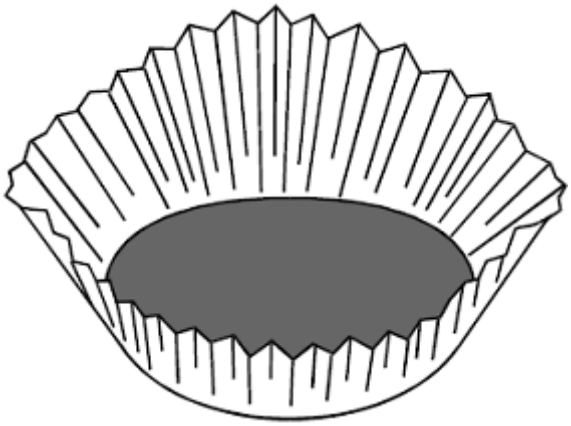
Practice Question Set For A-Level
Subject : Physics
Paper-3 Topic: Section A(Practical Skills Set-3)

Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

When a paper cake-case falls, right way up, through the air, it quickly reaches terminal velocity.



The drag force, D, acting on the paper cake-case, is given by

$$D = f\rho A v^2,$$

where ρ is the density of air (known to be 1.2 kg m^{-3}), v is the terminal velocity and A is the cross-sectional area of the base of the cake-case; f is a number (having no units) called the **shape factor**. Regardless of their size, paper cake-cases always have the same shape factor, even when several are stacked together.

Design an experiment to determine the shape factor for empty paper cake-cases. You shouldassume that the normal laboratory apparatus used in schools and colleges is available to you.
No diagram will be required for this question.

You should also include the following in your answer:

- The quantities you intend to measure and how you will measure them.
- How you propose to use your measurements to determine a reliable result for the shape factor.
- The factors you will need to control and how you will do this.
- How you could overcome any difficulties in obtaining reliable results.

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(Total 8 marks)

Q2.

(a) The Sombrero Galaxy is 50 million light years away from the Earth.

(i) Calculate the distance to this galaxy in parsecs.

(ii) Use Hubble's Law to show that this galaxy is receding at 1000 km s^{-1}.

(iii) One of the lines in the Hydrogen spectrum has a wavelength of 656.3 nm when measured in a laboratory on Earth. Calculate the wavelength of the same line in the observed spectrum of the Sombrero Galaxy.

(4)

(b) Show how Hubble's Law can be used to estimate the age of the Universe. State the assumption made.

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(3)
(Total 7 marks)

Q3.

(a) Betelgeuse is a red supergiant star with a mass approximately ten times greater than that of the Sun. Eventually it is quite likely that Betelgeuse will become a *supernova*, leaving a *neutron star* or perhaps a *black hole*.

State a significant property of a

(i) supernova,

_____

_____

(ii) neutron star,

_____

_____

(iii) black hole.

_____

_____

(3)

(b) Calculate the Schwarzchild radius for a black hole whose mass is ten times greater than that of the Sun.

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(2)
(Total 5 marks)