GCE ADVANCE LEVEL

PHYSICS

2013 PAPER 2

JUNE 2013

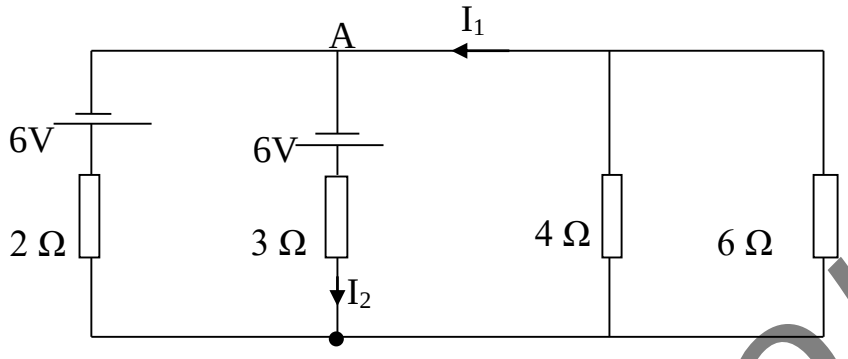
1. (a) Compare the images formed by a diverging lens and a converging lens, both of focal length 20 cm, if an object is placed 12 cm from each of them.
   (b) Why is a frequency modulated signal system preferred to an amplitude modulated signal system in communication?
2. A 1500 μF capacitor is fully charged using a 100V dc power supply. It is disconnected from the power supply and connected to an uncharged 1000μF capacitor.
   (a) Calculate the p.d across the terminals of the capacitor.
   (b) Calculate the initial and final energy stored in the capacitors.
   (c) Why is there loss in energy?
3. 

Figure 1

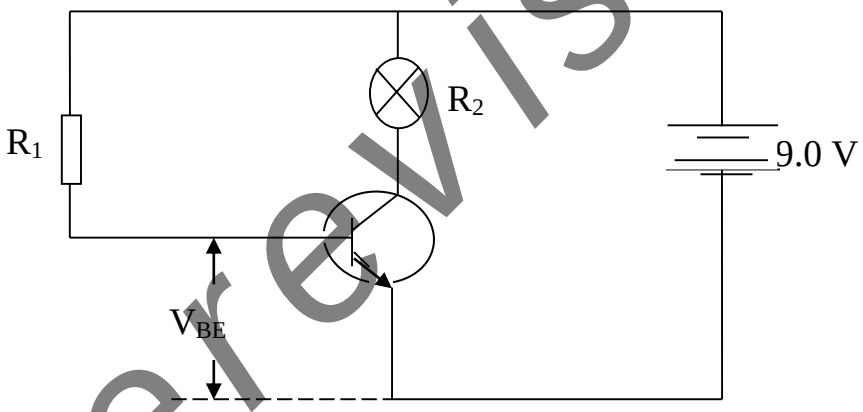
In figure 1, determine
   (i) The current I_1 and I_2.
   (ii) The p.dacross AB
4. 

Figure 2

   (i) What is a p-type semi-conductor?
   The figure 2 shows a transistor in the common emitter mode. The transistor has the following characteristics V_{BE} = 0.62 V, h_{fe} = 100. The input resistance R_1= 60 kΩ and the load resistance R_2 = 600Ω.
   (ii) Calculate the current through the load.
   (iii) Calculate V_{CE}
5. Distinguish between liquids and gases using
   (i) intermolecular forces and
   (ii) The kinetic theory of matter.

SECTION II
ONE HOUR
ANSWER ALL QUESTIONS

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

6. (a) (i) Explain what is meant by the thermometric property of a substance?
   (ii) State two qualiities which can make the thermometric property suitable for temperature measurements.

(iii) The melting point of a metal is measured using a resistance thermometer and a constant pressure gas thermometer. Explain whether the values obtained would be the same or different.

(b) Describe an experiment to determine the specific latent heat of vaporization of water. Your account should include a diagram, procedure, precautions, observations and conclusions

(c) (i) A piece of metal block of mass 0.8kg and specific heat capacity 455 $Jkg^{-1}K^{-1}$ is initially heated in a furnace. The block is then immersed in 1.2 kg ice in an ice container and equilibrium temperature of 48°C is obtained. Calculate the initial temperature of the metal block.

(ii) Explain whether all electrical insulators are necessarily good thermal insulators.

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

(d) (i) State the laws of electromagnetic induction.

(ii) **An** electron of charge, e, and mass, m, enters a uniform magnetic field B of value 2.0 x 10^{-3}T as shown in figure 3 and moves with a speed v.

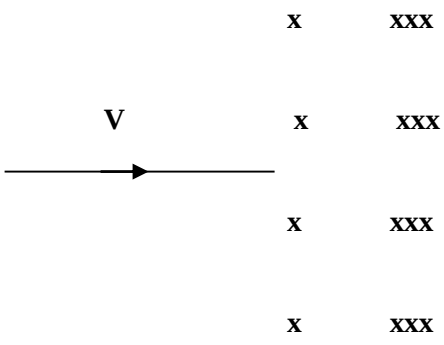


Figure 3

Copy figure 3 into your answer booklet and indicate the path the electron takes in the field.

(iii) Calculate the number of revolutions per second made by the electrons.

(e) Describe an experiment to determine the specific charge of an electron. Your account should include a diagram, procedure, observations and conclusion.

(f)

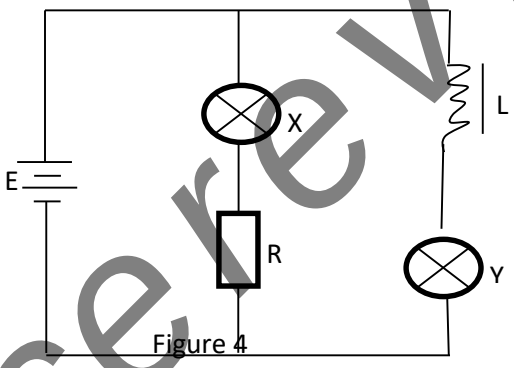


Figure 4

Figure 4 shows two bulbs X and Y connected to a supply E. The inductance of L is 6.0 x 10^{-3}H, the resistance of R is 2.0Ω while the resistance of the bulbs X and Y are each 2.0 Ω.

(i) Calculate the current in Y when it is fully lighted.

(ii) Sketch, on the same axes, graphs to show how the p.d across X and Y vary with time.

ANSWER either 9 (a), (b, (c)and (d) OR 8 (e), (f) and (g)

EITHER

7.

(a) Define stopping potential

(b) Use Einstein photoelectric equation to explain

(i) Why for a particular metal electrons are emitted only when the frequency of the incident radiation is greater than a certain value.

(ii) Why the maximum speed of the emitted electrons is independent of the intensity of the incident radiation.

(c) Figure 5 shows how the frequency (f) of incident radiation on a metal surface varies with the energy of the emitted photoelectrons.

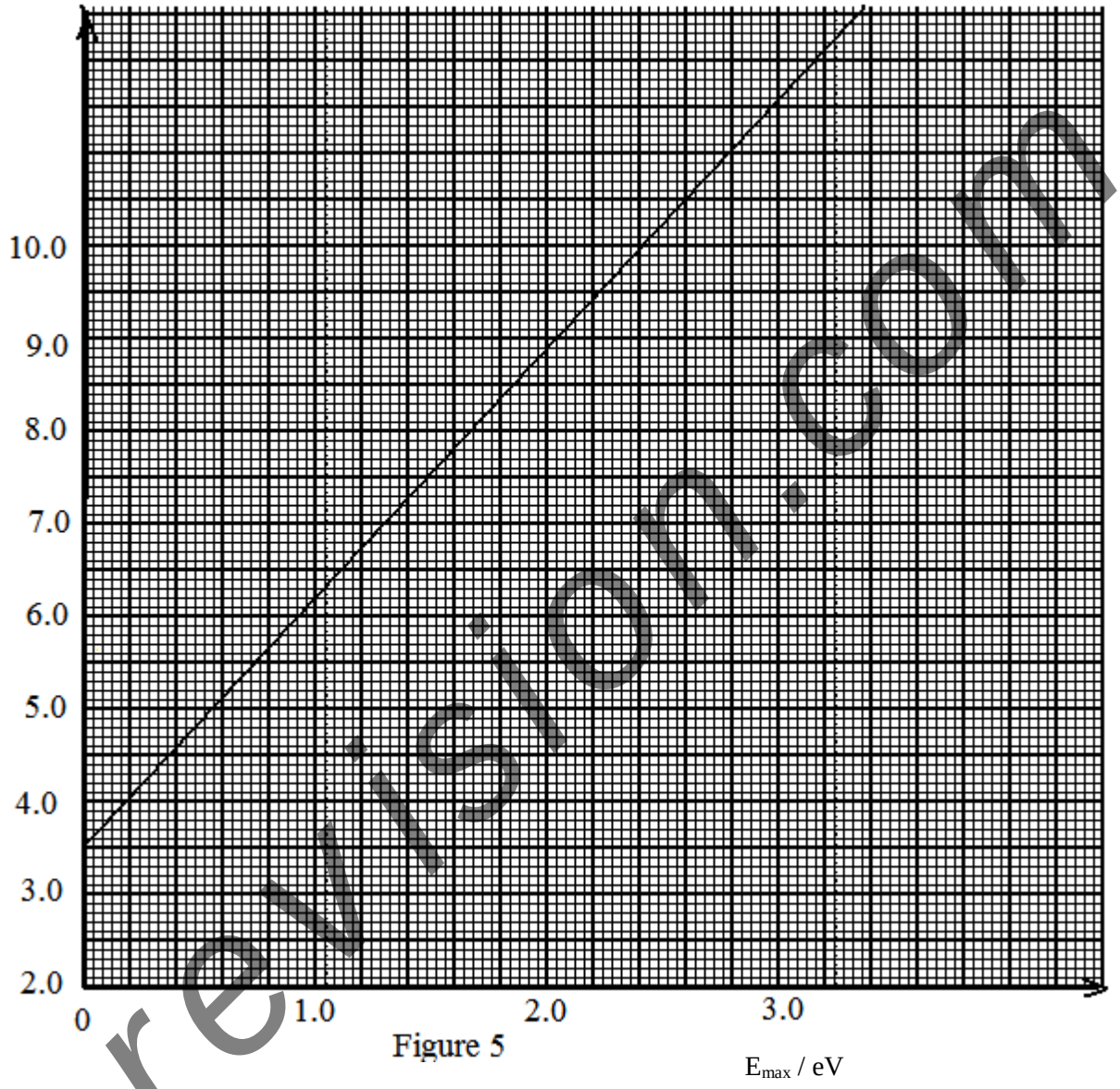


Figure 5

(i) From the graph, determine the threshold frequency and calculate the maximum wavelength of the emitted electrons.

(ii) Calculate values for the

- Plank's constant
- Work function of the metal in joules.

(d) An X-ray photon has a wavelength of 3.0×10^{-10} m. calculate the values for

(i) Momentum

(ii) Energy

(iii) Mass of the particle associated with the proton which moves at the speed of light.

OR

9.

(e) (i) define <u>time constant</u>

Figure 6 shows how a resisitor R and a capacitor may be connected in a circuit.

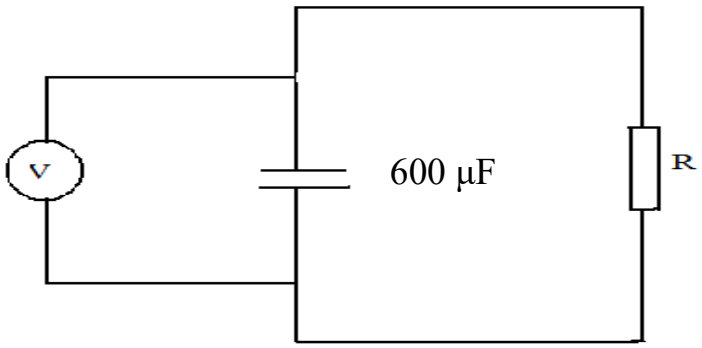


figure 6

The capacitor is fully charged and connected to the resisitor R and the reading on the voltmeter falls by half in 60s.

(ii) Calculate the time constant and explain how its value could be increased.

(f) Figure 7 shows the displacement time graph for a vibrating system.

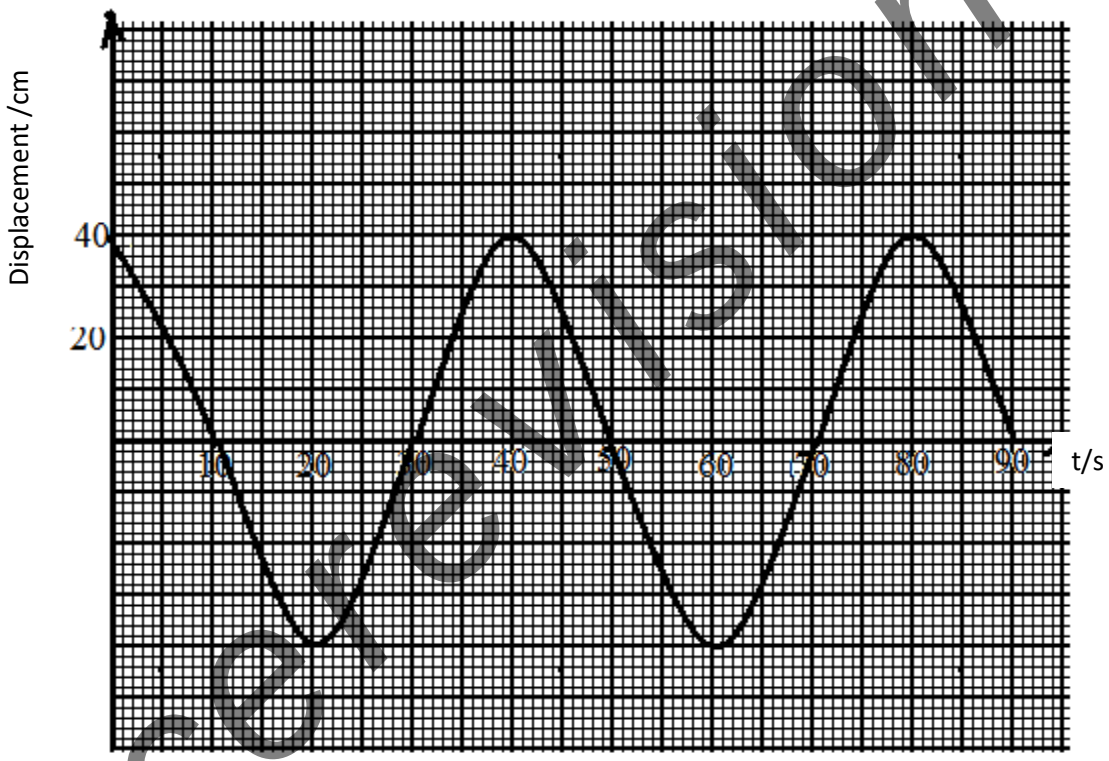


figure 7

(i) Explain whether the motion is simple harmonic or not.

Use the graph to calculate

(ii) The amplitude and frequency of oscillation.

(iii) Write the wave equation for the motion described in figure 7.

(g) (i) Sketch a graph to show the velocity changes with time for the motion above

(ii) Compare nuclear fission and nuclear fusion as sources of energy.

SECTION III

30 Minutes

8. The table below gives the force, F, between a pair of molecules in a solid at various separations, r.

Force, F/ 10^{-7} N	Separation, r /10^{-10} m
8.8	0.1
5.6	0.26
0.8	0.34
-2.0	0.42
-5.0	0.52
-8.0	0.8
-6.6	1.2
-4.0	1.34
-2.0	1.5
-0.8	1.8
-0.4	1.9

(a) Draw a graph of F against r for a pair of molecules.

(b) (i) From your graph, determine the molecular spacing for the molecules at equilibrium separation.

(ii) Calculate the energy used to separate the molecules completely

(iii) What is the physical significance of the energy calculated in (ii).

(c) How can your graph be used to explain that at some point

(i) Hooke'slawisobeyed

(j) The vibration of the molecules is simple harmonic.