GRAVITATION

NEWTON'S LAW OF GRAVITATION

$$F = G\frac{m_1m_2}{R^2}$$

1. If the distance between two masses is doubled, the gravitational attraction between them
   (a) Is doubled (b) Becomes four times
   (c) Is reduced to half (d) Is reduced to quarter
2. Two sphere of mass m and M are situated in air and the gravitational force between them is F. The space around the masses is now filled with a liquid of specific gravity 3. The gravitational force will be now be
   (a) F (b) F/3 (c) F/9 (d) 3F
3. Two particles of equal mass go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is
   (a) $v = \frac{1}{2R}\sqrt{\frac{1}{Gm}}$ (b) $v = \sqrt{\frac{Gm}{2R}}$ (c) $v = \frac{1}{2}\sqrt{\frac{Gm}{R}}$ (d) $v = \sqrt{\frac{4Gm}{R}}$
4. Force between two objects of equal masses is F. If 25% mass of one object is transferred to the other object than the new force will be
   (a) F/4 (b) 3 F/4 (c) 15/16 F (d) F
5. Three equal masses of 1 kg each are placed at the vertices of an equilateral triangle PQR and a mass of 2 kg is placed at the centroid O of the triangle which is at a distance of $\sqrt{2}$ m from each of the vertices of the triangle. The force, in newton, acting on the mass of 2 kg is
   (a) 2 (b) $\sqrt{2}$ (c) 1 (d) zero
6. Two point of masses A and B having masses in the ratio 4 : 3 are separated by a distance of 1 m. When another point mass C of mass M is placed in between A and B, the force between A and C is $1/3^{rd}$ of the force between B and C. Then the distance of C from A is
   (a) 2/3 m (b) 1/3 m (c) 1/4 m (d) 2/7 m

ACCELERATION DUE TO GRAVITY

At earth surface, $g = \frac{GM}{R^2}$

At height h from surface, $g' = \frac{gR^2}{(R+h)^2}$

$= g(1 - 2h/R)$, for $h << R$

At depth h from surface, $g' = g\left(1 - \frac{h}{R}\right)$

effect due to rotation of earth, $g' = g(1 - \omega^2 R\cos^2 \lambda)$

1. A body of mass 500 g is thrown upward with a velocity 20 m/s and reaches back to the surface of a planet after 20 sec. Then the weight of the body on that planet is

(a) 2 N (b) 4 N (c) 5 N (d) 1 N

2. If the change in the value of 'g' at a height h above the surface of the earth is the same as at a depth x below it, then (both x and h being much smaller than the radius of the earth)

(a) $x = h$ (b) $x = 2h$ (c) $x = h/2$ (d) $x = h^2$

3. A body weighs 700 g wt on the surface of the earth. How much will it weigh on the surface of a planet whose mass is 1/7 and radius is half that of the earth

(a) 200 g wt (b) 400 g wt (c) 50 g wt (d) 300 g wt

4. If the earth is supposed to be a sphere R, if g_{30} is value of acceleration due to gravity at latitude of 30^o and g at the equator, the value of $g - g_{30^o}$ is

(a) $1/4\omega^2R$ (b) $3/4\omega^2R$ (c) ω^2R (d) $1/2\omega^2R$

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

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

6. As we go from the equator to the poles, the value of g

(a) remain same (b) decreases
(c) increases (d) decreases upto a latitude of 45^o

7. The radius of the earth is 6400 km and g = 10 m/sec^2. In order that a body of 5 kg weighs zero at the equator, the angular speed of the earth is

(a) 1/80 radian/sec (b) 1/400 radian/sec
(c) 1/800 radian/sec (d) 1/1600 radian/sec

8. The weight of an object in the coal mine, sea level, at the top of the mountain are W_1, W_2 and W_3 respectively, then

(a) $W_1 < W_2 > W_3$ (b) $W_1 = W_2 = W_3$
(c) $W_1 < W_2 < W_3$ (d) $W_1 > W_2 > W_3$

9. The height at which the weight of a body becomes 1/16th, its weight on the surface of earth (radius R), is

(a) 5R (b) 15R (c) 3R (d) 4R

10. The ratio between the values of acceleration due to gravity at a height 1 km above and at a height of 1 km below the earth's surface is (radius of earth is R)

(a) $\frac{(R-2)}{(R-1)}$ (b) $\frac{R}{R-1}$ (c) $\frac{R-2}{R}$ (d) $\frac{2R}{R-1}$

11. The moon's radius is 1/4 that of the earth and its mass is 1/80 times that of the earth. If g represents the acceleration due to gravity on the surface of the earth, that on the surface of the moon is

(a) g/4 (b) g/5 (c) g/6 (d) g/8

12. The depth d at which the value of acceleration due to gravity becomes 1/n times the value at the surface, is [R = radius of the earth]

(a) R/n (b) $R\left(\frac{n-1}{n}\right)$ (c) R/n^2 (d) R(n/n+1)

13. If the density of a small planet is the same as that of earth, while the radius of the planet is 0.2 times that of the earth, the gravitational acceleration on the surface of that planet is

(a) 0.2 g (b) 0.4 g (c) 2 g (d) 4 g

14. The height vertically above the earth's surface at which the acceleration due to gravity becomes 1% of its value at the surface is

(a) 8 R (b) 9 R (c) 10 R (d) 20 R

15. The value of g decreases inside the surface of earth because

(a) A force of upward attraction is applied by the shell of earth above

(b) The shell of earth above exerts no net force

(c) the distance from the centre of the earth decreases

(d) the density of the material at the centre of the earth is very small

16. The angular velocity of the earth with which it has to rotate so that acceleration due to gravity on 60^o latitude becomes zero is (Radius of earth = 6400 km. At the poles g =$10ms^{-2}$)

(a) 2.5×10^{-3} rad/s (b) 5.0×10^{-1} rad/s

(c) 10×10^{1} rad/s (d) 7.8×10^{-2} rad/s

17. Acceleration due to gravity on moon is 1/6 of the acceleration due to gravity on earth. If the ratio of densities of earth (ρ_e) and moon (ρ_m) is (ρ_e/ρ_m) = 5/3 then radius of moon R_m in terms of R_e will be

(a) 5/18 R_e (b) 1/6 R_e (c) 3/18 R_e (d) $1/2\sqrt{3}$ R_e

18. A man can jump to a height of 1.5 m on a planet A. What is the height he may be able to jump on another planet whose density and radius are, respectively, one-quarter and one-third that of planet A

(a) 1.5 m (b) 15 m (c) 18 m (d) 28 m

GRAVITATIONAL FIELD INTENSITY

Due to point mass, $I = \frac{Gm}{r^2}$

Due to hollow sphere $\begin{cases} 0, \text{ inside}(r < R) \\ \frac{Gm}{r^2}, \text{outside}(r \geq R) \end{cases}$

Due to solid sphere = $\begin{cases} \frac{Gm}{R^3}.r, \text{ inside}(r < R) \\ \frac{Gm}{r^2}, \text{outside}(r \geq R) \end{cases}$

1. What is the intensity of gravitational field at the centre of a spherical shell

(a) Gm/r^2 (b) g (c) zero (d) none of these

2. 3 particles each of mass m are kept at vertices of an equilateral triangle of side L. The gravitational field at centre due to these particles is

(a) zero (b) $3GM/L^2$ (c) $9GM/L^2$ (d) $12/\sqrt{3}\ GM/L^2$

GRAVITATIONAL POTENTIAL

to point mass, $V = \frac{-Gm}{r}$

Due to hollow sphere $V = \begin{cases} \frac{-Gm}{R} \\ \frac{-Gm}{r} \end{cases}$

Due to solid sphere = V = $\begin{cases} -\frac{Gm}{R}\left(\frac{3}{2}-\left(\frac{r}{R}\right)^2\right) \\ -\frac{Gm}{r} \end{cases}$

1. A particle of mass m is situated at the centre of a spherical shell of same mass and radius a. The magnitude of the gravitational potential at a point situated at a/2 distance from the centre will be

(a) $\frac{4GM}{a}$ (b) $\frac{GM}{a}$ (c) $\frac{2GM}{a}$ (d) $\frac{3GM}{a}$

2. Two bodies of mass m and 4 m are placed at a distance r. The gravitational potential at a point on the line joining them where the gravitational field is zero is

(a) zero (b) $-\frac{4Gm}{r}$ (c) $-\frac{6Gm}{r}$ (d) $-\frac{9Gm}{r}$

3. Two small and heavy spheres, each of mass M, are placed a distance r apart on a horizontal surface. The gravitational potential at the mid-point on the line joining the centre of the sphere is

(a) zero (b) $-\frac{GM}{r}$ (c) $-\frac{2GM}{r}$ (d) $-\frac{4GM}{r}$

4. Four particles each of mass M, are located at the vertices of a square with side L. The gravitational potential due to this at the centre of the square is

(a) $-\sqrt{32}\frac{GM}{L}$ (b) $-\sqrt{64}\frac{GM}{L^2}$ (c) zero (d) $\sqrt{32}\frac{GM}{L}$

GRAVITATIONAL POTENTIAL ENERGY

of two points mass, $U = -G\frac{m_1m_2}{r}$

1. A body of mass 'm' is taken from the earth's surface to the height equal to twice the radius (R) of the earth. The change of potential energy of body will be

(a) $\frac{1}{3}mgR$ (b) mg2R (c) $\frac{2}{3}mgR$ (d) 3mgR

2. The potential energy of 4 –particles each of mass 1 kg placed at the four vertices of a square of side length 1 m is

(a) +4.0 G (b) –7.5 G (c) –5.4 G (d) +6.3 G

ESCAPE VELOCITY

$$V_e = \begin{cases} \sqrt{2gr}, & \text{from surface} \\ \sqrt{2gR\left(\frac{R}{R+h}\right)} & \text{at height h from surface} \end{cases}$$

1. A planet in a distant solar system is 10 times more massive than the earth and the radius is 10 times smaller. Given that the escape velocity from the earth is 11 km s^{-1}, the escape velocity from the surface of the planet would be

(a) 11 km s^{-1} (b) 110 km s^{-1} (c) 0.11 km s^{-1} (d) 1.1 km s^{-1}

2. The escape velocity from earth is v_{es}. A body is projected with velocity $2v_{es}$ with what constant velocity will it move in the inter planetary space

(a) v_{es} (b) $3v_{es}$ (c) $\sqrt{3}v_{es}$ (d) $\sqrt{5}v_{es}$

3. A black hole is an object whose gravitational field is so strong that even light cannot escape from it. To what approximate radius would earth (mass = 5.98 x 10^{24} kg) have to be compressed to be a black hole.

(a) 10^{-2} m (b) 100 m (c) 10^{-9} m (d) 10^{-6} m

4. A body is projected vertically upwards from the surface of a planet of radius R a velocity equal to half the escape velocity for that planet. The maximum height attained by the body is

(a) R/3 (b) R/2 (c) R/4 (d) R/5

5. The kinetic energy needed to projected a body of mass m from the earth surface (radius R) to infinity is

(a) mgR/2 (b) 2 mgR (c) mgR (d) mgR/4

6. If the escape velocity of a planet is 3 times that of the earth and its radius is 4 times that of the earth, then the mass of the planet is (Mass of the earth = 6 x 10^{24} kg)

(a) 1.62 x 10^{22} kg (b) 0.72 x 10^{22} kg

(c) 2.16 x 10^{26} kg (d) 1.22 x 10^{22} kg

7. The radius of a planet is twice the radius of earth. Both have almost equal average mass-densities. If V_P and V_E are escape velocities of the planet and the earth, respectively, then

(a) $V_P = 1.5V_E$ (b) $V_P = 2V_E$ (c) $V_E = 3V_P$ (d) $V_E = 1.5V_P$

8. The earth is assumed to be a sphere radius R. A platform is arranged at a height R from the surface of the Earth. The escape velocity of a body from this platform is fv, where v is its escape velocity from the surface of the Earth. The value of f is

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

9. The escape velocity for a body projected vertically upwards from the surface of earth is 11 km/s. If the body is projected at an angle of 45° with her vertical, the escape velocity will be

(a) $\frac{11}{\sqrt{2}}$ km/s (b) $11\sqrt{2}$ km/s (c) 22 km/s (d) 11 km/s

MOTION OF SATELLITE

Orbital velocity: $V_o = \begin{cases} \sqrt{\dfrac{gR^2}{R+h}}, \text{at height h} \\ \sqrt{gR}, \text{at surface} \end{cases}$

Time period: $T = \begin{cases} 2\pi\sqrt{\dfrac{(R+h)^3}{gR^2}} \\ 2\pi\sqrt{\dfrac{R}{g}} \end{cases}$

Energy of satellite: $E = \begin{cases} -G\dfrac{Mm}{2(R+h)}, \text{at distance h} \\ -G\dfrac{mm}{2R} \end{cases}$

K.E. = – E ; P.E. = 2E

Binding energy of satellite = –E

1. Energy required to move a body of mass m from an orbit of radius 2R to 3R is

(a) GMm/12R (b) GMm/3R (c) GMm/8R (d) GMm/6R

2. For a satellite in an orbit around the earth, the ratio of the kinetic energy to potential energy is

(a) 2 (b) 1/2 (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

3. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of g_o, the value of acceleration due to gravity at the earth's surface is

(a) $-\frac{2mg_0R^2}{R+h}$ (b) $\frac{mg_0R^2}{2(R+h)}$ (c) $-\frac{mg_0R^2}{2(R+h)}$ (d) $\frac{Rmg_0R^2}{R+h}$

4. If v_e and v_0 represent the escape velocity and orbital velocity of a satellite corresponding to a circular orbit of radius R, then

(a) $v_e = v_0$ (b) $\sqrt{2}v_0 = v_e$ (c) $v_e = v_0/\sqrt{2}$ (d) v_e and v_0 are not related

5. A satellite which is geostationary in a particular orbit is taken to another orbit. Its distance from the centre of earth in new orbit is 2 times that of the earlier orbit. The time period in the second orbit is

(a) 4.8 hours (b) $48\sqrt{2}$ hours (c) 24 hours (d) $24\sqrt{2}$ hours

6. The time period of a geostationary satellite at a height 3600 km is 24 hrs. A spy satellite orbits very close to earth surface (R = 6400 km). What will be its time period?

(a) 4 hrs (b) 1 hr (c) 2 hrs (d) 1.5 hrs

7. Two satellites A and B go around a planet P in circular orbits having radii 4R and R respectively. If the speed of the satellite A is 3V, the speed of the satellite B will be

(a) 12 V (b) 6 V (c) 4/3 V (d) 3/2 V

8. What is the minimum energy required to launch a satellite of mass m from the surface of the earth of mass M and radius R in a circular orbit at an altitude of 2R

(a) $\frac{5GmM}{6R}$ (b) $\frac{2GmM}{3R}$ (c) $\frac{GmM}{2R}$ (d) $\frac{GmM}{3R}$

9. A satellite is moving around the earth with speed v in a circular orbit of radius r. If the orbit is decreases by 1% its speed will

(a) Increase by 1% (b) Increase by 0.5 %

(c) Decrease 1% (d) Decrease by 0.5%

10. An artificial satellite of mass 'm' revolves around the earth near to its surface then its binding energy is [Re, g are radius and acceleration due to gravity respectively of the earth]

(a) $\frac{1}{2}mgR_e$ (b) $-\frac{1}{2}mgR_e$ (c) mg R_e (d) –mg R_e

11. The orbital speed of an artificial satellite very close to the surface of the earth is V_o. Then the orbital speed of the another artificial satellite at a height equal to three times the radius of the earth is

(a) 1 V_0 (b) $2V_0$ (c) $0.5V_0$ (d) 4 V_0

12. The distance of a geostationary satellite from the centre of the earth (Radius R = 6400 km) is nearest to

(a) 5R (b) 7R (c) 10R (d) 18 R

13. A geo-stationary satellite is orbiting the earth at a height of 6 R above the surface of earth, R being the radius of earth. The time period of another satellite at a height of 2.5 R from the surface of earth is

(a) 10 hr (b) $(6\sqrt{2})$hr (c) 6 hr (d) $6/\sqrt{2}$ hr

14. A satellite with kinetic energy E_k is revolving round the earth in a circular orbit. How much more kinetic energy should be given to it so that it may just escape into outer space

(a) E_k (b) 2 E_k (c) 1/2 E_k (d) 3 E_k

15. A satellite moves round the earth in a circular orbit of radius R making one revolution per day. A second satellite moving win a circular orbit, moves round the earth once in 8 days. The radius of the orbit of the second satellite is

(a) 8 R (b) 4 R (c) 2 R (d) R

KEEPLER'S LAW OF PLANETARY MOTION

Areal velocity: $\frac{dA}{dt} = \frac{L}{2m} = \text{constant}$

Time period (T): $T^2 \alpha a^3$, for elliptical orbit

$T^2 \alpha r^3$, for circular orbit

1. A planet moving along an elliptical orbit is closed to the sun at a distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are the linear velocity at these points respectively. Then the ratio v_1/v_2 is

(a) $\frac{r_1}{r_2}$ (b) $\left(\frac{r_1}{r_2}\right)^2$ (c) $\frac{r_2}{r_1}$ (d) $\left(\frac{r_2}{r_1}\right)^2$

2. The distance of neptune and saturn from sun are nearly 10^{13} and 10^{12} m respectively. Assuming that they moves in circular orbits, their periodic times will be in the ratio

(a) $\sqrt{10}$ (b) 100 (c) $10\sqrt{10}$ (d) $1\sqrt{10}$

3. A planet moving around the sun sweeps area A_1 in 2 days, A_2 in 3 days and A3 in 6 days. Then the relation between A_1, A_2 and A_3 is

(a) $3A_1 = 2A_2 = A_3$ (b) $2A_1 = 3A_2 = 6A_3$

(c) $3A_1 = 2A_2 = 6A_3$ (d) $6A_1 = 3A_2 = 2A_3$

4. The earth E moves in an ellipitical orbit with the sun S at one of the foci shown in figure. Its speed of motion will be maximum at the point

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

5. In an elliptical orbit under gravitational force, in general

(a) Tangential velocity is constant (b) Angular velocity is constant

(c) Radial velocity is constant (d) Areal velocity is constant

ADVANCE

1. Two identical solid copper spheres of radius R are placed in contact with each other. The gravitational attraction between the, is proportional to

(a) R^2 (b) R^{-2} (c) R^4 (d) R^{-4}

2. Mass M is divided into two parts xM and (1 – x)M. For a given separation, the value of x for which gravitational attraction between the two placed becomes maximum us

(a) 1/2 (b) 3/5 (c) 1 (d) 2

3. The time period of a single pendulum on a freely moving artificial satellite is

(a) Zero (b) 2 sec (c) 3 sec (d) infinite

4. At what height from the surface of earth the gravitation potential and the value of g are -5.4×10^7 Jkg^{-2} and 6.0 ms^{-2} respectively? Take the radius of earth as 6400 km

(a) 2600 km (b) 1600 km (c) 1400 km (d) 2000 km

5. Two spheres of same size, one of mass 2 kg and another of mass 4 kg are dopped simultaneously from the top of Qutub Minar (height = 72 m). When they are 1 m above the ground, the two spheres have the surface

(a) Momentum (b) Kinetic energy (c) Potential energy (d) Acceleration

6. A rocket is fired from inside a deep mine, so as to escape the earth's gravitational field. The minimum velocity to be imparted to the rocket is

(a) Exactly the same as the escape velocity of fire from the earth's surface

(b) A little more than the escape velocity of fire from the earth's surface

(c) A little less than the escape velocity of fire from the earth's surface

(d) Infinity

7. The mass of a spaceship is 1000 kg. It is to be launched from the earth's surface out into free space. The value of 'g' and 'R' (radius of earth) are $10 m/s^2$ and 6400 km respectively. The required energy for this work will be

(a) 6.4×10^{11} Joules (b) 6.4×10^8 Joules

(c) 6.4×10^9 Joules (d) 6.4×10^{10} Joules

8. From a solid sphere of mass M and radius R, a spherical portion of radius R/2 is removed as shown in the figure. Taking gravitation potential V = 0 at r = ∞, the potential at the centre of cavity thus formed is (G = Gravitational constant)

(a) $\frac{-GM}{2R}$ (b) $\frac{-GM}{R}$ (c) $\frac{-2GM}{3R}$ (d) $\frac{-2GM}{R}$

9. A body is orbiting very close to the earth surface with kinetic energy KE. The energy required to completely escape from it is

(a) $\sqrt{2}KE$ (b) KE (c) $KE/\sqrt{2}$ (d) none of these

10. A body of mass m kg starts falling a point 2R above the Earth's surface. Its kinetic energy when it has fallen to a point 'R' above the earth's surface [R = radius of earth. M =mass of earth, G = gravitational constant]

(a) $\frac{1}{2}\frac{GMm}{R}$ (b) $\frac{1}{6}\frac{GMm}{R}$ (c) $\frac{2}{3}\frac{GMm}{R}$ (d) $\frac{1}{3}\frac{GMm}{R}$

11. The escape velocity for a rocket from earth is 11.2 km/sec. Its value on a planet where acceleration due to gravity is double that on the earth and diameter of the planet is twice that of the earth will be in km/sec

(a) 11.2 (b) 5.6 (c) 22.4 (d) 53.6

12. There are two planets. The ratio of radius of the two planets is K but ratio of acceleration due to gravity of both planets is g. What will be the ratio of their escape velocity

(a) $(Kg)^{1/2}$ (b) $(Kg)^{-1/2}$ (c) $(Kg)^2$ (d) $(Kg)^{-2}$

13. A satellite of mass 'm' is revolving in circular orbit of radius 'r' round the earth. Its angular momentum w.r.t the centre of its orbit is (M = mass of earth, G = universal gravitational constant)

(a) $(GMmr)^{1/2}$ (b) $(GMm^2r)^{1/2}$ (c) $(GMm^2r^2)^{1/2}$ (d) $(GM^2m^2r)^{1/2}$

14. If the gravitational force between two objects were proportional to 1/R (and not as $1/R^2$) where R is separation between them, then a particle in circular orbit under such a force would have its orbital speed v proportional to

(a) $1/R^2$ (b) R^0 (c) R^1 (d) $1/R$

15. An asteroid of mass m is approaching earth, initially at a distance of 10 R_e with speed v_1. It hits the earth with a speed v_1 (R_e and M_e are radius and mass of earth, then

(a) $v_1^2 = v_1^2 + \frac{2Gm}{M_eR}\left(1-\frac{1}{10}\right)$ (b) $v_1^2 = v_1^2 + \frac{2Gm}{R_e}\left(1+\frac{1}{10}\right)$

(c) $v_1^2 = v_1^2 + \frac{2GM_e}{R_e}\left(1-\frac{1}{10}\right)$ (d) $v_1^2 = v_1^2 + \frac{2Gm}{R_e}\left(1-\frac{1}{10}\right)$

16. Suppose the gravitational force varies inversely as the nth power of distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to

(a) $R^{(n+1/R)}$ (b) $R^{(n-1/2)}$ (c) R^n (d) $R^{(n-2/2)}$

17. The speed of moon's rotation around the earth in nearly 29 days. If moon's mass were 2 fold, its present value and all other things remained unchanged, the period of moon's rotation would be nearly

(a) $29\sqrt{2}$ days (b) $29/\sqrt{2}$ days (c) 29 x 2 days (d) 29 days

ANSWERS

NEWTON'S LAW OF GRAVITATION

1.	(d)	2.	(a)	3.	(c)	4.	(c)	5.	(d)	6.	(a)

ACCELERATION DUE TO GRAVITY

1.	(d)	2.	(b)	3.	(b)	4.	(b)	5.	(b)	6.	(c)	7.	(c)
8.	(a)	9.	(c)	10.	(a)	11.	(b)	12.	(b)	13.	(a)	14.	(b)
15.	(b)	16.	(a)	17.	(a)	18.	(c)						

GRAVITATIONAL FIELD INTENSITY

1.	(c)	2.	(a)

GRAVITATIONAL POTENTIAL

1.	(d)	2.	(d)	3.	(d)	4.	(a)

GRAVITATIONAL POTENTIAL ENERGY

1.	(c)	2.	(c)

ESCAPE VELOCITY

1.	(b)	2.	(c)	3.	(a)	4.	(a)	5.	(c)	6.	(c)	7.	(b)
8.	(d)	9.	(d)										

MOTION OF SATELLITE

1.	(a)	2.	(b)	3.	(c)	4.	(b)	5.	(b)	6.	(d)	7.	(b)
8.	(a)	9.	(b)	10.	(a)	11.	(c)	12.	(b)	13.	(b)	14.	(a)
15.	(b)												

KEEPLER'S LAW OF PLANETARY MOTION

1.	(c)	2.	(c)	3.	(c)	4.	(b)	5.	(d)

ADVANCED QUESTIONS

1.	(c)	2.	(a)	3.	(d)	4.	(a)	5.	(d)	6.	(b)	7.	(d)
8.	(b)	9.	(b)	10.	(c)	11.	(c)	12.	(a)	13.	(b)	14.	(b)
15.	(c)	16.	(a)	17.	(b)								