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2005 Past GCE Advanced Level Paper 2

JUNE 2005

SECTION I (One hour)
Answer all questions in this section.

2. Figure 1 shows a graph of the square of the frequency against the inverse of the length for a simple pendulum.

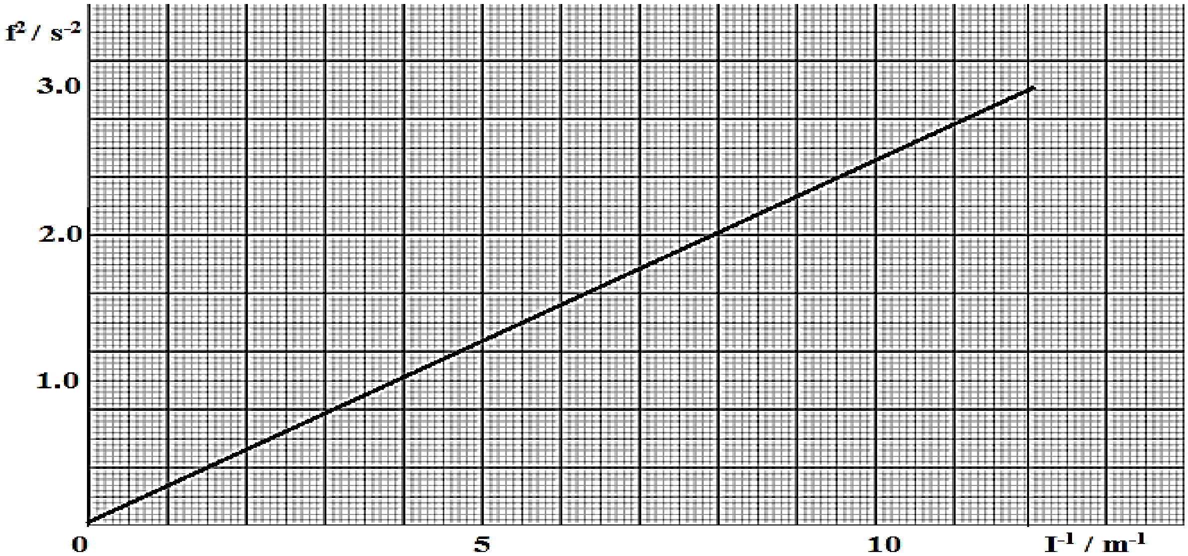

Figure 1

i) Use the graph to determine a value for the acceleration due to gravity.

ii) Calculate a length for which the pendulum would have a frequency of 20.0Hz.

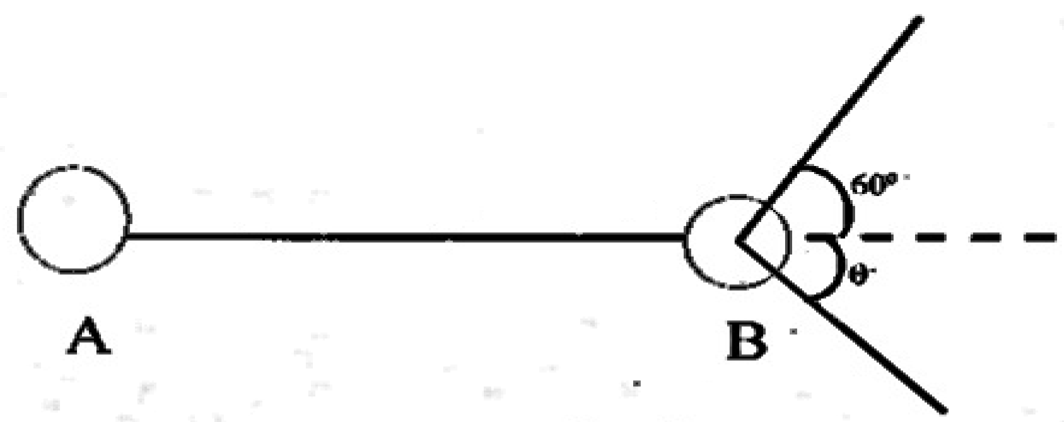

Figure 2

Figure 2 shows a snooker ball A moving with a velocity of 5.5 m s^{-1}, which hits a stationary sooker ball B. After collision A moves with a velocity of 2.5 m s^{-1} at 60^0 to its original path.Calculate

i) The velocity of B after collision.

4. Figure 3 shows two light beams X and Y of wavelength 450nm travelling in air and incident on a composite crystal of thickness 20µm. The refractive index of P is 1.40 and that of Q is 1.45.

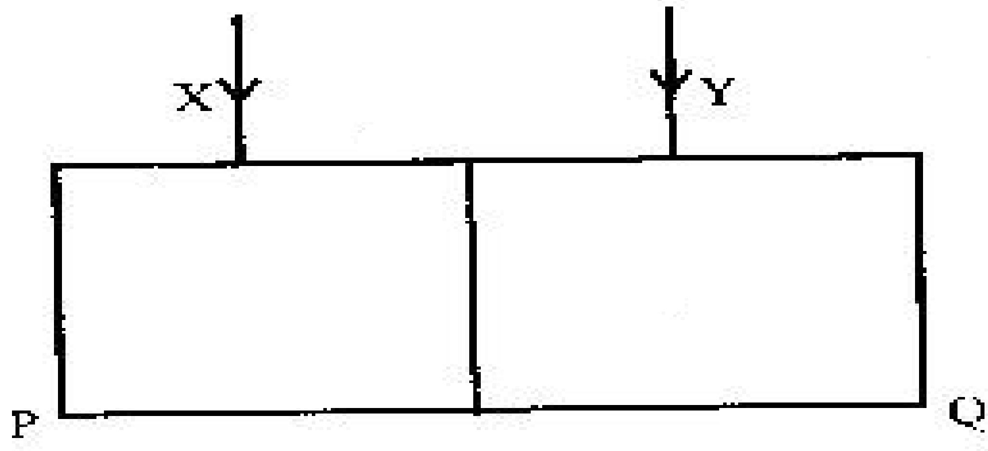

Figure 3

a) Determine which beam will first emerge from the crystal
b) If X and Y are in phase as they enter the crystal, calculate their phase difference as they leave the crystal.

5. A converging lens of focal length 20.0 cm is placed 25.0 cm away from a screen on which an image is formed .A biconcave lens of focal length 30.0 cm is now placed

Between the converging lens and screen so that it is 10.0 cm from the converging lens. Calculate how far the screen has to be moved to focus the new image.

6. Figure 4 shows an electrical circuit.

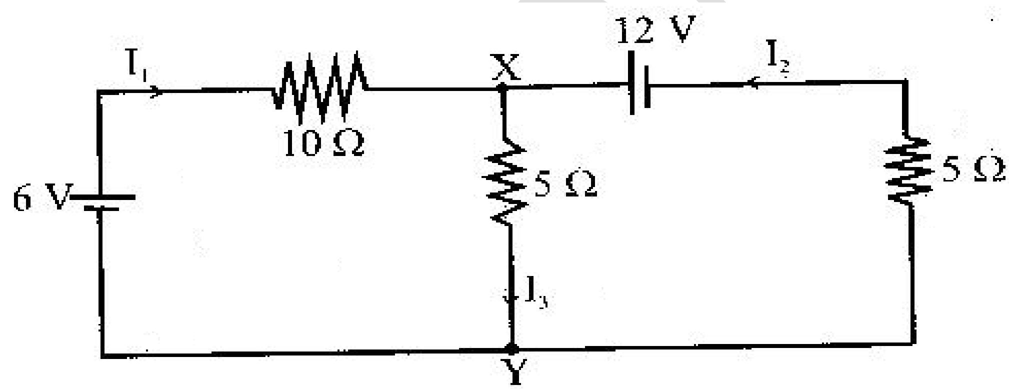

Figure 4

Determine the

i) Current I_1, I_2 and I_3.
ii) Pd between X and Y.

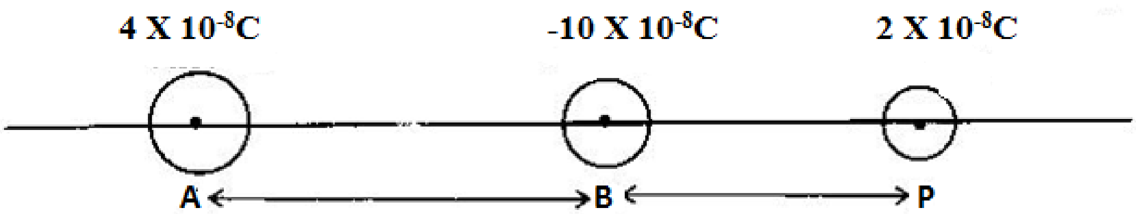

Figure 5

Figure 5 shows three charges A, B and P placed in a straight line. The charge at A is 4 $\times 10^{-8}$C, that at B is -10 $\times 10^{-8}$ C and that at P is 2 $\times 10^{-8}$C.

a) Calculate the force on the charge to the point due to charges A and B.

b) Show that the resultant force on P cannot be zero, if the charge at P is Placed between A and B.

SECTION II (one and half hours)

Answer all questions

Answer either 8a, b, and c or 8d, e, and f.

Either 8a, b and c.

8. a) i) State Newton's laws of motion

ii) Show how the principle of conservation of linear momentum could be derived from the second and third lows of motion.

b)Describe an experiment to verify the principle of conversation of linear momentum.

c) 8 d, e and f

d) i) State Kirchhoff's laws

ii) Explain how each the law is essentially a statement of either the conservation of energy or the conservation of electric charge.

e) Describe an experiment to investigate how the p.d. across a wire filament varies with current through it at constant temperature.

f) Given the circuit in figure 6.

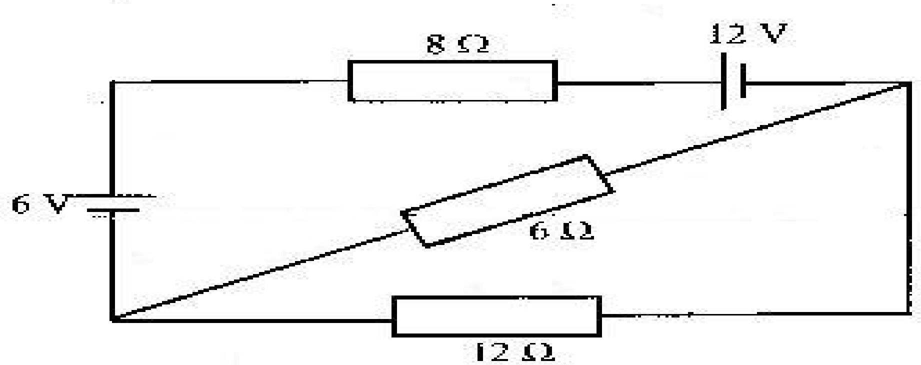

Figure 6

Calculate

a) The current in the 6 Ω resistors.

b) The p.d. across the 6 Ω resistor

Answer either 9a, b, and c or 9 c, and d

Either 9a, b

9. a) state the assumptions used in deriving the kinetic theory for an ideal gas.

i) From these assumptions derive the kinetic theory equation.

$P=\frac{1}{3}\rho \overline{c^2}$

Where p= pressure of the ideal gas

ρ=the density of the gas

c=the velocity of a gas molecule.

b)Figure 7 shows how the pressure of oxygen gas at temperature T and 300K varies whit density ρ

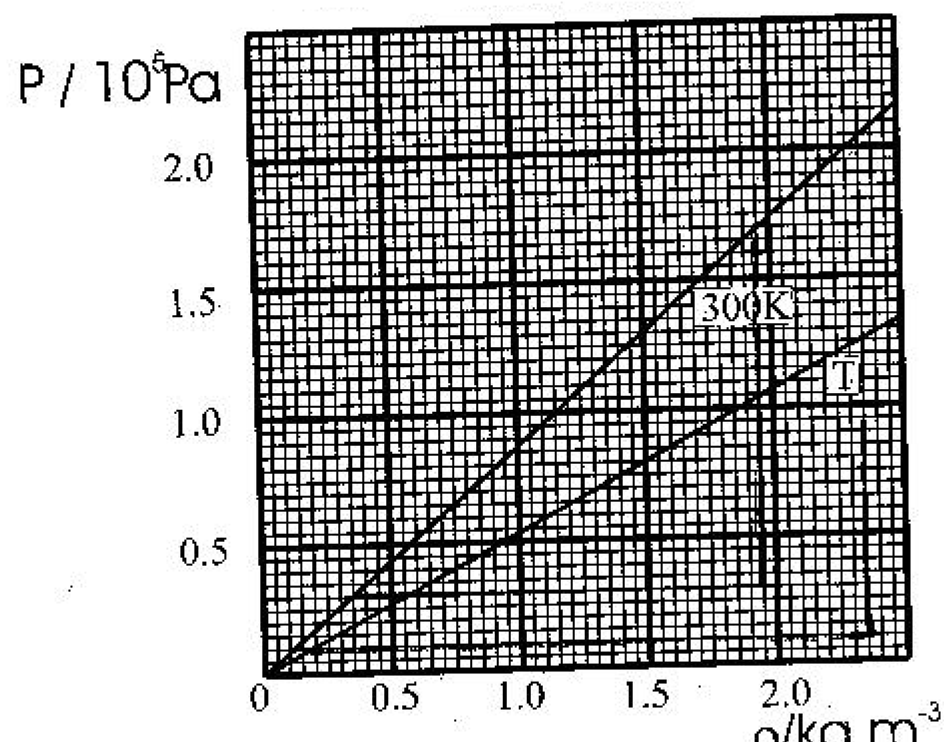

figure 7

Use the graph to

i) Calculate a value for the r.m.s speed of oxygen molecules at 300K

ii) Explain whether T is higher or lower than 300K

c) i) On the same axes sketch labeled graphsto show how the speeds of the molecules in an ideal gas are distributed at temperature of 300K and 600K.

ii) On one of the graph shows the position of average velocity, r.m.s speed and most probable velocity.

Or 9c, and d

d) Materials could be classified as *crystalline*, *amorphous* or *polymeric*. Define the terms in italics. Give one example for each of the terms.

e) An aluminium wire and a glass thread are subjected to linear stress until they break. On the same Axes, sketch graph of stress-strain to show the behavior of each material.

f) Figure 8 shows a graph of extension,e, against force,F, for a certain nylon climbing rope.

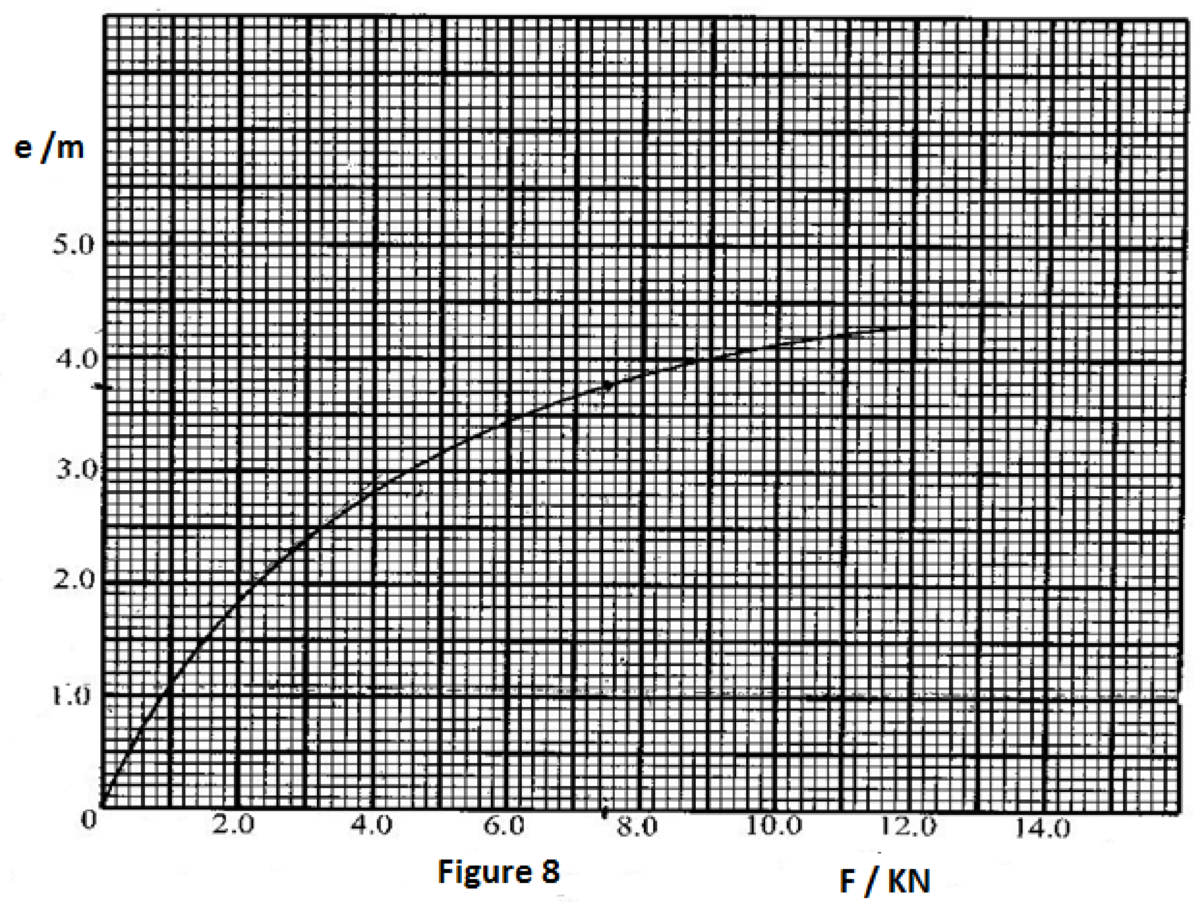

Figure 8

A climber of mass 80kg, attached to a 10m length of this rope, can withstand a force from the rope of not more than 7.5 kN without the risk of serious injury.

Use the graph to

i) Estimate the maximum energy stored in the rope when climber is not at risk.

ii) Explain how you would determine a value for Young's Modulus for a given extension.

Answer either 10,a ,b, and c or d, e, f

Either 10 a, b, and c

10 a) Differentiate between interference and diffraction of light.

b)A parallel beam of light of wavelength 5.5 x 10^{-2}m in air is incident on the slits in Young's double slit experiment. A thin film of transparent plastic of refractive index 1.48 and thickness 5.2 x 10^{-6} m is placed over one of the slits.

i) Determine the increase in the optical path of the light passing through the thin film. Hence determine the number of fringes by which the central fringe is displaced.

ii) Explain how the fringe spacing would change if

the slit separation were increased

the slit-screen distance were increased.

c) Light of wavelength 5.5 x 10^{-7} m falls on a single slit of width 0.15 mm. A screen is placed 1.2m beyond the slit.

i)Sketch a graph showing the light pattern observed on the screen.

ii) calculate the width of the central fringe.

Or 10,d, e, and f

10 d) State the following laws.

i)Newton's gravitational law

ii) Coulomb's law.

e)Explain in what ways the Coulomb force between two charge particles is

i) different.

ii) similar to the gravitational force between two masses.

f)The gravitational potential energy,U, of a mass,m, a distance,h,above the surface of the earth is

u =$\frac{-GMm}{(R+h)}$

Where M is the mass of the earth,R the radius of the earth and G,the gravitational constant.

(R= 6.4 106m)

i)Show that this expression is equivalent to U=mgh usually quoted in elementary physics courses where g is the gravitational force per unit mass near the surface of the earth.

ii) how much kinetic energy must a 100kg spacecraft have at the surface of the earth to be able to leave the earth completely.

iii)explain what would happen if the space craft had

- Less energy
- More energy