QUESTIONS FROM COMPETITIVE EXAMS

5.1 Introduction

(MHT-CET 2011)

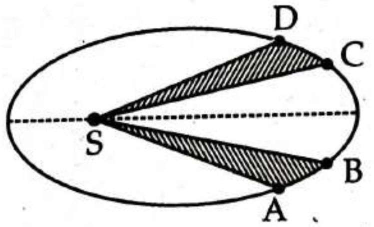
1. Arrange the basic forces Gravitation (G), Electromagnetic (E), Strong nuclear (S) and Weak nuclear (W) forces in ascending order of their strengths
   a) $G > E > S > W$
   b) $G > W > E > S$
   c) $W > G > E > S$
   d) $W > G > S > E$

2. Which of the following is the evidence to show that there must be a force acting on the earth and directed towards the sun ?
   a) Deviation of the falling bodies toward east.
   b) Revolution of the earth around the sun
   c) Phenomenon of day and night
   d) Apparent motion of sun round the earth

5.2 Kepler's Laws

(MHT-CET 2006)

3. The figure shows the motion of a planet around the sun in an elliptical orbit with the sun at one focus. The shaded area SAB is twice that of SCD. If t_1 and t_2 are the times taken by the planet to move from A to B and C to D respectively, then



   a) $t_1 = t_2$
   b) $t_2 = 2t_1$
   c) $t_1 = 2t_2$
   d) none

4. Kepler's second law states that the straight line joining the planet to the sun sweeps out equal areas in equal times. This statement is equivalent to saying that.
   a) total acceleration is zero
   b) tangential acceleration is zero
   c) longitudinal acceleration is zero
   d) radial acceleration is zero

(MHT-CET 2018)

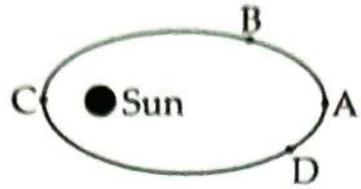
5. A planet revolves round the sun in an elliptical orbit of minor and major axes x and y respectively. Then time period of its revolution is proportional to
   a) $(x + y)^{3/2}$
   b) $(y - x)^{3/2}$
   c) $x^{3/2}$
   d) $y^{3/2}$

(MHT-CET 2019)

6. A satellite revolves round a planet in an elliptical orbit. Its maximum and minimum distances from the planet are 1.5×10^7m and 0.5×10^7m respectively. If the speed of satellite at farthest point be 5 km/s, then its speed at nearest point will be
   a) 28 km/s
   b) 15 km/s
   c) 5/3 km/s
   d) 3.5 km/s

(MHT-CET 2022)

7. A planet is moving around the sun in an elliptical orbit at different positions A, B, C, D. The maximum rotational kinetic energy of the planet is at position



a) B b) A c) D d) C

5.3 Universal Law of Gravitation

(MHT-CET 2006)

8. The universal gravitational constant has the dimensions

a) $[M^1 L^{-3} T^2]$ b) $[M^{-1} L^3 T^{-2}]$ c) $[M^{-1} L^{-3} T]$ d) $[M^1 L^3 T^2]$

(MHT-CET 2008)

9. A small planet is revolving around a very massive star in a circular orbit of radius R with a period of revolution T. If the gravitational force between the planet and the star were proportional to $R^{-5/2}$, then T^2 would be proportional to

a) $R^{3/2}$ b) $R^{3/5}$ c) $R^{7/2}$ d) $R^{7/4}$

(MHT-CET 2011)

10. If the earth stops rotating, then change in the weight of the body at the north pole is

a) zero b) constant c) increases d) decreases

(MHT-CET 2015)

11. The gravitational force between two bodies does not depend upon

a) their separation b) product of their masses

c) both 'a' and 'b' d) media between two bodies

(MHT-CET 2016)

12. A rocket is fired from the earth to the moon. The distance between the earth and the moon is r and the mass of the earth is 81 times the mass of the moon. The gravitational force on the rocket will be zero when its distance from the moon is

a) $\frac{r}{20}$ b) $\frac{r}{15}$ c) $\frac{r}{10}$ d) $\frac{r}{5}$

(MHT-CET 2018)

13. Two identical spheres of same material each of radius 'R' are placed with their centres at a distance of nR, where n is an integer greater than 2. The gravitational force between them will be proportional to

a) $1/4R^4$ b) $1/R^2$ c) R^2 d) R^4

14. Two particles of masses 4 kg and 8 kg are kept at $x = -2$ m and $x = 4$ m respectively. Then the net force acting on a third particle of mass 1 kg kept at the origin in newton is

a) G b) 2 G c) G/2 d) G/4

(MHT-CET 2020)

15. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a seconds pendulum on earth)

a) $2\sqrt{2}$ s b) $(2)^{\frac{1}{3}}$ s c) 2 s d) $\sqrt{2}$ s

26. The acceleration due to gravity on the planet whose mass and radius are half of those of the earth, will be

a) $g/4$ b) g c) $2g$ d) $g/2$

(MHT-CET 2021)

27. If the density of a planet is double that of the earth and the radius 1.5 times that of the earth, the acceleration due to gravity on the planet is

a) 4/3 times that on the surface of the earth
b) 3 times that on the surface of the earth
c) 3/4 times that on the surface of the earth
d) 6 times that on the surface of the earth

(MHT-CET 2022)

28. Acceleration due to gravity at earth's surface is 10 m/s^2. The value of acceleration due to gravity at the surface of a planet of mass $(1/5)^{th}$ and radius 1/2 of the earth is

a) 4 m/s^2 b) 6 m/s^2 c) 8 m/s^2 d) 12 m/s^2

5.5 Acceleration due to Gravity

(MHT-CET 2008)

29. The depth from the surface of the earth where acceleration due to gravity is 20% of its value on the surface of the earth is (R = 6400 km)

a) 1280 km b) 5120 km c) 128 km d) 640 km

(MHT-CET 2010)

30. Two planets are of the same material but their radii are in the ratio 2 : 1. Then ratio of accelerations due to gravity on those two planets is

a) 2 : 1 b) 1 : 2 c) 4 : 1 d) 1 : 4

(MHT-CET 2014)

31. The masses of two planets are in the ratio 1 : 2. Their radii are in the ratio 1 : 2. The accelerations due to gravity on the planets are in the ratio.

a) 1 : 2 b) 2 : 1 c) 3 : 5 d) 5 : 3

(MHT-CET 2019)

32. The mass of a body on the surface of the earth is 10 kg. The mass of the same body on the surface on the moon is (Given : $g_m = \frac{1}{6} g_e$, where g_m, g_e are accelerations due to gravity on the surfaces of the moon and the earth respectively)

a) 10 kg b) 20 kg c) 5 kg d) 15 kg

(MHT-CET 2022)

33. Two spherical planets A and B have same mass but densities are in ratio 8 : 1. For these planets, the ratio of acceleration due to gravity at the surface of A to its value at the surface of B is :

a) 1 : 2 b) 8 : 1 c) 4 : 1 d) 1 : 4

34. Which one of the following statements is not correct about the acceleration due to gravity ? (Do not assume earth as a sphere)

A) It is independent of the shape of earth.
B) It increases with increase in latitude.
C) It decreases with increase in depth. (density of earth is constant)
D) It decreases with increase in altitude.

a) B b) C c) D d) A

(MHT-CET 2019)

42. Consider a particle of mass 'm' suspended by a string at the equator. Let 'R' and 'M' denote radius and mass of the earth. If 'ω' is the angular velocity of rotation of the earth about its own axis, then the tension on the string will be

a) $\frac{GMm}{R^2} - m\omega^2R$ b) $\frac{GMm}{2R^2}$ c) $\frac{GMm}{2R^2} + m\omega^2R$ d) $\frac{GMm}{R^2}$

43. A hole is drilled half way to the centre of the earth. A body weighs 300 N on the surface of the earth. How much will it weigh at the bottom of the hole ?

a) 150 N b) 250 N c) 200 N d) 120 N

44. A pendulum swings at depth 'd' below the surface of the earth with period 'T'. Same pendulum oscillates with same period 'T' at height 'h' above the surface of earth. The ratio $\frac{d}{h}$ will be

a) 1 : 4 b) 2 : 1 c) 1 : 1 d) 1 : 2

(MHT-CET 2021)

45. What should be the velocity of earth due to rotation about its own axis so that the weight becomes half of the initial value ?

a) $\left(\frac{g}{2R}\right)^{\frac{1}{2}}$ b) $\left(\frac{2g}{R}\right)^{\frac{1}{2}}$ c) $\left(\frac{g}{R}\right)^{\frac{1}{2}}$ d) $\left(\frac{4g}{R}\right)^{\frac{1}{2}}$

(MHT-CET 2022)

46. The height above the surface of the earth where acceleration due to gravity becomes $\left(\frac{g}{9}\right)$ is

a) $\frac{R}{3}$ b) 2 R c) $\sqrt{2}$ R d) $\frac{R}{\sqrt{2}}$

47. Consider earth to be sphere of radius 'R_e' rotating about its own axis with angular speed 'ω'. If 'g_e' and 'g_p' are the accelerations due to gravity at the equator and the poles respectively, then $(g_p - g_e)$ is given by

a) $R_e^2\omega^2$ b) $\frac{R_e}{\omega^2}$ c) $R_e\,\omega$ d) $R_e\,\omega^2$

5.7 Gravitational Potential and Potential Energy (Escape Velocity)

(MHT-CET 2001)

48. The escape velocities on the two planets of densities ρ_1 and ρ_2 and having same radius are v_1 and v_2 respectively. Then

a) $\frac{v_1}{v_2} = \frac{\rho_1}{\rho_2}$ b) $\frac{v_2}{v_1} = \frac{\rho_1}{\rho_2}$ c) $\frac{v_1}{v_2} = \left(\frac{\rho_1}{\rho_2}\right)^2$ d) $\frac{v_1}{v_2} = \sqrt{\frac{\rho_1}{\rho_2}}$

49. How much energy will be required if a mass of 100 kg escapes from the earth ? $[R_e = 6.4 \times 10^6$ m, $g = 10$ m/s$^2]$

a) 3.2×10^9 J b) 6.4×10^9 J c) 1.6×10^9 J d) 8×10^9 J