Deformation of Solids

Question paper 7

Level	International A Level
Subject	Physics
Exam Board	CIE
Topic	Deformation of Solids
Sub Topic	
Paper Type	Theory
Booklet	Question paper 7

Time Allowed: **33 minutes**

Score: **/27**

Percentage: **/100**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 **(a)** The kilogram, metre and second are SI base units.

State two other base units.

1. .....

2. .....
[2]

(b) Determine the SI base units of

(i) stress,

SI base units .....[2]

(ii) the Young modulus.

SI base units .....[1]

2 **(a)** Underline **all** the base quantities in the following list.

ampere c ature eight [2]

(b) The potential energy E_P stored in a stretched wire is given by

$$E_P = \tfrac{1}{2} C \sigma^2 V$$

where C is a constant,
σ is the strain,
V is the volume of the wire.

Determine the SI base units of C.

base units .....[3]

3 A straight wire of unstretched length ***L*** has an electrical resistance ***R***. When it is stretched by a force ***F***, the wire extends by an amount ΔL and the resistance increases by ΔR. The area of cross-section ***A*** of the wire may be assumed to remain constant.

(a) (i) State the relation between ***R***, ***L***, ***A*** and the resistivity ρ of the material of the wire.

.....

..... [1]

(ii) Show that the fractional change in resistance $\frac{\Delta R}{R}$ ain in the wire.

[2]

(b) A steel wire has area of cross-section $1.20 \times 10^{-7}\,\text{m}^2$ and a resistance of $4.17\,\Omega$.

The Young modulus of steel is $2.10 \times 10^{11}\,\text{Pa}$.

The tension in the wire is increased from zero to 72.0 N. The wire obeys Hooke's law at these values of tension.

Determine the strain in the wire and hence its change in resistance. Express your answer to an appropriate number of significant figures.

change = ... Ω [5]

4 **(a)** Explain

(i) what is meant by a ***radian***,

.....

.....

.....[2]

(ii) why one complete revolution is equivalent to an angular displacement of 2π rad.

.....

.....[1]

(b) An elastic cord has an unextended length of 13.0 cm. One end of the cord is attached to a fixed point C. A small mass of weight 5.0 N is hung from the free end of the cord. The cord extends to a length of 14.8 cm, as shown in Fig. 1.1.

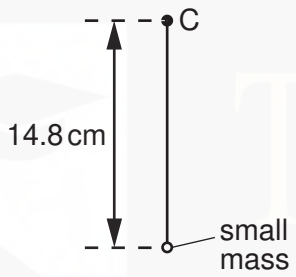

Fig. 1.1

The cord and mass are now made to rotate at constant angular speed ω in a vertical plane about point C. When the cord is vertical and above C, its length is the unextended length of 13.0 cm, as shown in Fig. 1.2.

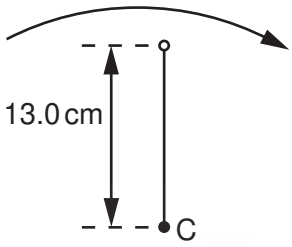

Fig. 1.2

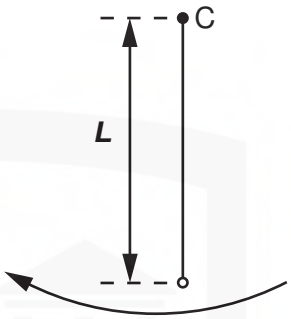

Fig. 1.3

(i) Show that the angular speed ω of the cord and mass is 8.7 rad s^{-1}.

[2]

(ii) The cord and mass rotate so that the cord is vertically below C, as shown in Fig. 1.3.

Calculate the length ***L*** of the cord, assuming it obeys Hooke's law.

L = ... cm [4]