Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic : 4_Materials

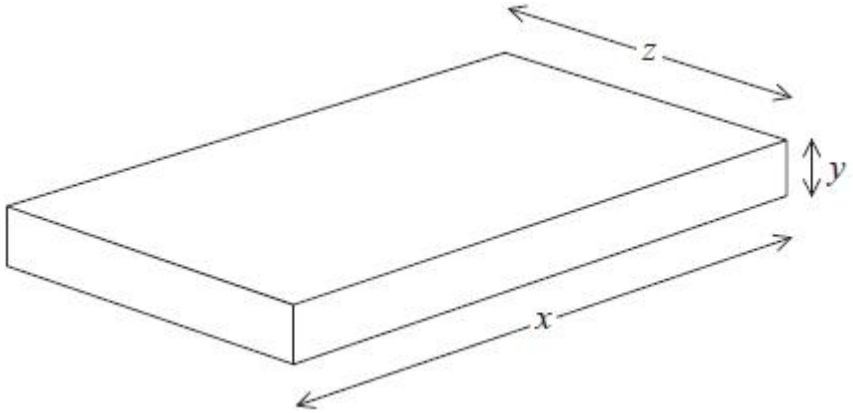
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Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

A student carries out measurements to determine the density of glass. The student has 20 glass microscope slides available.

The approximate dimensions of one slide are shown.



$x \approx 75\,\text{mm}$
$y \approx 1\,\text{mm}$
$z \approx 25\,\text{mm}$

(a) The density is calculated using the equation

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Describe how the student can determine an accurate value for the density of the glass.
Your answer should include the measuring instruments required.

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(b) State one precaution that the student should take to ensure the measurements are accurate.

(1)

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(Total for question = 5 marks)

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Q2.

The photograph shows a type of drink known as stout.



When the drink is poured, it contains many spherical bubbles of gas which rise and form the foamy 'head' at the top of the drink. The manufacturers of the drink state "It takes 120 seconds for the head to form".

For the smallest bubbles, the uniform upward velocity can be calculated using the equation

$$v = \frac{2(\rho_{\text{stout}} - \rho_{\text{gas}})r^2 g}{9\eta}$$

(i) Derive this equation by considering the forces acting on a bubble.

(3)

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(ii) State an assumption you have made.

(1)

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(iii) Evaluate the statement from the manufacturers that it takes 120 seconds for the head to form.
You should consider the time for a bubble to travel from the bottom of the glass to the top.
height of glass = 11.5 cm
density of gas = 1.22 kg m^{-3}
density of stout = 1.01×10^3 kg m^{-3}
viscosity of stout = 2.06×10^{-3} Pa s
diameter of bubble = 122 μm

(4)

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(Total for question = 8 marks)

Q3.

An exhibit in a science museum requires the observer to use a pump to create air bubbles in a column of liquid. The bubbles then rise through the liquid.



A student wishes to determine the total drag force acting on a bubble.

(i) Explain why it might not be possible to use Stokes' law to calculate the drag force acting on a bubble.

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*(ii) Describe an additional measurement that would need to be taken from the photograph and how it could be used to determine the drag force, assuming that the bubble has reached its terminal velocity.

(4)

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Q4.

The photograph shows a guitar.



When a guitar string is plucked, a standing wave is created.

One end of the guitar string is wrapped around a cylindrical tuning peg. Turning the peg changes the total length of the string and hence changes the tension in the string.

This changes the frequency of vibration of the string.



(i) The length of one string is 68 cm.

Calculate the extension required to produce a tension of 93.4 N in the string.

Young modulus of string material = 1.8×10^{9} N m^{-2}
cross-sectional area of string = 6.6×10^{-7} m^{2}

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Extension = ...

(ii) The vibrating length of string is unchanged by turning the tuning peg.

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Explain the effect that tightening the string has on the frequency of the sound produced.

(2)

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(Total for question = 6 marks)

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