QB365

Important Questions - Gravitation

11th Standard CBSE

Physics

Reg.No. : | | | | | | |

Time : 01:00:00 Hrs

Total Marks : 50

Section-A

1) By which law is the Kepler's law of areas identical? **1**

2) Work done in moving a particle round a closed path under the action of gravitation force zero. Why? **1**

3) Calculate the velocity with which a body projected from the surface of the moon may escape from its gravitational pull. **1**

4) Two satellites are at different heights.Which would have greater velocity? **1**

5) If the force of gravity acts on all bodies in proportion to their masses, then why doesn't a heavy body fall faster than a light body? **1**

6) What is the apparent weight of a man of 60kg who is standing in a lift which is moving up with a uniform speed? **1**

7) Give a method for the determination of the mass of the moon. **1**

8) What is the value of gravitational potential at the surface of the earth, referred top zero potential at infinite distance? **1**

9) If the radius of the earth were increased by a factor of 3, then by what factor would its density have to be changed to keep g the same? **1**

10) Imagine what would happen if the value of G becomes 1/100 times of its present value **1**

Section-B

11) Two particular of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. What is the speed of each particle? **2**

12) An artificial satellite moving in a circular orbit around the earth has a total energy E_0 . What is its potential energy? **2**

13) Two satellites have their masses in the ratio of 3:1. The radii of their circular orbits are in the ratio of 1:4. What is the ratio of total mechanical energy of A and B? **2**

14) The gravitational force between two spheres os x when the distance between their centre is y. What will be the new force, if the separation is made 3y? **2**

15) A mass of 1 g is separated from another mass of 1 g by a distance of 1 cm. How many g-wt of force exists between them? **2**

16) Show that the orbital velocity of a satellite revolvimg the earth is 7.92 kms^{-1} **2**

17) A satellite does not need any fuel to circle around the earth.Why? **2**

18) On what factor does the escape speed from a surface depend? **2**

19) The world's first artificial satellite launched by USSR was circling the earth at a distance of 896 km. Calculate its orbital speed and period of revolution. **2**

20) If the earth has a mass nine times and radius twice that of the planet Mars, calculate the maximum velocity by a rocket to pull out of the gravitational force of the Mars. **2**

Section-C

21) What will be the potential energy of a body of mass 67kg at a distance of $6.6\times10^{10}m$ from the centre of the earth? Find gravitational potential at this distance. **5**

22) Viscous force increases the velocity of a satellite.Discuss **5**

23) At what height above the surface of the earth, the value of acceleration due to gravity is 36% of its value on the surface of the earth? Given the radius of the earth = 6400 km. **5**

24) A body weighs 90kg on the surface of the earth. How much will it weigh on the surface of the mass whose mass is $\frac{1}{9}th$ and radius $\frac{1}{2}$ of that of the earth? **5**

****

Section-A

1) The law of conservation of angular momentum **1**

2) **1**

Gravitational force is a conservative force which means that work done by it, is independent of path followed.

3) 2.5 km/s **1**

4) $v_0 \quad \alpha\frac{1}{\sqrt{r}}$;so the satellite at small height would possess greater velocity **1**

5) Acceleration due to gravity is independent of the mass of the body. **1**

6) Apparent weight=mg=60x10N=600N **1**

7) By making use of the relation, $g_m = \frac{GM_m}{R_m^2}$ **1**

8) $-6.25\times10^7 J/kg$ **1**

9) $\rho/3$ **1**

10) Earth's attraction would be so less that we can easily jump from the top of a multi-storey building. **1**

Section-B

11) $\frac{1}{2}\sqrt{\frac{Gm}{R}}$ **2**

12) $U = 2E_0$ **2**

13) 12:1 **2**

14) **2**

$F\alpha\frac{1}{r^2}$ So, if r is increased by a factor of 3, F will be reduced by a factor of 9. Thus, the new force will be x/9.

15) $F = G\frac{m_1 m_2}{r^2}$ **2**

$= 6.67 \times 10^{-8}) \left(\frac{1\times1}{1^2}\right) dyne$

$= 6.67 \times 10^{-8} \quad dyne = \frac{6.67\times10^{-8}}{980}$

$= 7 \times 10^{-11} g - wt$

16) Orbital velocity , **2**

$v_o = \sqrt{gR}$

$= \sqrt{9.8 \times 6.4 \times 10^6} = 7.92 kms^{-1}$

17) **2**

The gravitation force between satellite and the earth provides the centripetal force required by the satellite to move in a circular orbit.The satellite orbits around earth at such a higher height where air friction is neglible

18) **2**

Value of escape speed at the surface of a planet is given by the relation

$v_{es} = \sqrt{\frac{2GM}{R}} = \sqrt{2gR}$

Thus,the value of escape speed from the surface of planet depends upon(i) value of acceleration due to gravity g at the surface and (ii) the size(i.e. radius) R of the planet only.It is independent of all other factors.

e.g The mass and size of the body to be projected,angle of projection,etc

19) 7.417 km/s, 1 h 43 min 3 s **2**

20) 5.28 km/s **2**

Section-C

21) Mass of the earth, **5**

$M = 6.0 \times 10^{24} kg, \quad m = 67 kg$

$G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$

Gravitational potential,

$V = -\frac{GM}{R}$

$= -\frac{6.67\times10^{-11}\times6\times10^{24}}{6.6\times10^{10}}$

$V = -6.1 \times 10^3 Jkg^{-1}$

22) **5**

Imagine a satellite of mass m moving with a velocity v in an orbit of radius r around a planet mass M.

PE of the satellite , $U = -\frac{GMn}{r}$

KE of the satellite, $K = \frac{1}{2}mv^2 = \frac{GMn}{2r}$ $\quad [as \quad v = \sqrt{Gm/r}]$

Total energy of the satellite,i.e

$E = K + U = \frac{GMn}{2r} - \frac{GMn}{r} = -\frac{GMn}{2r}$

For the sake of clarity,take $\frac{GMn}{2r} = x$

Clearly, $U = -2x, K = x, E = -x$

The orbitting satellite losses energy due to viscous force acting on it due to Let the new orbital radiuatmosphere and as such it loses height.

Let the new orbital radius be $\frac{r}{2}$ (say)

Clearly, $U^{'} = -4x$

$K^{'} = 2x$

$E^{'} = -2x$

Clearly $E^{'} < E, U^{'} < u$ and $K^{'} > K$,Since ,kinetic energy has incresed,the velocity of the satellite increases

23) 4267 km **5**

24) 40 kg **5**