Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic : 2 (Mechanics)

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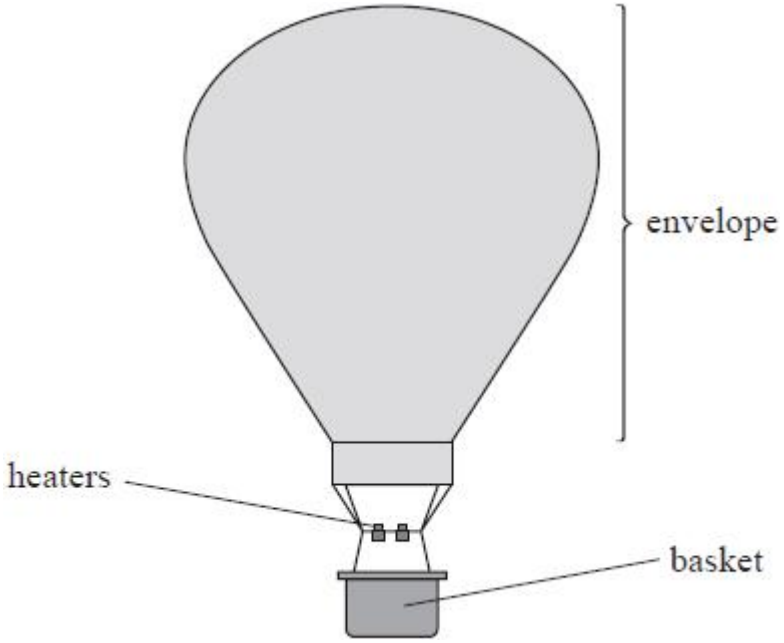
Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

A hot air balloon consists of a fabric envelope, heaters and a basket, as shown.



When the balloon is set up, the envelope is partly filled with air at 20°C. The air is then heated to 120°C and expands to fill the envelope and becomes less dense.

The air pressure inside the envelope is always equal to the air pressure outside the envelope because the envelope is open at the bottom.

The balloon takes off when the upthrust is more than the total weight of the balloon, the air in the envelope and the passengers.

Deduce whether the balloon can take off.

volume of air at 120°C in inflated envelope = 2800 m^3
density of air at 20°C = 1.2 kg m^{-3}
mass of balloon = 380 kg
mass of passengers = 340 kg
upthrust when the envelope is full = 33 000 N

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(Total for question = 6 marks)

Q2.

A student placed a metal block of mass 220 g in boiling water at 100 °C for several minutes.

The student then transferred the metal block into 300 g of water at 19 °C inside a glass container of mass 50 g. The final temperature of the water was 23 °C.

The table shows specific heat capacity values for copper and tin.

Metal	copper	tin
Specific heat capacity / $J\,kg^{-1}K^{-1}$	390	230

Deduce whether the metal block was made from copper or tin.

specific heat capacity of water = $4200 Jkg^{-1}K^{-1}$
specific heat capacity of glass = $840 Jkg^{-1}K^{-1}$

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(Total for question = 5 marks)

Q3.

A student wound a piece of string around the head of an electric toothbrush. The student attached a small mass

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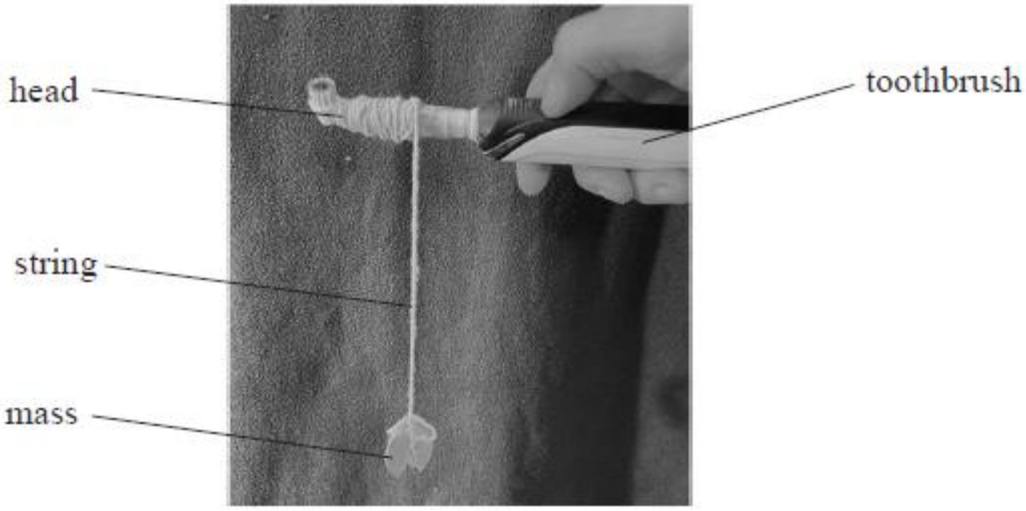
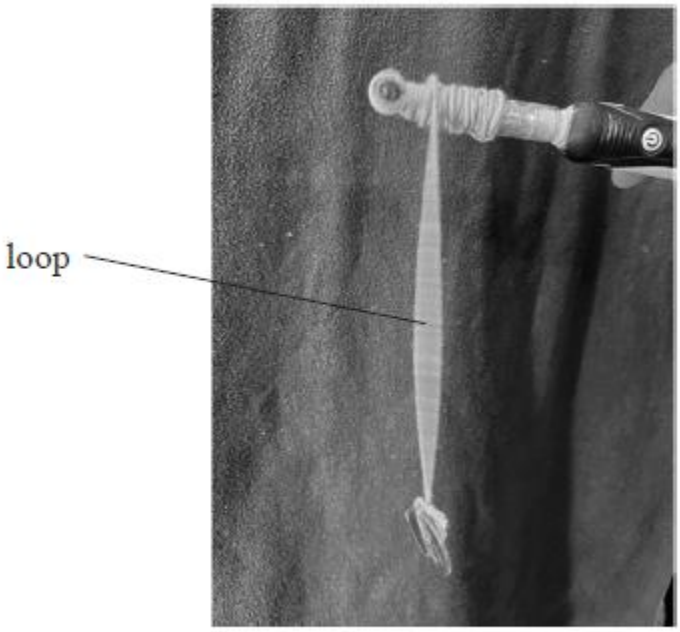
to the other end of the string, as shown in Photograph 1.



Photograph 1

The toothbrush was switched on and the head started to vibrate. The student rotated the toothbrush slowly to unwind the string. At a particular length, large vibrations were observed on the string. The string formed a loop, as shown in Photograph 2.



Photograph 2

The student continued to unwind the string and the loop disappeared. When the length of the unwound string was twice that shown in Photograph 2 two loops were seen. Three loops were seen when the unwound length was three times that shown in Photograph 2 and so on.

Determine the frequency of vibration of the toothbrush head.

unwound length of string with 4 loops = 0.69 m
mass on string = 0.010 kg
mass per unit length of string = 9.1×10^{-4} kg m^{-1}

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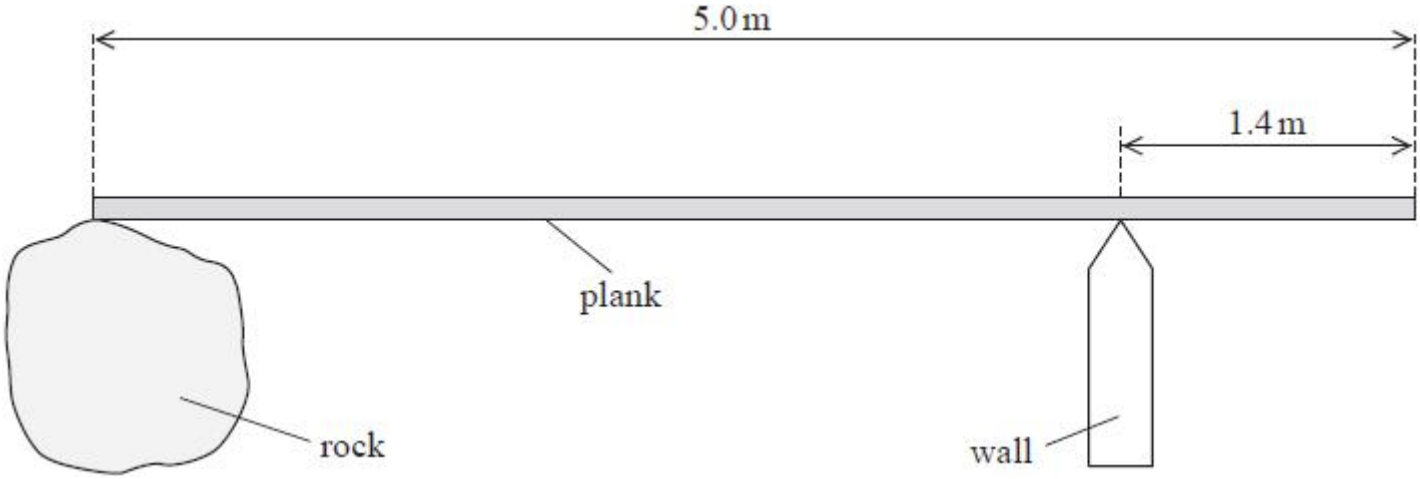
Frequency = ...

(Total for question = 5 marks)

Q4.

Some students used a plank to make a bridge to cross a stream. The plank rested on a rock and a wall as shown. Assume the plank is uniform.



(i) Show that the weight of the plank is about 250 N.

mass of plank = 25 kg

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(ii) Determine the force exerted by the wall on the plank.

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Force exerted by wall on plank = ...

(Total for question = 4 marks)

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