EXERCISE-I

1. Gravitational mass is proportional to gravitational
(A) Field (B) Force
(C) Intensity (D) All of these

2. The gravitational force between two point masses m_1 and m_2 at separation r is given by $F = k\frac{m_1 m_2}{r^2}$ The constant k
(A) Depends on system of units only
(B) Depends on medium between masses only
(C) Depends on both (A) and (B)
(D)Is independent of both (A) and (B)

3. The distance of the centres of moon and earth is *D*. The mass of earth is 81 times the mass of the moon. At what distance from the centre of the earth, the gravitational force will be zero
(A) $\frac{D}{2}$ (B) $\frac{2D}{3}$
(C) $\frac{4D}{3}$ (D) $\frac{9D}{10}$

4. Who among the following gave first the experimental value of *G*
(A) Cavendish (B) Copernicus
(C) Brook Teylor (D) None of these

5. The mass of the moon is $7.34\times10^{22}\ kg$ and the radius is $1.74\times10^{6}\ m$. The value of gravitation force will be
(A) 1.45 *N*/*kg* (B) 1.55 *N*/*kg*
(C) 1.75 *N*/*kg* (D) 1.62 *N*/*kg*

6. The centripetal force acting on a satellite orbiting round the earth and the gravitational force of earth acting on the satellite both equal *F*. The net force on the satellite is
(A) Zero (B) *F*
(C) $F\sqrt{2}$ (D) 2 *F*

7. Reason of weightlessness in a satellite is
(A) Zero gravity
(B) Centre of mass
(C) Zero reaction force by satellite surface
(D) None

8. Mass *M* is divided into two parts *xM* and $(1-x)M$. For a given separation, the value of *x* for which the gravitational attraction between the two pieces becomes maximum is
(A) $\frac{1}{2}$ (B) $\frac{3}{5}$
(C) 1 (D) 2

9. The force of gravitation is
(A) Repulsive (B) Electrostatic
(C) Conservative (D) Non-conservative

10. The gravitational force F_g between two objects does not depend on
(A) Sum of the masses
(B) Product of the masses
(C) Gravitational constant
(D) Distance between the masses

11. The mass of the earth is 81 times that of the moon and the radius of the earth is 3.5 times that of the moon. The ratio of the acceleration due to gravity at the surface of the moon to that at the surface of the earth is
(A) 0.15 (B) 0.04
(C) 1 (D) 6

12. Spot the *wrong* statement :
The acceleration due to gravity '*g*' decreases if
(A) We go down from the surface of the earth towards its centre
(B) We go up from the surface of the earth
(C) We go from the equator towards the poles on the surface of the earth
(D) The rotational velocity of the earth is increased

13. Which of the following statements is true
(A) *g* is less at the earth's surface than at a height above it or a depth below it
(B) *g* is same at all places on the surface of the earth
(C) *g* has its maximum value at the equator
(D) *g* is greater at the poles than at the equator

14. A spring balance is graduated on sea level. If a body is weighed with this balance at consecutively increasing heights from earth's surface, the weight indicated by the balance

(A) Will go on increasing continuously
(B) Will go on decreasing continuously
(C) Will remain same
(D) Will first increase and then decrease

15. The value of g on the earth's surface is $980\, cm/\sec^2$. Its value at a height of 64 *km* from the earth's surface is

(A) $960.40\, cm/\sec^2$ (B) $984.90\, cm/\sec^2$
(C) $982.45\, cm/\sec^2$ (D) $977.55\, cm/\sec^2$
(Radius of the earth R = 6400 *kilometers*)

16. Choose the correct statement from the following :
Weightlessness of an astronaut moving in a satellite is a situation of

(A) Zero g (B) No gravity
(C) Zero mass (D) Free fall

17. If the earth rotates faster than its present speed, the weight of an object will

(A) Increase at the equator but remain unchanged at the poles
(B) Decrease at the equator but remain unchanged at the poles
(C) Remain unchanged at the equator but decrease at the poles
(D) Remain unchanged at the equator but increase at the poles

18. If the earth suddenly shrinks (without changing mass) to half of its present radius, the acceleration due to gravity will be

(A) $g/2$ (B) $4g$
(C) $g/4$ (D) $2g$

19. 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) $g/8$

20. R is the radius of the earth and ω is its angular velocity and g_p is the value of g at the poles. The effective value of g at the latitude $\lambda = 60°$ will be equal to

(A) $g_p - \frac{1}{4}R\omega^2$ (B) $g_p - \frac{3}{4}R\omega^2$
(C) $g_p - R\omega^2$ (D) $g_p + \frac{1}{4}R\omega^2$

21. At the surface of a certain planet, acceleration due to gravity is one-quarter of that on earth. If a brass ball is transported to this planet, then which one of the following statements is not correct

(A) The mass of the brass ball on this planet is a quarter of its mass as measured on earth
(B) The weight of the brass ball on this planet is a quarter of the weight as measured on earth
(C) The brass ball has the same mass on the other planet as on earth
(D) The brass ball has the same volume on the other planet as on earth

22. Weight of 1 *kg* becomes 1/6 on moon. If radius of moon is $1.768 \times 10^6\, m$, then the mass of moon will be

(A) $1.99 \times 10^{30}\, kg$ (B) $7.56 \times 10^{22}\, kg$
(C) $5.98 \times 10^{24}\, kg$ (D) $7.65 \times 10^{22}\, kg$

23. Radius of earth is around 6000 *km*. The weight of body at height of 6000 *km* from earth surface becomes

(A) Half (B) One-fourth
(C) One third (D) No change

24. Let g be the acceleration due to gravity at earth's surface and K be the rotational kinetic energy of the earth. Suppose the earth's radius decreases by 2% keeping all other quantities same, then

(A) g decreases by 2% and K decreases by 4%
(B) g decreases by 4% and K increases by 2%
(C) g increases by 4% and K increases by 4%
(D) g decreases by 4% and K increases by 4%

25. Where will it be profitable to purchase 1kilogram sugar

(A) At poles (B) At equator

(C) At 45° latitude (D) At 40° latitude

26. If the radius of the earth shrinks by 1.5% (mass remaining same), then the value of acceleration due to gravity changes by

(A) 1% (B) 2%

(C) 3% (D) 4%

27. If radius of the earth contracts 2% and its mass remains the same, then weight of the body at the earth surface

(A) Will decrease

(B) Will increase

(C) Will remain the same

(D) None of these

28. If mass of a body is *M* on the earth surface, then the mass of the same body on the moon surface is

(A) *M*/6 (B) Zero

(C) *M* (D) None of these

29. Mass of moon is $7.34 \times 10^{22} kg$. If the acceleration due to gravity on the moon is $1.4 m/s^2$, the radius of the moon is ($G = 6.667 \times 10^{-11}\ Nm^2/kg^2$)

(A) $0.56 \times 10^4\ m$ (B) $1.87 \times 10^6\ m$

(C) $1.92 \times 10^6\ m$ (D) $1.01 \times 10^8\ m$

30. What should be the velocity of earth due to rotation about its own axis so that the weight at equator become 3/5 of initial value. Radius of earth on equator is 6400 *km*

(A) $7.4 \times 10^{-4}\ rad/\sec$

(B) $6.7 \times 10^{-4}\ rad/\sec$

(C) $7.8 \times 10^{-4}\ rad/\sec$

(D) $8.7 \times 10^{-4}\ rad/\sec$

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

(A) $2.5 \times 10^{-3} rad/s$ (B) $5.0 \times 10^{-1} rad/s$

(C) $10 \times 10^{1} rad/s$ (D) $7.8 \times 10^{-2} rad/s$

32. Assuming earth to be a sphere of a uniform density, what is the value of gravitational acceleration in a mine 100 *km* below the earth's surface (Given *R* = 6400 *km*)

(A) $9.66\, m/s^2$ (B) $7.64\, m/s^2$

(C) $5.06 m/s^2$ (D) $3.10\, m/s^2$

33. If radius of earth is *R* then the height '*h*' at which value of '*g*' becomes one-fourth is

(A) $\frac{R}{4}$ (B) $\frac{3R}{4}$

(C) R (D) $\frac{R}{8}$

34. *R* and *r* are the radii of the earth and moon respectively. ρ_e and ρ_m are the densities of earth and moon respectively. The ratio of the accelerations due to gravity on the surfaces of earth and moon is

(A) $\frac{R}{r}\frac{\rho_e}{\rho_m}$ (B) $\frac{r}{R}\frac{\rho_e}{\rho_m}$

(C) $\frac{r}{R}\frac{\rho_m}{\rho_e}$ (D) $\frac{R}{r}\frac{\rho_e}{\rho_m}$

35. If the mass of earth is 80 times of that of a planet and diameter is double that of planet and '*g*' on earth is $9.8\, m/s^2$, then the value of '*g*' on that planet is

(A) $4.9\, m/s^2$ (B) $0.98\, m/s^2$

(C) $0.49\, m/s^2$ (D) $49\, m/s^2$

36. Assume that the acceleration due to gravity on the surface of the moon is 0.2 times the acceleration due to gravity on the surface of the earth. If R_e is the maximum range of a projectile on the earth's surface, what is the maximum range on the surface of the moon for the same velocity of projection

(A) $0.2\, R_e$ (B) $2\, R_e$

(C) $0.5\, R_e$ (D) $5\, R_e$

37. The angular speed of earth, so that the object on equator may appear weightless, is ($g = 10\, m/s^2$, radius of earth 6400 *km*)

(A) $1.25 \times 10^{-3}\, rad/sec$

(B) $1.56 \times 10^{-3}\, rad/sec$

(C) $1.25 \times 10^{-1}\, rad/sec$

(D) 1.56 *rad/sec*

38. At what distance from the centre of the earth, the value of acceleration due to gravity *g* will be half that on the surface (*R* = radius of earth)

(A) 2 *R* (B) *R*

(C) 1.414 *R* (D) 0.414 *R*

39. If density of earth increased 4 times and its radius become half of what it is, our weight will

(A) Be four times its present value

(B) Be doubled

(C) Remain same

(D) Be halved

40. 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*

41. The acceleration of a body due to the attraction of the earth (radius *R*) at a distance 2 *R* from the surface of the earth is (*g* = acceleration due to gravity at the surface of the earth)

(A) $\frac{g}{9}$ (B) $\frac{g}{3}$

(C) $\frac{g}{4}$ (D) g

42. The depth at which the effective value of acceleration due to gravity is $\frac{g}{4}$ is

(A) R (B) $\frac{3R}{4}$

(C) $11.2 \times 10^{2}\ kms^{-1}$ (D) $\frac{R}{4}$

43. Weight of a body of mass *m* decreases by 1% when it is raised to height *h* above the earth's surface. If the body is taken to a depth *h* in a mine, change in its weight is

(A) 2% decrease (B) 0.5% decrease

(C) 1% increase (D) 0.5% increase

44. If both the mass and the radius of the earth decrease by 1%, the value of the acceleration due to gravity will

(A) Decrease by 1% (B) Increase by 1%

(C) Increase by 2% (D) Remain unchanged

45. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of the earth is *R*, the radius of the planet would be

(A) $2R$ (B) $4R$

(C) $\frac{1}{4}R$ (D) $\frac{1}{2}R$

46. Two planets of radii in the ratio 2 : 3 are made from the material of density in the ratio 3 : 2. Then the ratio of acceleration due to gravity g_1 / g_2 at the surface of the two planets will be

(A) 1 (B) 2.25

(C) 4/9 (D) 0.12

47. A person will get more quantity of matter in *kg –wt.* at

(A) Poles (B) At latitude of 60^{o}

(C) Equator (D) Satellite

48. At what depth below the surface of the earth, acceleration due to gravity *g* will be half its value 1600 *km* above the surface of the earth

(A) $4.2 \times 10^{6}\ m$ (B) $3.19 \times 10^{6}\ m$

(C) $1.59 \times 10^{6}\ m$ (D) None of these

49. What should be the angular speed of earth, so that body lying on equator may appear weightlessness

($g = 10\, m/s^2,\ R = 6400\, km$)

(A) $\frac{1}{800}\, rad/s$ (B) $\frac{1}{400}\, rad/s$

(C) $\frac{1}{600}\, rad/s$ (D) $\frac{1}{100}\, rad/s$

50. A body weight 500 *N* on the surface of the earth. How much would it weigh half way below the surface of the earth

(A) 125 *N* (B) 250 *N*
(C) 500 *N* (D) 1000 *N*

51. The gravitational potential energy of a body of mass '*m*' at the earth's surface $-mgR_e$. Its gravitational potential energy at a height R_e from the earth's surface will be (Here R_e is the radius of the earth)

(A) $-2\,mgR_e$ (B) $2\,mgR_e$
(C) $\frac{1}{2}mgR_e$ (D) $-\frac{1}{2}mgR_e$

52. Escape velocity of a body of 1 kg mass on a planet is 100 *m/sec*. Gravitational Potential energy of the body at the Planet is

(A) – 5000 *J* (B) – 1000 *J*
(C) – 2400 *J* (D) 5000 *J*

53. A body of mass *m* is placed on the earth's surface. It is taken from the earth's surface to a height $h = 3R$. The change in gravitational potential energy of the body is

(A) $\frac{2}{3}mgR$ (B) $\frac{3}{4}mgR$
(C) $\frac{mgR}{2}$ (D) $\frac{mgR}{4}$

54. A body of mass *m kg.* starts falling from a point 2*R* 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) $\frac{1}{3}\frac{GMm}{R}$

55. A body is projected vertically upwards from the surface of a planet of radius *R* with 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

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

(A) $GMm/12R^2$ (B) $GMm/3R^2$
(C) $GMm/8R$ (D) $GMm/6R$

57. The kinetic energy needed to project 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

58. Radius of orbit of satellite of earth is *R*. Its kinetic energy is proportional to

(A) $\frac{1}{R}$ (B) $\frac{1}{\sqrt{R}}$
(C) R (D) $\frac{1}{R^{3/2}}$

59. In some region, the gravitational field is zero. The gravitational potential in this region

(A) Must be variable (B) Must be constant
(C) Cannot be zero (D) Must be zero

60. A particle falls towards earth from infinity. It's velocity on reaching the earth would be

(A) Infinity (B) $\sqrt{2gR}$
(C) $2\sqrt{gR}$ (D) Zero

61. A missile is launched with a velocity less than the escape velocity. The sum of its kinetic and potential energy is

(A) Positive
(B) Negative
(C) Zero
(D) May be positive or negative depending upon its initial velocity

62. If *g* is the acceleration due to gravity at the earth's surface and *r* is the radius of the earth, the escape velocity for the body to escape out of earth's gravitational field is

(A) gr (B) $\sqrt{2gr}$
(C) g/r (D) r/g

63. The escape velocity of a projectile from the earth is approximately

(A) 11.2 *m*/*sec* (B) 112 *km*/*sec*
(C) 11.2 *km*/*sec* (D) 11200 *km*/*sec*

64. The escape velocity of a particle of mass m varies as

(A) m^2 (B) m

(C) m^0 (D) m^{-1}

65. For the moon to cease to remain the earth's satellite, its orbital velocity has to increase by a factor of

(A) 2 (B) $\sqrt{2}$

(C) $1/\sqrt{2}$ (D) $\sqrt{3}$

66. The escape velocity for the earth is 11.2 *km*/*sec*. The mass of another planet is 100 times that of the earth and its radius is 4 times that of the earth. The escape velocity for this planet will be

(A) 112.0 *km*/*s* (B) 5.6 *km*/*s*

(C) 280.0 *km*/*s* (D) 56.0 *km*/*s*

67. The escape velocity of a planet having mass 6 times and radius 2 times as that of earth is

(A) $\sqrt{3}V_e$ (B) $3V_e$

(C) $\sqrt{2}V_e$ (D) $2V_e$

68. The escape velocity of an object on a planet whose g value is 9 times on earth and whose radius is 4 times that of earth in *km*/*s* is

(A) 67.2 (B) 33.6

(C) 16.8 (D) 25.2

69. The escape velocity on earth is 11.2 *km*/*s*. On another planet having twice radius and 8 times mass of the earth, the escape velocity will be

(A) 3.7 *km*/*s* (B) 11.2 *km*/*s*

(C) 22.4 *km*/*s* (D) 43.2 *km*/*s*

70. The escape velocity of a body on the surface of the earth is 11.2 *km*/*s*. If the earth's mass increases to twice its present value and the radius of the earth becomes half, the escape velocity would become

(A) 5.6 *km*/*s*

(B) 11.2 *km*/*s* (remain unchanged)

(C) 22.4 *km*/*s*

(D) 44.8 *km*/*s*

71. If the radius of a planet is R and its density is ρ, the escape velocity from its surface will be

(A) $v_e \propto \rho R$ (B) $v_e \propto \sqrt{\rho}R$

(C) $v_e \propto \frac{\sqrt{\rho}}{R}$ (D) $v_e \propto \frac{1}{\sqrt{\rho}R}$

72. Escape velocity on the earth

(A) Is less than that on the moon

(B) Depends upon the mass of the body

(C) Depends upon the direction of projection

(D) Depends upon the height from which it is projected

73. If acceleration due to gravity on the surface of a planet is two times that on surface of earth and its radius is double that of earth. Then escape velocity from the surface of that planet in comparison to earth will be

(A) 2 v_e (B) 3 v_e

(C) 4 v_e (D) None of these

74. The escape velocity of a rocket launched from the surface of the earth

(A) Does not depend on the mass of the rocket

(B) Does not depend on the mass of the earth

(C) Depends on the mass of the planet towards which it is moving

(D) Depends on the mass of the rocket

75. The ratio of the radii of planets A and B is k_1 and ratio of acceleration due to gravity on them is k_2. The ratio of escape velocities from them will be

(A) k_1k_2 (B) $\sqrt{k_1k_2}$

(C) $\sqrt{\frac{k_1}{k_2}}$ (D) $\sqrt{\frac{k_2}{k_1}}$

76. A mass of $6\times10^{24}\,kg$ is to be compressed in a sphere in such a way that the escape velocity from the sphere is $3\times10^8\,m/s$. Radius of the sphere should be ($G = 6.67\times10^{-11}\,N-m^2/kg^2$)

(A) 9 *km* (B) 9 *m*

(C) 9 *cm* (D) 9 *mm*

77. The escape velocity of a body on an imaginary planet which is thrice the radius of the earth and double the mass of the earth is (v_e is the escape velocity of earth)

(A) $\sqrt{2/3}\,v_e$ (B) $\sqrt{3/2}\,v_e$

(C) $\sqrt{2}/3\,v_e$ (D) $2/\sqrt{3}\,v_e$

78. Escape velocity on the surface of earth is $11.2\,km/s$. Escape velocity from a planet whose mass is the same as that of earth and radius 1/4 that of earth is

(A) 2.8 *km/s* (B) 15.6 *km/s*

(C) 22.4 *km/s* (D) 44.8 *km/s*

79. The velocity with which a projectile must be fired so that it escapes earth's gravitation does not depend on

(A) Mass of the earth

(B) Mass of the projectile

(C) Radius of the projectile's orbit

(D) Gravitational constant

80. The radius of a planet is $\frac{1}{4}$ of earth's radius and its acceleration due to gravity is double that of earth's acceleration due to gravity. How many times will the escape velocity at the planet's surface be as compared to its value on earth's surface

(A) $\frac{1}{\sqrt{2}}$ (B) $\sqrt{2}$

(C) $2\sqrt{2}$ (D) 2

81. The escape velocity for the earth is v_e. The escape velocity for a planet whose radius is four times and density is nine times that of the earth, is

(A) $36\,v_e$ (B) $12\,v_e$

(C) $6\,v_e$ (D) $20\,v_e$

82. 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^o with the 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*

83. If *V*, *R* and *g* denote respectively the escape velocity from the surface of the earth radius of the earth, and acceleration due to gravity, then the correct equation is

(A) $V=\sqrt{gR}$ (B) $V=\sqrt{\frac{4}{3}gR^3}$

(C) $V=R\sqrt{g}$ (D) $V=\sqrt{2gR}$

84. The escape velocity for a body of mass 1 *kg* from the earth surface is 11.2 kms^{-1}. The escape velocity for a body of mass 100 *kg* would be

(A) $11.2\times10^2\ kms^{-1}$ (B) $11.2\ kms^{-1}$

(C) $11.2\times10^{-2}\ kms^{-1}$ (D) None of these

85. The acceleration due to gravity on a planet is same as that on earth and its radius is four times that of earth. What will be the value of escape velocity on that planet if it is v_e on earth

(A) v_e (B) $2v_e$

(C) $4v_e$ (D) $\frac{v_e}{2}$

86. If a satellite is orbiting the earth very close to its surface, then the orbital velocity mainly depends on

(A) The mass of the satellite only

(B) The radius of the earth only

(C) The orbital radius only

(D) The mass of the earth only

87. The relay satellite transmits the T.V. programme continuously from one part of the world to another because its

(A) Period is greater than the period of rotation of the earth

(B) Period is less than the period of rotation of the earth about its axis

(C) Period has no relation with the period of the earth about its axis

(D) Period is equal to the period of rotation of the earth about its axis

88. Two satellites A and B go round 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) $\frac{4}{3}V$ (D) $\frac{3}{2}V$

89. A geostationary satellite

(A) Revolves about the polar axis

(B) Has a time period less than that of the near earth satellite

(C) Moves faster than a near earth satellite

(D) Is stationary in the space

90. A small satellite is revolving near earth's surface. Its orbital velocity will be nearly

(A) 8 km/sec (B) 11.2 km/sec

(C) 4 km/sec (D) 6 km/sec

91. A satellite revolves around the earth in an elliptical orbit. Its speed

(A) Is the same at all points in the orbit

(B) Is greatest when it is closest to the earth

(C) Is greatest when it is farthest from the earth

(D) Goes on increasing or decreasing continuously depending upon the mass of the satellite

92. The orbital velocity of an artificial satellite in a circular orbit just above the earth's surface is v. For a satellite orbiting at an altitude of half of the earth's radius, the orbital velocity is

(A) $\frac{3}{2}v$ (B) $\sqrt{\frac{3}{2}}v$

(C) $\sqrt{\frac{2}{3}}v$ (D) $\frac{2}{3}v$

93. In a satellite if the time of revolution is T, then K.E. is proportional to

(A) $\frac{1}{T}$ (B) $\frac{1}{T^2}$

(C) $\frac{1}{T^3}$ (D) $T^{-2/3}$

94. If the height of a satellite from the earth is negligible in comparison to the radius of the earth R, the orbital velocity of the satellite is

(A) gR (B) $gR/2$

(C) $\sqrt{g/R}$ (D) $\sqrt{gR}$

95. Choose the correct statement from the following : The radius of the orbit of a geostationary satellite depends upon

(A) Mass of the satellite, its time period and the gravitational constant

(B) Mass of the satellite, mass of the earth and the gravitational constant

(C) Mass of the earth, mass of the satellite, time period of the satellite and the gravitational constant

(D) Mass of the earth, time period of the satellite and the gravitational constant

96. Out of the following, the only incorrect statement about satellites is

(A) A satellite cannot move in a stable orbit in a plane passing through the earth's centre

(B) Geostationary satellites are launched in the equatorial plane

(C) We can use just one geostationary satellite for global communication around the globe

(D) The speed of a satellite increases with an increase in the radius of its orbit

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

(A) Increase by 1% (B) Increase by 0.5%

(C) Decrease by 1% (D) Decrease by 0.5%

98. Orbital velocity of an artificial satellite does not depend upon

(A) Mass of the earth

(B) Mass of the satellite

(C) Radius of the earth

(D) Acceleration due to gravity

99. The time period of a geostationary satellite is

(A) 24 hours (B) 12 hours

(C) 365 days (D) One month

100. Orbital velocity of earth's satellite near the surface is 7 *km*/*s*. When the radius of the orbit is 4 times than that of earth's radius, then orbital velocity in that orbit is

(A) 3.5 *km*/*s* (B) 7 *km*/*s*

(C) 72 *km*/*s* (D) 14 *km*/*s*

101. Two identical satellites are at R and $7R$ away from earth surface, the wrong statement is (R = Radius of earth)

(A) Ratio of total energy will be 4

(B) Ratio of kinetic energies will be 4

(C) Ratio of potential energies will be 4

(D) Ratio of total energy will be 4 but ratio of potential and kinetic energies will be 2

102. For a satellite escape velocity is 11 *km*/*s*. If the satellite is launched at an angle of 60° with the vertical, then escape velocity will be

(A) 11 *km*/*s* (B) $11\sqrt{3}$ *km*/*s*

(C) $\frac{11}{\sqrt{3}}$ *km*/*s* (D) 33 *km*/*s*

103. The mean radius of the earth is R, its angular speed on its own axis is ω and the acceleration due to gravity at earth's surface is g. The cube of the radius of the orbit of a geostationary satellite will be

(A) $R^2 g / \omega$ (B) c $R^2\omega^2 / g$

(C) Rg / ω^2 (D) $R^2 g / \omega^2$

104. Which one of the following statements regarding artificial satellite of the earth is incorrect

(A) The orbital velocity depends on the mass of the satellite

(B) A minimum velocity of 8 *km*/*sec* is required by a satellite to orbit quite close to the earth

(C) The period of revolution is large if the radius of its orbit is large

(D) The height of a geostationary satellite is about 36000 *km* from earth

105. A ball is dropped from a spacecraft revolving around the earth at a height of 120 *km*. What will happen to the ball

(A) It will continue to move with velocity v along the original orbit of spacecraft

(B) It will move with the same speed tangentially to the spacecraft

(C) It will fall down to the earth gradually

(D) It will go very far in the space

106. Given radius of Earth 'R' and length of a day 'T' the height of a geostationary satellite is [G–Gravitational Constant, M–Mass of Earth]

(A) $\left(\frac{4\pi^2 GM}{T^2}\right)^{1/3}$ (B) $\left(\frac{4\pi GM}{R^2}\right)^{1/3} - R$

(C) $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3} - R$ (D) $\left(\frac{GMT^2}{4\pi^2}\right)^{1/3} + R$

107. 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*

108. The distance between centre of the earth and moon is 384000 *km*. If the mass of the earth is $6\times10^{24}\,kg$ and $G = 6.66\times10^{-11}\,Nm^2/kg^2$. The speed of the moon is nearly

(A) 1 *km/sec* (B) 4 *km/sec*

(C) 8 *km/sec* (D) 11.2 *km/sec*

109. A satellite is launched into a circular orbit of radius 'R' around earth while a second satellite is launched into an orbit of radius 1.02 R. The percentage difference in the time periods of the two satellites is

(A) 0.7 (B) 1.0

(C) 1.5 (D) 3

110. Where can a geostationary satellite be installed

(A) Over any city on the equator

(B) Over the north or south pole

(C) At height R above earth

(D) At the surface of earth

111. Distance of geostationary satellite from the surface of earth *radius* $(R_e = 6400\ km)$ in terms of R_e is

(A) 13.76 R_e (B) 10.76 R_e

(C) 6.56 R_e (D) 2.56 R_e

112. A satellite is to revolve round the earth in a circle of radius 8000 *km*. The speed at which this satellite be projected into an orbit, will be

(A) 3 km/s (B) 16 km/s

(C) 7.15 km/s (D) 8 km/s

113. Two satellite *A* and *B*, ratio of masses 3 : 1 are in circular orbits of radii *r* and 4*r*. Then ratio of total mechanical energy of *A* to *B* is

(A) 1 : 3 (B) 13 : 1

(C) 3 : 4 (D) 12 : 1

114. The orbital velocity of a planet revolving close to earth's surface is

(A) $\sqrt{2gR}$ (B) $\sqrt{gR}$

(C) $\sqrt{\frac{2g}{R}}$ (D) $\sqrt{\frac{g}{R}}$

115. 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*

116. Two planets move around the sun. The periodic times and the mean radii of the orbits are T_1, T_2 and r_1, r_2 respectively. The ratio T_1/T_2 is equal to

(A) $(r_1/r_2)^{1/2}$ (B) r_1/r_2

(C) $(r_1/r_2)^2$ (D) $(r_1/r_2)^{3/2}$

117. Kepler's second law regarding constancy of aerial velocity of a planet is a consequence of the law of conservation of

(A) Energy

(B) Angular momentum

(C) Linear momentum

(D) None of these

118. The largest and the shortest distance of the earth from the sun are r_1 and r_2, its distance from the sun when it is at the perpendicular to the major axis of the orbit drawn from the sun

(A) $\frac{r_1 + r_2}{4}$ (B) $\frac{r_1 r_2}{r_1 + r_2}$

(C) $\frac{2r_1 r_2}{r_1 + r_2}$ (D) $\frac{r_1 + r_2}{3}$

119. The rotation period of an earth satellite close to the surface of the earth is 83 minutes. The time period of another earth satellite in an orbit at a distance of three earth radii from its surface will be

(A) 83 minutes (B) $83 \times \sqrt{8}$ minutes

(C) 664 minutes (D) 249 minutes

120. A satellite of mass *m* is circulating around the earth with constant angular velocity. If radius of the orbit is R_0 and mass of the earth *M*, the angular momentum about the centre of the earth is

(A) $m\sqrt{GMR_0}$ (B) $M\sqrt{GmR_0}$

(C) $m\sqrt{\frac{GM}{R_0}}$ (D) $M\sqrt{\frac{GM}{R_0}}$

121. According to Kepler, the period of revolution of a planet (*T*) and its mean distance from the sun (*r*) are related by the equation

(A) $T^3 r^3 =$ constant (B) $T^2 r^{-3} =$ constant

(C) $Tr^3 =$ constant (D) $T^2 r =$ constant

122. A planet revolves around sun whose mean distance is 1.588 times the mean distance between earth and sun. The revolution time of planet will be

(A) 1.25 years (B) 1.59 years

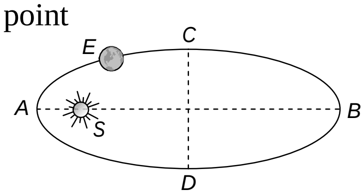
(C) 0.89 years (D) 2 years

123. A satellite A of mass m is at a distance of r from the centre of the earth. Another satellite B of mass $2m$ is at a distance of $2r$ from the earth's centre. Their time periods are in the ratio of

(A) 1 : 2 (B) 1 : 16

(C) 1 : 32 (D) $1:2\sqrt{2}$

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



(A) C

(B) A

(C) B

(D) D

125. The period of revolution of planet A around the sun is 8 times that of B. The distance of A from the sun is how many times greater than that of B from the sun

(A) 2 (B) 3

(C) 4 (D) 5

126. Which of the following astronomer first proposed that sun is static and earth rounds sun

(A) Copernicus (B) Kepler

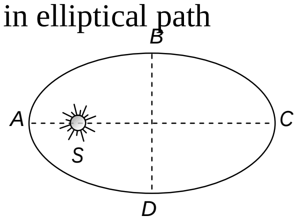
(C) Galileo (D) None

127. The distance of a planet from the sun is 5 times the distance between the earth and the sun. The time period of the planet is

(A) $5^{3/2}$ *years* (B) $5^{2/3}$ *years*

(C) $5^{1/3}$ *years* (D) $5^{1/2}$ *years*

128. A planet is revolving around the sun as shown in elliptical path



The correct option is

(A) The time taken in travelling DAB is less than that for BCD

(B) The time taken in travelling DAB is greater than that for BCD

(C) The time taken in travelling CDA is less than that for ABC

(D) The time taken in travelling CDA is greater than that for ABC

129. In the previous question the orbital velocity of the planet will be minimum at

(A) A (B) B

(C) C (D) D

130. The radius of orbit of a planet is two times that of the earth. The time period of planet is

(A) 4.2 *years* (B) 2.8 *years*

(C) 5.6 *years* (D) 8.4 *years*

131. The orbital angular momentum of a satellite revolving at a distance r from the centre is L. If the distance is increased to $16r$, then the new angular momentum will be

(A) 16 L (B) 64 L

(C) $\frac{L}{4}$ (D) 4 L

132. According to Kepler's law the time period of a satellite varies with its radius as

(A) $T^2 \propto R^3$ (B) $T^3 \propto R^2$

(C) $T^2 \propto (1/R^3)$ (D) $T^3 \propto (1/R^2)$

133. In planetary motion the areal velocity of position vector of a planet depends on angular velocity (ω) and the distance of the planet from sun (r). If so the correct relation for areal velocity is

(A) $\frac{dA}{dt} \propto \omega r$ (B) $\frac{dA}{dt} \propto \omega^2 r$

(C) $\frac{dA}{dt} \propto \omega r^2$ (D) $\frac{dA}{dt} \propto \sqrt{\omega r}$

134. The ratio of the distances of two planets from the sun is 1.38. The ratio of their period of revolution around the sun is

(A) 1.38 (B) $1.38^{3/2}$

(C) $1.38^{1/2}$ (D) 1.38^3

135. Kepler's second law (law of areas) is nothing but a statement of
(A) Work energy theorem
(B) Conservation of linear momentum
(C) Conservation of angular momentum
(D) Conservation of energy

136. 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

137. If a new planet is discovered rotating around Sun with the orbital radius double that of earth, then what will be its time period (in earth's days)
(A) 1032 (B) 1023
(C) 1024 (D) 1043

138. Suppose the law of gravitational attraction suddenly changes and becomes an inverse cube law i.e. $F \propto 1/r^3$, but still remaining a central force. Then
(A) Keplers law of areas still holds
(B) Keplers law of period still holds
(C) Keplers law of areas and period still hold
(D) Neither the law of areas, nor the law of period still holds

139. What does not change in the field of central force
(A) Potential energy
(B) Kinetic energy
(C) Linear momentum
(D) Angular momentum

140. The eccentricity of earth's orbit is 0.0167. The ratio of its maximum speed in its orbit to its minimum speed is
(A) 2.507 (B) 1.033
(C) 8.324 (D) 1.000