Class 11 Physics · Chapter 7: Gravitation

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. Two small spheres attract each other with a gravitational force F. If the mass of each sphere is doubled and the distance between their centres is tripled, the new force is [1]

(a) $\frac{4}{9}$ F (b) $\frac{2}{3}$ F

(c) $\frac{4}{3}$ F (d) $\frac{9}{4}$ F

2. A satellite in a circular orbit around the Earth has kinetic energy 5.0×10^9 J. Taking the potential energy to be zero at infinity, its total energy is [1]

(a) 5.0×10^9 J (b) -1.0×10^{10} J

(c) -2.5×10^9 J (d) -5.0×10^9 J

3. An astronaut inside a satellite orbiting the Earth feels weightless because [1]

(a) the astronaut and the satellite are both in free fall towards the Earth (b) the gravitational force of the Earth is zero at that height

(c) the Moon's pull cancels the Earth's pull at that height (d) the walls of the satellite shield the astronaut from the Earth's gravity

4. Treating the Earth as a uniform sphere, the acceleration due to gravity is greatest [1]

(a) at the centre of the Earth (b) on the surface of the Earth

(c) at a height R_E above the surface (d) at a depth $R_E/2$ below the surface

5. The dimensional formula of the universal gravitational constant G is [1]

(a) $[M\,L^3\,T^{-2}]$ (b) $[M^{-1}\,L^3\,T^{-2}]$

(c) $[M^{-1}\,L^2\,T^{-2}]$ (d) $[M\,L^2\,T^{-2}]$

6. Starting from $W(r) = -GM_E\,m/r$, show that the gain in potential energy when a body of mass m is raised from the Earth's surface to a small height h is approximately mgh. [2]

7. Two point masses A and B are fixed 12 m apart. A small body placed on the line AB at 3 m from A experiences no net gravitational force. Find the ratio m_B/m_A. [2]

8. A 100 kg satellite moves around the Earth with angular momentum 4.0×10^{12} kg m^2 s^{-1} about the Earth's centre. Find the area swept out per second by the line joining the satellite to the Earth's centre. Does this rate change as the satellite moves along an elliptical orbit? [2]

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9. A 1 kg particle is at the origin. A 4 kg mass is fixed at (2 m, 0) and a 9 kg mass at (0, 3 m). Find the magnitude and direction of the resultant gravitational force on the 1 kg particle. Take $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}. [3]

10. Show that the period of a satellite in a circular orbit of radius r around the Earth varies as $r^{3/2}$. A satellite close to the surface has period T_0. At what height above the surface (R_E = 6400 km) is the period $2\sqrt{2}\,T_0$? [3]

11. Show that the areal velocity of a planet about the Sun is L/2m, where L is its angular momentum and m its mass. Hence explain why the law of areas holds for any central force. [3]

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