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

Q1.

(a) Define gravitational potential at a point.

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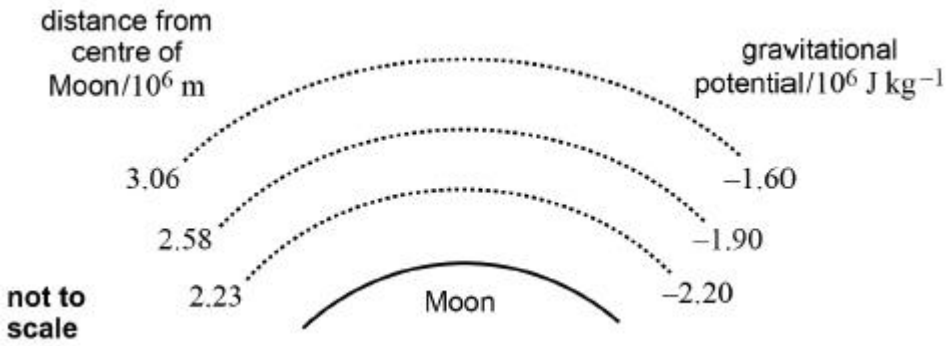
(1)

(b) The diagram shows the positions of equipotential surfaces at different distances from the centre of the Moon.



Explain how the equipotential surfaces in the diagram show that the gravitational field is **not** uniform.

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_____

(1)

(c) Calculate, using the diagram above, the escape velocity at the surface of the Moon.

radius of Moon = 1.74×10^6 m

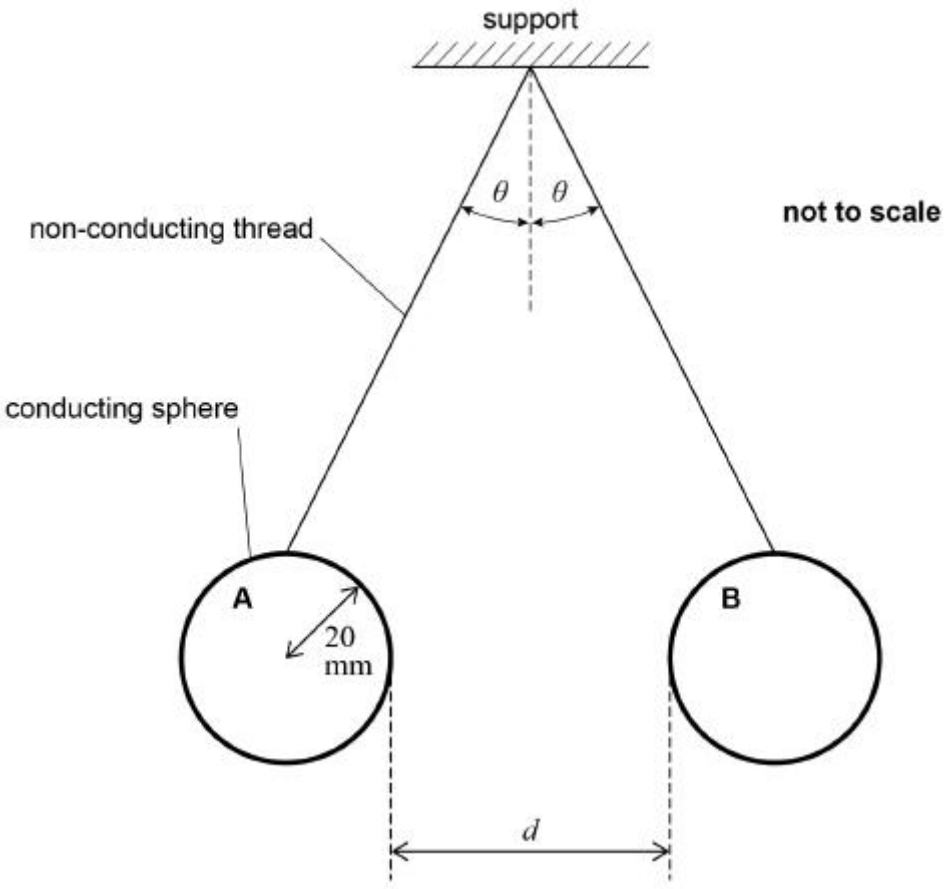
escape velocity = _____ m s^{-1}

(4)

(Total 6 marks)

Q2.

The diagram shows an arrangement used to investigate the repulsive forces between two identical charged conducting spheres.
The spheres are suspended by non-conducting thread.



Each sphere has a mass of 3.2×10^{-3} kg and a radius of 20 mm.
The distance d is 40 mm.

The capacitance of a sphere of radius r is $4\pi\varepsilon_0 r$.

Each sphere is charged by connecting it briefly to the positive terminal of a high-voltage supply, the other terminal of which is at 0 V.
After this has been done the charge on each sphere is 52 nC.

(a) Calculate the potential of one of the spheres.

potential = _____ V

(3)

(b) The charged spheres in the diagram above are at equilibrium.

Draw labelled arrows on the diagram to show the forces on sphere **B**.

(2)

(c) Suggest a solution to **one** problem involved in the measurement of d in the diagram.

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(2)

(d) Show that the magnitude of the electrostatic force on each sphere is about 4×10^{-3} N.

(3)

(e) A student measures the angle θ when the apparatus in the diagram above is at equilibrium. The student records θ as 7°.

Discuss whether this measurement is consistent with the other data in this investigation.

_____

_____

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_____

(2)

(f) The student says that the gravitational force between the two spheres has no **significant** effect on the angle at which the spheres are in equilibrium.

Deduce with a calculation whether this statement is valid.

_____

_____

(2)

(Total 14 marks)