K.C.S.E PHYSICS PAPER 232/2 2005

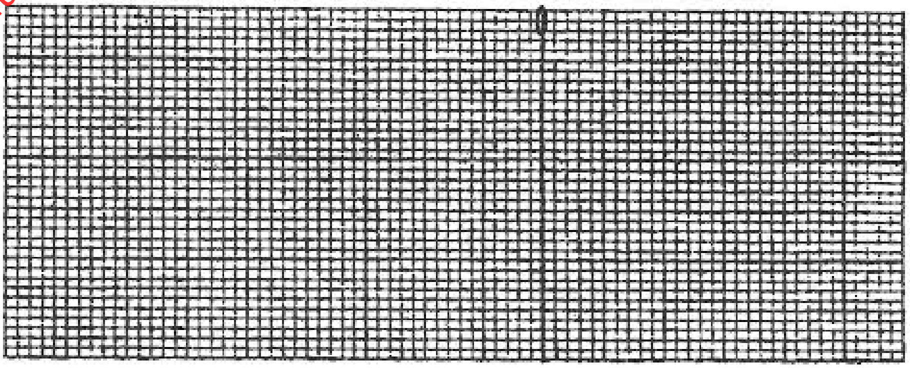
SECTION A

Answer ALL questions in this section.

1. (a) You are provided with the following:-

An illuminated object, a convex lens, a lens holder, a plane mirror and a metre rule. Describe with the aid of a labelled diagram an experiment to determine the focal length of the lens (5 marks)

(b) A small vertical object is placed 28 cm in front of a convex lens of focal length 12 cm. On the grid provided, draw a ray diagram to locate the image. The lens position is shown. (Use a scale: 1 cm represents 4 cm) (5 marks)



Determine the image distance

(c) **Figure 1.** shows a human eye with a certain defect.

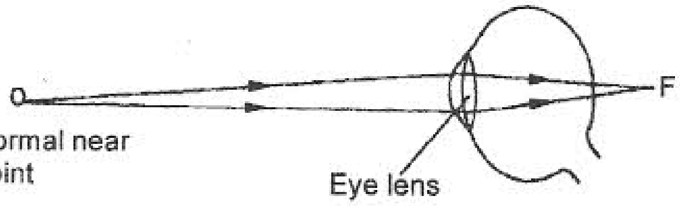


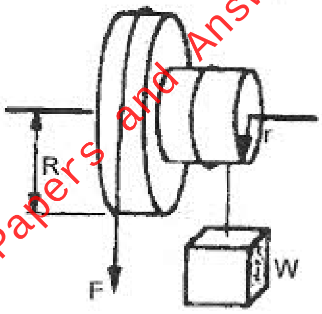
Figure 1

(i) Name the defect (1 mark)

(ii) On the same diagram, sketch the appropriate lens to correct the defect and sketch rays to show the effect of the lens (2 marks)

2. (a) **Figure 2.** shows a wheel and axle being used to raise a load **W** by applying an effort **F**. The radius of the large whell is **R** and of the small wheel **r** as shown.

Figure 2



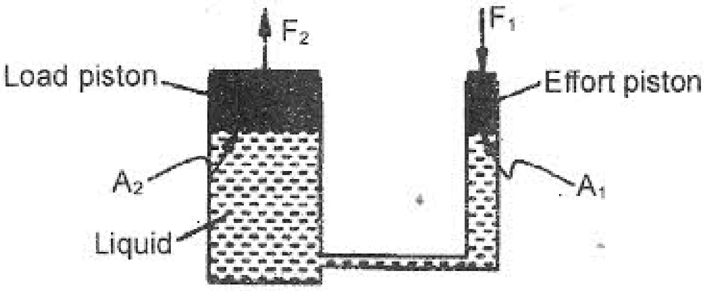
(i) Show that the velocity ratio (VR) of this machine is given by R/r. (3 marks)

(ii) Given that **r** = 5 cm, **R** = 8 cm, determine the effort required to raise a load of 20 N if the efficiency of the machine is 80% (4 marks)

(iii) It is observed that the efficiency of the machine increases when it is used to lift larger loads. Give a reason for this. (1 mark)

(b) **Figure 3.** shows a simplified hydraulic jack. The cross section area A_2 of the load piston is 25 times the area A_1 of the effort piston $\left(\frac{A_2}{A_1} = 25\right)$ F_1 is the force applied (effort) while F_2 represents the load.

Figure 3



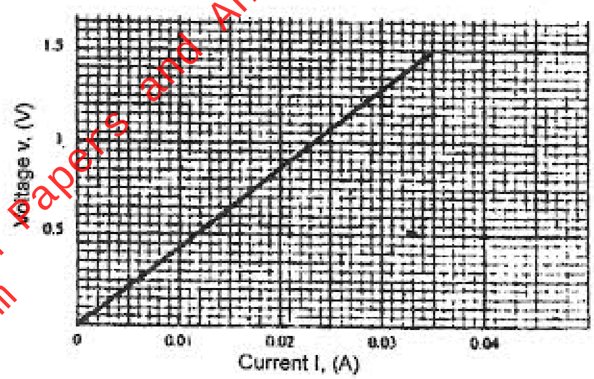
(i) Write an expression for the pressure exerted on the liquid by the effort piston. (1 mark)

A mechanic applies a force of 100 N on the effort piston while raising the rear part of a car.

(ii) Determine the maximum load that can be raised (2 marks)

(iii) Give a reason why gas is not suitable for use in place of the liquid in the jack. (1 mark)

3. (a) The graph in **Figure 3.** shows the voltage-current relationship for a certain conductor.

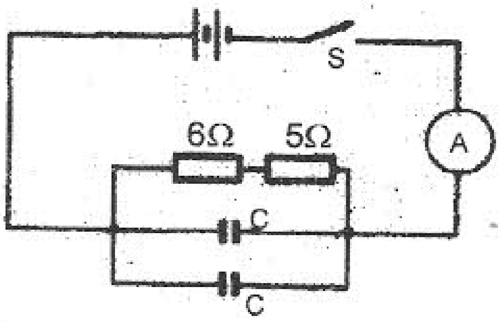


(i) determine the resistance of the conductor (4 marks)

(ii) Given that the length of the conductor used was 0.50 m and the radius of its cross-section was 0.40mm, determine the resisitivity, P, of the material of the conductor (4 marks)

(b) In the circuit diagram shown in **Figure 4**. each cell has an e.m.f of 1.5V and internal resistance of 0.5Ω. The capacitance of each capacitor is 1.4μF.
The switch S is now closed. Determine:

Figure 4



(i) The ammeter reading (3 marks)

(ii) The charge on each capacitor (3 marks)

4. (a) Explain how doping produces an n-type semi-conductor for a pure semi-conductor material (3 marks)

(b) **Figure 5**. shows the circuit of a rectifier using four diodes D_1, D_2, D_3 and D_4

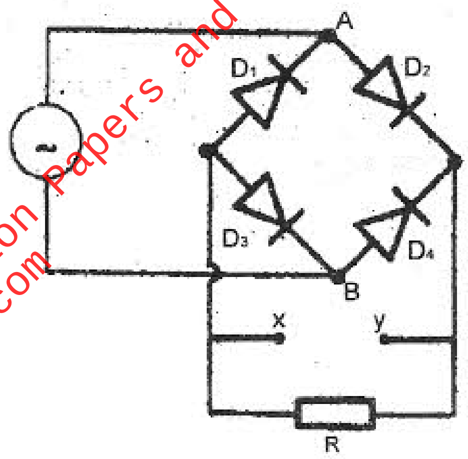
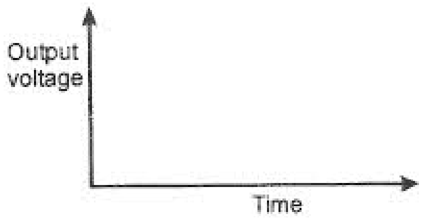


Figure 5

(i) Explain how a rectified output is produced from the set up when an a.c input is connected across AB. (4 marks)

(ii) On the axis provided sketch the graph of output voltage against time for the rectifier (1 mark)

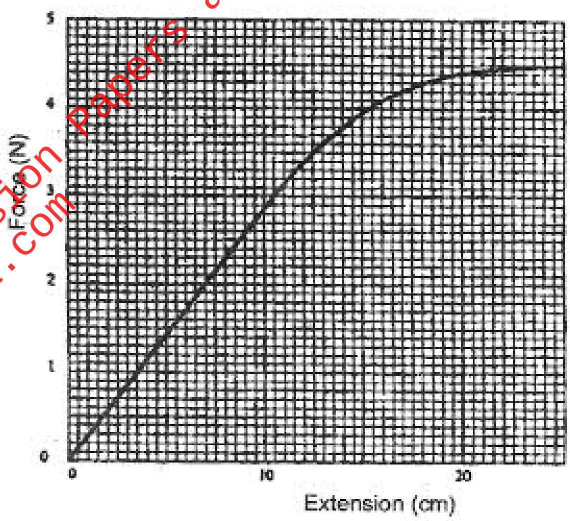


(iii) A capacitor is now connected across XY. Explain the effect on the output. (2 marks)

(c) A transistor in a common-emitter amplifier has $hf_2 = 120$. A signal in the input causes the base current to change by $20\mu A$. What is the corresponding change in the output voltage if the load resistance is 1000Ω? (4 marks)

5. (a) State Hooke's law (1 mark)

(b) One end of a piece of rubber was fixed to a rigid support and the other end pulled with a force of varying magnitude. The graph in Figure 6. shows the relationship between the force (N) and the extension (cm)



Using the graph determine:

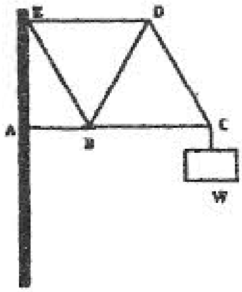
(i) The stretching force at the elastic limit (2 marks)

(ii) The tensile stress in the rubber at an extension of 5 cm if the cross-section area of the rubber is 0.25 cm^2 (4 marks)

(iii) The tensile strain in the rubber at an extension of 5 cm if the original length was 2m (3 marks)

(c) In **Figure** 7. girders AB, BC, CD, ED, EB and BD were joined to make the rigid structure shown. The load W hangs from the structure as shown.

Figure 7



Which of the girders can be replaced with strings without affecting the structure? (2 marks)

SECTION B

Answer ONE question from this section

6. (a) Define the term angular velocity (1 mark)

(b) A body moving with uniform angular velocity is found to have covered an angular distance of 170 radians in t seconds. Thirteen seconds later it is found to have covered a total of angular distance of 300 radians. Determine **t**. (3 marks)

(c) **Figure 8**. shows a body of mass **m** attached to the centre of a rotating table with a string whose tension can be measured. (The device for measuring the tension is not shown in the figure)

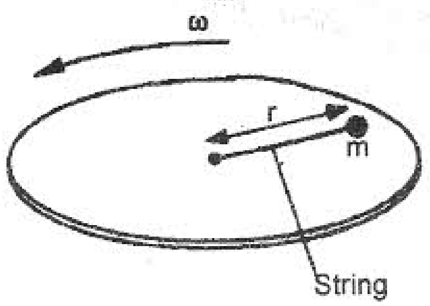


Figure 8.

The tension, **T**, on the string was measured for various values of angular velocity, ω. The distance r of the body from the centre was maintained at 30 cm. Table 1 shows the results obtained.

Table 1

Angular Velocity ω($rads^{-1}$)	2.0	3.0	4.0	5.0	6.0
Tension T (N)	0.04	0.34	0.76	1.30	1.96

(i) Plot the graph of **T** (y-axis) against ω^2 (5 marks)

(ii) From the graph, determine the mass, m, of the body given that

$$T = m\omega^2 r - C$$

where C is a constant (4 marks)

(iii) Determine the constant C and suggest what it represents in the set up. (2 marks)

7. (a) What is meant by **Radioactivity**? (1 mark)

(b) With an aid of a labelled diagram, explain the working of a Geiger Müller tube as a detector of radiation. (5 marks)

(c) In an experiment to determine the half-life of a certain radioactive substance, the activity in disintegrations per minute was measured for sometime. **Table 1** shows the results obtained.

Time in minutes	0	10	20	30	40	50	60	70	80
Activity in disintegrations per minute	152	115	87	66	50	38	20	12	6

On the grid provided plot a suitable graph and use it to determine the half life, $t_{1/2}$ of the substance. (7 marks)

(d) At time t = 40 minutes, the activity of a sample of a certain radioactive isotope with a half life of 12 minutes is found to be 480 disintegrations per minute. Determine the time at which the activity was 3840 disintegrations per minute. (2 marks)