) and (f).

8. (a) (i) What is the photoelectric effect?
(ii) What are the experimental observations of the photoelectric effect?
(iii) How do these observations compare to the classical theory?

(b) Figure 3 shows how the stopping potential V_s varies with the frequency, f of the incident radiation in a photoelectric investigation of metal.

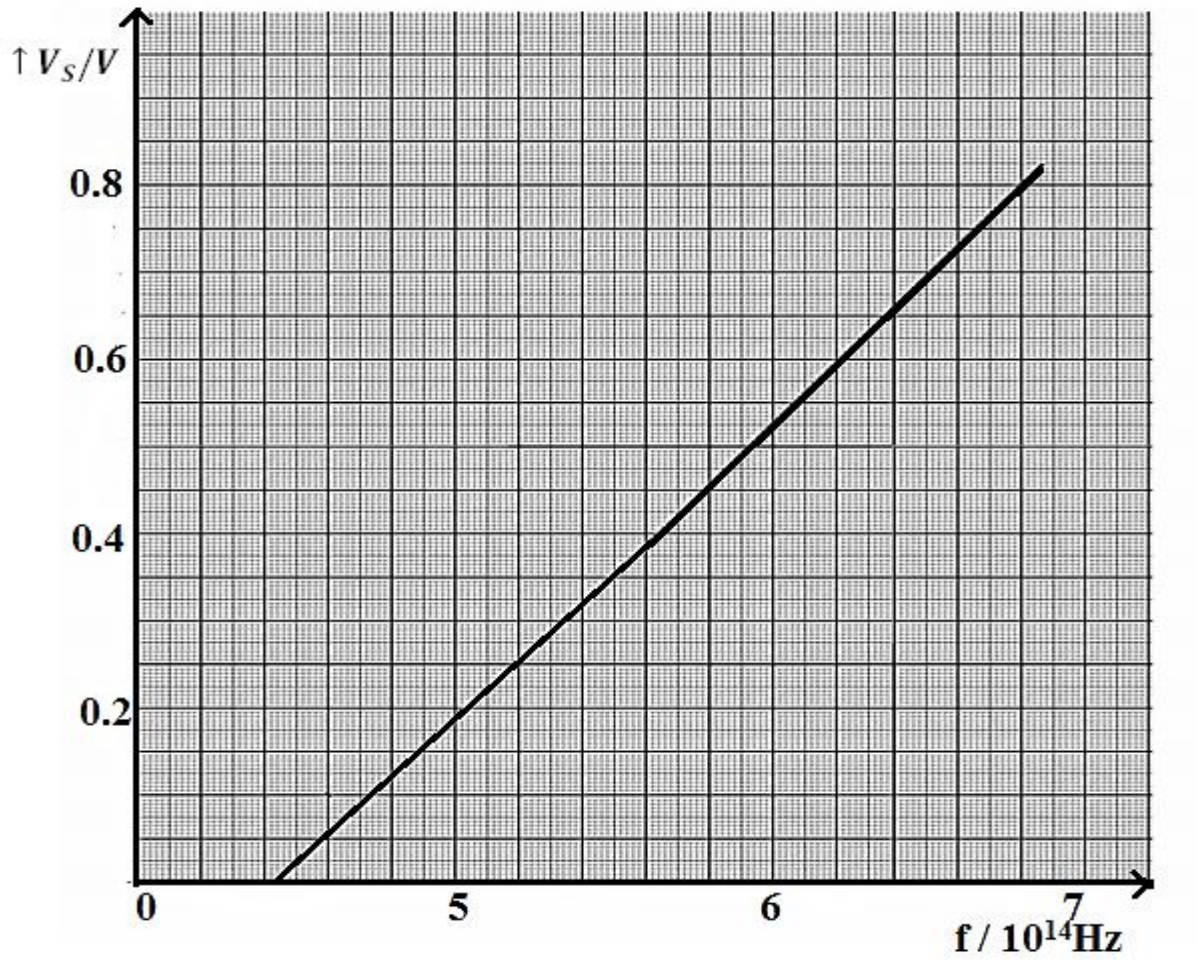

Figure 3

(b) Use the graph in figure 3 to calculate values for

(i) The Planck's constant

(ii) The work function for this metal

(c) (i) Explain the thermionic emission

(ii) Make a sketch of an electron gun

OR 9(d), (e) and (f)

(d) Using either force and kinetic energy or separation and motion of particles, differentiate between the different states of matter.

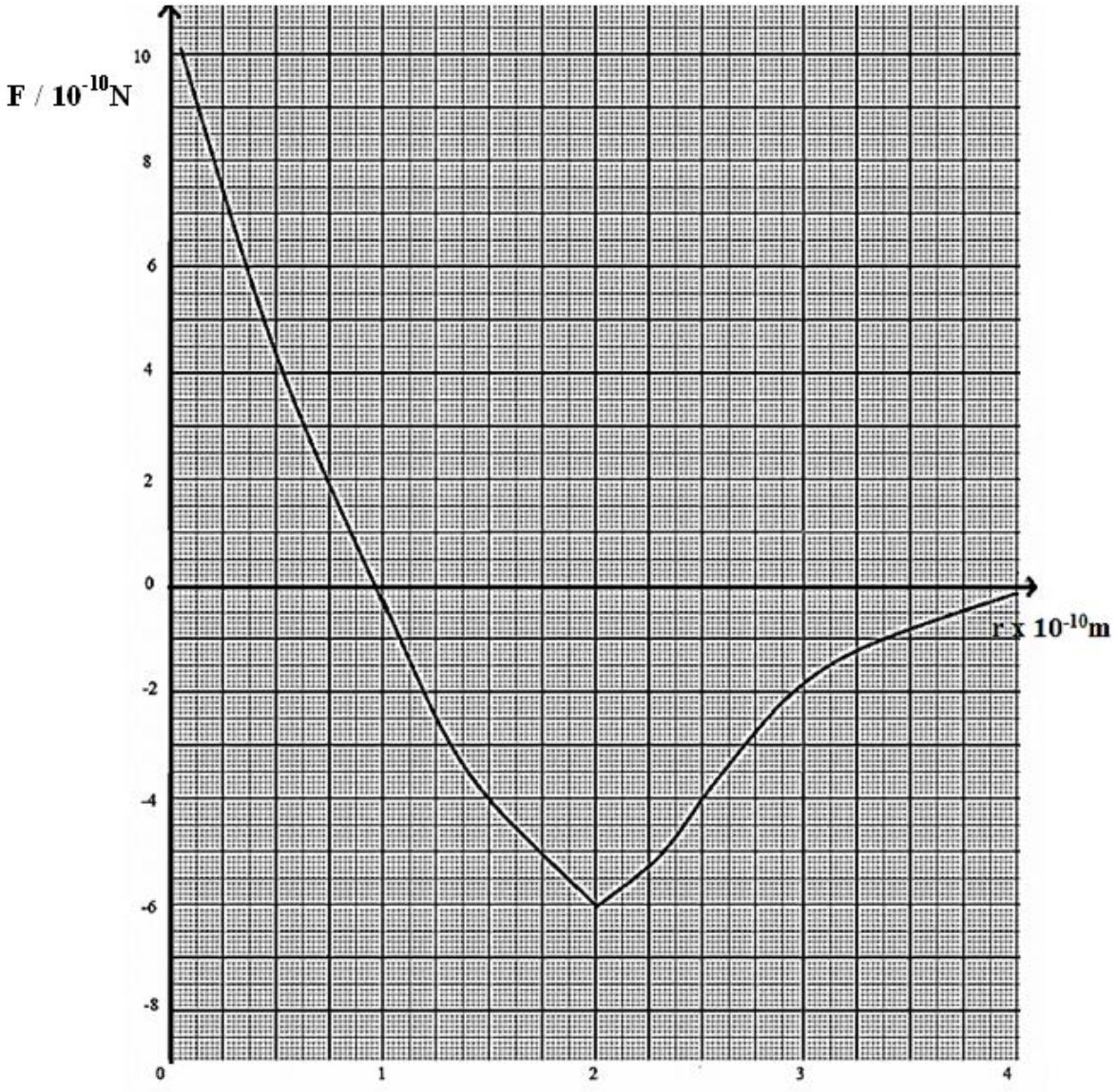

Figure 4

(e) (i) Use the graph in figure (4) to describe the forces that exists between the two molecules.

(ii) How can this graph be used to explain Hookian behavior of matter.

(f) (i) Sketch an energy-separation curve from this graph.

(ii) Estimate the amount of work done in separating the molecules from the equilibrium position to infinity.

(iii) What is the physical significance of this energy?

Either 10(a),(b) and (c)

9. (a) (i) Distinguish between the conduction mechanism for copper and silicon.

(iii) Describe how an n-type semiconductor may be produced. Hence explain the formation of a p-n, junction.

(b)

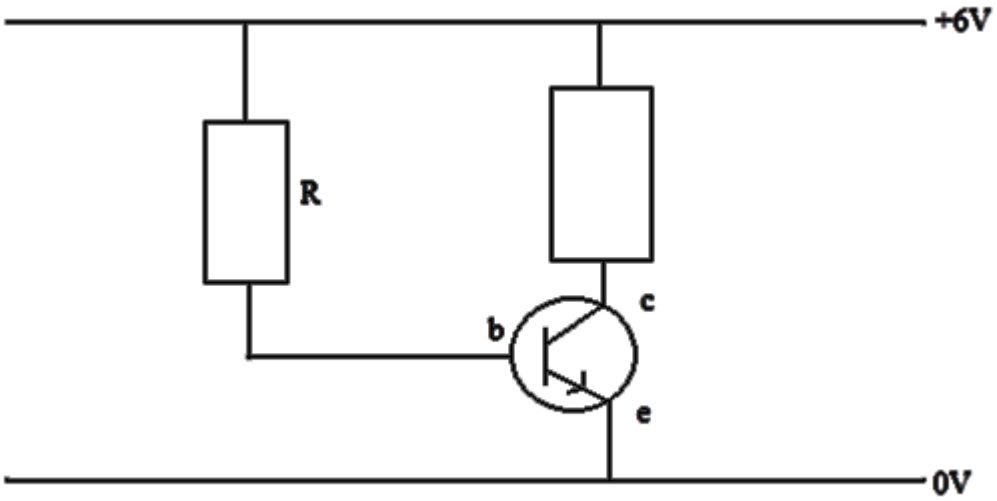

Figure 5

From the circuit in Figure 5, calculate

(i) Base emitter voltage of the transistor at saturation.

(ii) If the base emitter resistance is 100Ω. Calculate a value for R at saturation.

(c) (i) Draw a circuit diagram of a bridge rectifier to convert a.c to d.c.

(ii) Sketch the output characteristics of the transistor in the C.E mode.

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

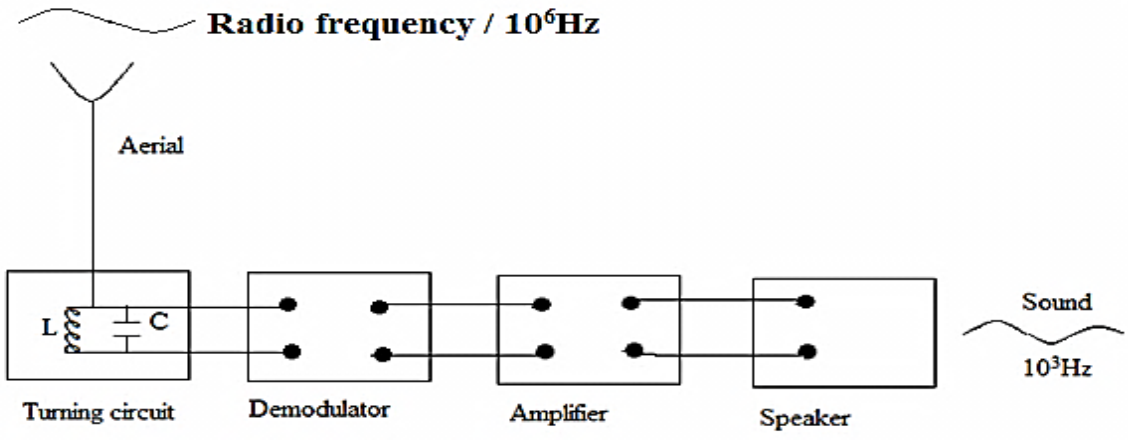

Figure 6

(d) (i) Figure 6 shows a simple radio receiver. The turning circuit selects one station. Explain why this happen.

(ii) Explain the functions of the demodulation and the amplifier?

(e) (i) Briefly explain the difference between the F.M and AM transmission?

(ii) if the capacitance of the capacitor is 2μF and the circuit is turned at a frequency of 10^6Hz, Calculate the inductance of the inductor.

(iii) How could the turning circuit be altered so that it could select other frequencies.

(f) A satellite of mass (m) is launched from the earth's surface to cycle the earth in the plane of the equator?

(i) Explain the conditions under which such a situation is possible.

(ii) Explain the height of the satellite orbit above the earth's surface, if the radius of the earth is 6400km.