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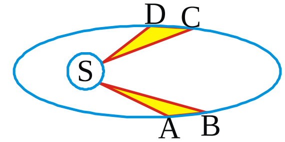
C.U.Q

KEPLER'S LAWS

1. **The time period of an earth's satellite in circular orbit is independent of**
   1) the mass of the satellite
   2) radius of its orbit
   3) both the mass and radius of the orbit
   4) neither the mass of the satellite nor the radius of its orbit
2. **If the earth is at one-fourth of its present distance from the sun, the duration of the year would be**
   1) half the present year
   2) one-eighth the present year
   3) one-fourth the present year
   4) one -sixteenth the present year
3. **The radius vector drawn from the sun to a planet sweeps out ___ areas in equal time**
   1) equal 2) unequal 3) greater 4) less
4. **If the area swept by the line joining the sun and the earth from Feb 1 to Feb 7 is 'A', then the area swept by the radius vector from Feb 8 to Feb 28 is**
   1) A 2) 2A 3) 3A 4) 4A
5. **The motion of a planet around sun in an elliptical orbit is shown in the following figure. Sun is situated at one focus. The shaded areas are equal. If the planet takes time 't_1' and 't_2' in moving from A to B and from C to D respectively, then**



   1) $t_1 > t_2$ 2) $t_1 < t_2$
   3) $t_1 = t_2$ 4) Incomplete information
6. **Two satellites are revolving around the earth in circular orbits of same radii. Mass of one satellite is 100 times that of the other. Then their periods of revolution are in the ratio**
   1) 100:1 2) 1:100 3) 1:1 4) 10:1
7. **According to Kepler's second law, line joining the planet to the sun sweeps out equal areas in equal time intervals. This suggests that for the planet**
   1) radial acceleration is zero
   2) tangential acceleration is zero
   3) transverse acceleration is zero 4) All

NEWTON'S LAW OF GRAVITATION

8. **If F_g and F_e are gravitational and electrostatic forces between two electrons at a distance 0.1 m then F_g / F_e is in the order of**
   1) 10^{43} 2) 10^{-43} 3) 10^{35} 4) 10^{-35}
9. $F = \frac{Gm_1m_2}{r^2}$ **is valid**
   1) Between bodies with any shape
   2) Between particles
   3) Between any bodies with uniform density
   4) Between any bodies with same shape
10. **F_g, F_e and F_n represent the gravitational, electro-magnetic and nuclear forces respectively, then arrange the increasing order of their strengths**
    1) F_n, F_e, F_g 2) F_g, F_e, F_n 3) F_e, F_g, F_n 4) F_g, F_n, F_e
11. **Find the false statement**
    1) Gravitational force acts along the line joining the two interacting particles
    2) Gravitational force is independent of medium
    3) Gravitational force forms an action-reaction pair
    4) Gravitational force does not obey the principle of superposition.
12. **Law of gravitation is not applicable if**
    A) Velocity of moving objects are comparable to velocity of light
    B) Gravitational field between objects whose masses are greater than the mass of sun.
    1) A is true, B is false 2) A is false, B is true
    3) Both A & B are true 4) Both A&B are false

13. **Among the following the wrong statement is**
1) Law of gravitation is framed using Newton's third law of motion
2) Law of gravitation cannot explain why gravity exists
3) Law of gravitation does not explain the presence of force even when the particles are not in physical contact
4) When the range is long, gravitational force becomes repulsive.

14. **Out of the following interactions, weakest is**
1) gravitational 2) electromagnetic
3) nuclear 4) electrostatic

15. **Neutron changing into Proton by emitting electron and anti neutrino. This is due to**
1) Gravitational Force 2) Electromagnetic Force
3) Weak Nuclear Force 4) Strong Nuclear Force

16. **Attractive Force exists between two protons inside the Nucleus. This is due to**
1) Gravitational Forces 2) Electromagnetic Forces
3)Weak Nuclear Forces 4)Strong Nuclear Forces

17. **Repulsive force exist between two protons out side the nucleus. This is due to**
1) Gravitational Forces 2) Electromagnetic Forces
3)Weak Nuclear Forces 4)Strong Nuclear Forces

18. **Radioactive decay exist due to**
1)Gravitational Forces 2)Electromagnetic Forces
3)Weak-Nuclear Forces
4)Strong-Nuclear Forces

19. **Two equal masses separated by a distance d attract each other with a force (F). If one unit of mass is transferred from one of them to the other, the force**
1) does not change 2) decreases by (G/d^2)
3) becomes d^2 times 4) increases by $(2G/d^2)$

20. **Which of the following is the evidence to show that there must be a force acting on earth and directed towards Sun?**
1) Apparent motion of sun around the earth
2) Phenomenon of day and night
3) Revolution of earth round the Sun
4) Deviation of the falling body towards earth

21. **Six particles each of mass 'm' are placed at the corners of a regular hexagon of edge length 'a'. If a point mass 'm_0' is placed at the centre of the hexagon,then the net gravitational force on the point mass is**
1) $\frac{6Gm^2}{a^2}$ 2) $\frac{6Gmm_0}{a^2}$ 3) Zero 4) $\frac{6Gm}{a^4}$

22. **If suddenly the gravitational force of attraction between earth and satellite revolving around it becomes zero, then the satellite will (2002A)**
1) Continue to move in its orbit with same velocity
2) Move tangential to the original orbit with the same velocity
3) Becomes stationary in its orbit
4) Move towards the earth

RELATION BETWEEN g AND G, VARIATION OF g

23. **If the speed of rotation of earth about its axis increases, then the weight of the body at the equator will**
1) increase 2) decrease 3) remains unchanged
4) some times decrease and sometimes increase

24. **The ratio of acceleration due to gravity at a depth 'h' below the surface of earth and at a height 'h' above the surface for h<<R**
1) constant only when h<<R
2) increases linearly with h
3) increases parabolically with h 4) decreases

25. **If the gravitational force of earth suddenly disappears, then,**
1) weight of the body is zero
2) mass of the body is zero
3) both mass and weight become zero
4) neither the weight nor the mass is zero

26. **Which of the following quantities remain constant in a planetary motion, when seen from the surface of the sun.**
1) K.E 2) angular speed
3) speed 4) angular momentum

27. **Average density of the earth (2005A)**
1) does not depend on 'g'
2) is a complex function of 'g'
3) is directly proportional to 'g'
4) is inversely proportional to 'g'

28. **A person will get more quantity of matter in kg-wt at**
1) poles 2) a latitude of 60^0 3) equator 4) satellite

29. **A pendulum clock which keeps correct time at the surface of the earth is taken into a mine, then**
1) it keeps correct time 2) it gains time
3) it loses time 4) none of these

30. **Two identical trains A and B move with equal speeds on parallel tracks along the equator. A moves from east to west and B moves from west to east. Which train will exert greater force on the track?**
1) A 2) B 3) they will exert equal force
4) The mass and the speed of each train must be known to reach a conclusion.

31. **Assuming the earth to be a sphere of uniform density, the acceleration due to gravity**
1) at a point outside the earth is inversely proportional to the square of its distance from the centre
2) at a point outside the earth is inversely proportional to its distance from the centre
3) at a point inside is zero
4) at a point inside is inversely proportional to its distance from the centre.

32. **If earth were to rotate faster than its present speed, the weight of an object**
1) increase at the equator but remain unchanged at poles
2) decrease at the equator but remain unchanged at the poles
3) remain unchanged at the equator but decrease at the poles
4) remain unchanged at the equator but increase at the poles

33 **The time period of a simple pendulum at the centre of the earth is**
1) Zero 2) infinite 3) less than zero 4) two second

34. **A body of mass 5 kg is taken into space. Its mass becomes**
1) 5 kg 2) 10 kg 3) 2 kg 4) 30 kg

35. **If the mean radius of earth is R, its angular velocity is w and the acceleration due to gravity at the surface of the earth is 'g' then the cube of the radius of the orbit of a satellite will be**
1) $\frac{Rg}{w^2}$ 2) $\frac{R^2 g}{w}$ 3) $\frac{R^2 g}{w^2}$ 4) $\frac{R^2 w}{g}$

36. **If R=radius of the earth and g =acceleration due to gravity on the surface of the earth, the acceleration due to gravity at a distance (r<R) from the centre of the earth is proportional to**
1) r 2) r^2 3) r^{-2} 4) r^{-1}

37. **If R = radius of the earth and g = acceleration due to gravity on the surface of the earth, the acceleration due to gravity at a distance (r>R) from the centre of the earth is proportional to**
1) r 2) r^2 3) r^{-2} 4) r^{-1}

38. **Earth is flattened at poles and bulged at equator. This is due to**
1) revolution of earth around the sun in an elliptical orbit
2) angular velocity of spinning motion about its axis is more at equator
3) centrifugal force is more at equator than poles
4) more centrifugal force at poles than equator

39. **Tidal waves in the sea are primarily due to**
1) the gravitational effect of the moon on the earth
2) the gravitational effect of the sun on the earth
3) the gravitational effect of the Venus on the earth
4) the atmospheric effect of the earth itself

40. **Consider earth to be a homogeneous sphere. Scientist A goes deep down in a mine and Scientist B goes high up in a balloon. The gravitational field measured by**
1) A goes on decreasing and that of B goes on increasing
2) B goes on decreasing and that of A goes on increasing
3) Each decreases at the same rate
4) Each decreases at different rates.

GRAVITATIONAL FIELD INTENSITY, GRAVITATIONAL POTENTIAL, POTENTIAL ENERGY AND WORKDONE

41. **Intensity of gravitational field inside the hollow spherical shell is**
1) Variable 2) minimum 3) maximum 4) zero

42. **The work done by an external agent to shift a point mass from infinity to the centre of the earth is 'W'. Then choose the correct relation.**
1) W=0 2) W>0 3) W<0 4) $W \leq 0$

43. **The intensity of the gravitational field of the earth is maximum at**
1) centre of earth 2) equator
3) poles 4) same everywhere

44 **Let V_G and E_G denote gravitational potential and field respectively, then choose the wrong statement.**
1) $V_G = 0, E_G = 0$ 2) $V_G \neq 0, E_G = 0$
3) $V_G = 0, E_G \neq 0$ 4) $V_G \neq 0, E_G \neq 0$

45. **Two identical spherical masses are kept at some distance. Potential energy when a mass 'm' is taken from the surface of one sphere to the other**
1)increases continuously 2)decreases continuously
3) first increases, then decreases
4) first decreases, then increases

46. **A thin spherical shell of mass 'M' and radius 'R' has a small hole. A particle of mass 'm' is released at its mouth. Then**
1) the particle will execute S.H.M inside the shell
2) the particle will oscillate inside the shell, but the oscillations are not simple harmonic
3) the particle will not oscillate, but the speed of the particle will go on increasing 4) none of these

47. The gravitational field is a conservative field. The work done in this field by moving an object from one point to another

1) depends on the end-points only
2) depends on the path along which the object is moved
3) depends on the end-points as well as the path between the points.
4) is not zero when the object is brought back to its initial position.

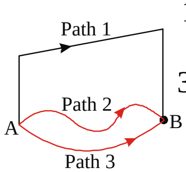
48. A hole is drilled through the earth along a diameter and a stone is dropped into it. When the stone is at the centre of the earth, it has finite a) weight b) acceleration c) P.E. d) mass

1) a & b 2) b & c 3) a, b & c 4) c & d

49. A body has weight (W) on the ground. The work which must be done to lift it to a height equal to the radius of the earth is

1) equal to WR 2) greater than WR
3) less than WR 4) we can't say

50. A gravitational field is present in a region. A point mass is shifted from A to B, along different paths shown in the figure. If W_1, W_2 and W_3 represent the work done by gravitational force for respective paths, then



1) $W_1 = W_2 = W_3$ 2) $W_1 > W_2 > W_3$
3) $W_1 > W_3 > W_2$ 4) none of these

51. The energy required to remove an earth satellite of mass 'm' from its orbit of radius 'r' to infinity is

1) $\frac{GMm}{r}$ 2) $\frac{-GMm}{2r}$ 3) $\frac{GMm}{2r}$ 4) $\frac{Mm}{2r}$

52. A hollow spherical shell is compressed to half its radius. The gravitational potential at the centre

1) increases 2) decreases 3) remains same
4) during the compression increases then returns to the previous value.

53. For a satellite projected from the earth's surface with a velocity greater than orbital velocity the nature of the path it takes when its energy is negative, zero and positive respectively is

1) Elliptical, parabolic and hyperbolic
2) Hyperbolic, parabolic and elliptical
3) Elliptical, circular and parabolic
4) Parabolic, circular and Elliptical

54. If a satellite is moved from one stable circular orbit to a farther stable circular orbit, then the following quantity increases

1) Gravitational force 2) Gravitational P.E.
3) linear orbital speed 4) Centripetal acceleration

55. If the universal gravitational constant decreases uniformly with time, then a satellite in orbit will still maintain its

1) weight 2) tangential speed
3) period of revolution 4) angular momentum

ESCAPE SPEED

56. The earth retains its atmosphere, due to

1) the special shape of the earth
2) the escape velocity being greater than the mean speed of the molecules of the atmospheric gases.
3) the escape velocity being smaller than the mean speed of the molecules of the atmospheric gases.
4) the sun's gravitational effect.

57. Ratio of the radius of a planet A to that of planet B is 'r'. The ratio of accelerations due to gravity for the two planets is x. The ratio of the escape velocities from the two planets is

1) $\sqrt{rx}$ 2) $\sqrt{r/x}$ 3) $\sqrt{r}$ 4) $\sqrt{x/r}$

58. The ratio of the escape velocity and the orbital velocity is

1) $\sqrt{2}$ 2) $\frac{1}{\sqrt{2}}$ 3) 2 4) 1/2

59. The escape velocity from the earth for a rocket is 11.2 km/sec. Ignoring the air resistance, the escape velocity of 10 mg grain of sand from the earth will be (in km/sec)

1) 0.112 2) 11.2 3) 1.12 4) None

60. 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 45^0 with the vertical, the escape velocity will be

1) $11\sqrt{2}\,km/s$ 2) $22\,km/s$
3) $11km/s$ 4) $22\sqrt{2}\,km/s$

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

1) Positive 2) Negative 3) Zero
4) May be positive or negative depending upon its initial velocity

62. The escape velocity of a body depends upon its mass as

1) m^0 2) m^1 3) m^3 4) m^2

63. The magnitude of potential energy per unit mass of the object at the surface of earth is 'E'. Then escape velocity of the object is

1) $\sqrt{2E}$ 2) $4E^2$ 3) $\sqrt{E}$ 4) $\sqrt{E/2}$

64. A space station is set up in space at a distance equal to earth's radius from earth's surface. Suppose a satellite can be launched from space station. Let V_1 and V_2 be the escape velocities of the satellite on earth's surface and space station respectively. Then

1) $V_2 = V_1$ 2) $V_2 < V_1$

3) $V_2 > V_1$ 4) No relation

EARTH SATELLITES

65. The minimum number of geo-stationary satellites required to televise a programme all over the earth is

1) 2 2) 6 3) 4 4) 3

66. When a satellite going around the earth in a circular orbit of radius r and speed v loses some of its energy , then

1)r and v both increase 2)r and v both decrease

3) r will increase and v will decrease

4) r will decrease and v will increase

67. The satellite is orbiting a planet at a certain height in a circular orbit. If the mass of the planet is reduced to half, the satellite would

1) fall on the planet

2) go to orbit of smaller radius

3) go to orbit of higher radius

4) escape from the planet

68. A satellite is revolving round the earth in an elliptical orbit. Its speed will be

1) same at all points of the orbit

2) different at different points of the orbit

3) maximum at the farthest point

4) minimum at the nearest point

69. An artificial satellite of the earth releases a packet. If air resistance is neglected, the point where the packet will hit, will be

1) ahead 2) exactly below 3) behind

4) it will never reach the earth

70. A satellite is moving in a circular orbit round the earth. If any other planet comes in between them, it will

1) Continue to move with the same speed along the same path

2) Move with the same velocity tangential to original orbit.

3) Fall down with increasing velocity.

4) Come to rest after moving certain distance along original path.

71. A space-ship entering the earth's atmosphere is likely to catch fire. This is due to

1) The surface tension of air 2) The viscosity of air

3) The high temperature of upper atmosphere

4) The greater portion of oxygen in the atmosphere at greater height.

72. An astronaut orbiting the earth in a circular orbit 120 km above the surface of earth, gently drops a ball from the space-ship. The ball will

1) Move randomly in space

2) Move along with the space-ship

3) Fall vertically down to earth

4) Move away from the earth

73. Following physical quantity is constant when a planet that revolves around Sun in an elliptical orbit .

1) Kinetic energy 2) Potential energy

3) Angular momentum 4) Linear velocity

74. A satellite launching station should be

1) Near the equatorial region

2) Near the polar region

3) On the polar axis 4) At any place

75. When a satellite in a circular orbit around the earth enters the atmospheric region, it encounters small air resistance to its motion. Then

1) its angular momentum about the earth decreases

2) its kinetic energy decreases

3) its kinetic energy remains constant

4) its period of revolution around the earth increases

76. The period of a satellite moving in circular orbit near the surface of a planet is independent of

1) mass of the planet 2) radius of the planet

3) mass of the satellite 4) density of planet

77. Out of the following statements, the one which correctly describes a satellite orbiting about the earth is

1) There is no force acting on the satellite

2) The acceleration and velocity of the satellite are roughly in the same direction

3) The satellite is always accelerating about the earth

4) The satellite must fall, back to earth when its fuel is exhausted.

78. When an astronaut goes out of his space-ship into the space he will

1) Fall freely on the earth 2) Go upwards
3) Continue to move along with the satellite in the same orbit.
4) Go spiral to the earth

79. When the height of a satellite increases from the surface of the earth.

1) PE decreases, KE increases
2) PE decreases, KE decreases
3) PE increases, KE decreases
4) PE increases, KE increases

80. A satellite S is moving in an elliptical orbit around the earth. The mass of the satellite is very small compared to the mass of the earth

1) the acceleration of S is always directed towards the centre of the earth
2) the angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant
3) the total mechanical energy of S varies periodically with time
4) the linear momentum of S remains constant in magnitude

81. If S_1 is surface satellite and S_2 is geo-stationary satellite, with time periods T_1 and T_2, orbital velocities V_1 and V_2,

1) $T_1 > T_2; V_1 > V_2$ 2) $T_1 > T_2; V_1 < V_2$
3) $T_1 < T_2; V_1 < V_2$ 4) $T_1 < T_2; V_1 > V_2$

82. A relay satellite transmits the television programme from one part of the world to another part continuously because its period

1) is greater than period of the earth about its axis
2) is less than period of rotation of the earth about its axis.
3) has no relation with the period of rotation of the earth about its axis.
4) is equal to the period of rotation of the earth about its axis.

83. The following statement is correct about the motion of earth satellite.

1) It is always accelerating towards the earth
2) There is no force acting on the satellite
3) Move away from the earth normally to the orbit
4) Fall down on to the earth

84. An artificial satellite of mass m is revolving round the earth in a circle of radius R. Then work done in one revolution is

1) mgR 2) $\frac{mgR}{2}$ 3) $2p\,R \times mg$ 4) Zero

85. A satellite is revolving round the earth. Its kinetic energy is E_k. How much energy is required by the satellite such that it escapes out of the gravitational field of earth

1) $2E_k$ 2) $3E_k$ 3) $\frac{E_k}{2}$ 4) infinity

86. If the universal gravitational constant increases uniformly with time, then a satellite in orbit will still maintain its

1) weight 2) tangential speed
3) period of revolution 4) angular momentum

87. Two satellites of masses m_1 and m_2 ($m_1 > m_2$) are revolving around earth in circular orbits of radii r_1 and r_2 ($r_1 > r_2$) respectively. Which of the following statements is true regarding their velocities V_1 and V_2.

1) $V_1 = V_2$ 2) $V_1 < V_2$ 3) $V_1 > V_2$ 4) $\frac{V_1}{r_1} = \frac{V_2}{r_2}$

88. An earth satellite is moved from one stable circular orbit to another larger and stable circular orbit. The following quantities increase for the satellite as a result of this change

1) gravitational potential energy
2) angular velocity 3) linear orbital velocity
4) centripetal acceleration

89. A satellite is revolving in an elliptical orbit in free space; then the false statement is

1) its mechanical energy is constant
2) its linear momentum is constant
3) its angular momentum is constant
4) its areal velocity is constant

90. When a satellite falls into an orbit of smaller radius its speed

1) decreases 2) increases
3) does not change 4) zero

91. Two artificial satellites are revolving in the same circular orbit. Then they must have the same

1) Mass 2) Angular momentum
3) Kinetic energy 4) Period of revolution

92. If satellite is orbiting in space having air and no energy being supplied, then path of that satellite would be

1) circular 2) elliptical
3) spiral of increasing radius
4) spiral of decreasing radius

93. A satellite in vacuum

1) is kept in orbit by solar energy
2) previous energy from gravitational field
3) by remote control
4) No energy is required for revolving

94. Two heavenly bodies s_1 & s_2 not far off from each other, revolve in orbit

1) around their common centre of mass
2) s_1 is fixed and s_2 revolves around s_1

3) s_2 is fixed and s_1 revolves around s_2
4) cannot say

95. If V, T, L, K and r denote speed, time period, angular momentum, kinetic energy and radius of satellite in circular orbit

a) $V \alpha r^{-1}$ b) $L \alpha r^{1/2}$
c) $T \alpha r^{3/2}$ d) $K \alpha r^{-2}$

1) a,b are true 2) b,c are true
3) a,b,d are true 4) a,b,c are true

96. Two similar satellites s_1 and s_2 of same mass 'm' possess around completely inelastic collision while orbiting earth in the same circular orbit in opposite direction then

1) total energy of satellites and earth system become zero
2) the satellites stick together and fly into space
3) the combined mass falls vertically down
4) the satellites move in opposite direction

ENERGY OF ORBITING SATELLITES

97. For a planet revolving round the sun, when it is nearest to the sun

1) K.E. is min and P.E. is max.
2) Both K.E. and P.E. are min
3) K.E. is max. and P.E. is min
4) K.E. and P.E. are equal

98. A body is dropped from a height equal to radius of the earth. The velocity acquired by it before touching the ground is

1) $V=\sqrt{2gR}$ 2) V=3gR 3) $V=\sqrt{gR}$ 4) V=2gR

99. When projectile attains escape velocity, then on the surface of planet , its

1) $KE > PE$ 2) $PE > KE$
3) $KE = PE$ 4) $KE = 2PE$

100. A satellite is moving with constant speed 'V' in a circular orbit around earth. The kinetic energy of the satellite is

1) $\frac{1}{2}mV^2$ 2) mV^2 3) $\frac{3}{2}mV^2$ 4) $2mV^2$

GEOSTATIONARY AND POLAR SATELLITES

101. The orbit of geo-stationary satellite is circular, the time period of satellite depends on (2008 E)

1) mass of the Earth 2) radius of the orbit
3) height of the satellite from the surface of Earth
4) all the above

102. Polar satellites go round the poles of earth in

1) South-east direction 2) north-west direction
3) east-west direction 4) north-south direction

103. A geo-stationary satellite has an orbital period of

1) 2 hours 2) 6 hours 3) 24 hours 4) 12 hours

104. The time period of revolution of geo-stationary satellite with respect to earth is

1) 24 hrs 2) 1 year 3) Infinity 4) Zero

105. A synchronous satellite should be at a proper height moving

1) From West to East in equatorial plane
2) From South to North in polar plane
3) From East to West in equatorial plane
4) From North to South in polar plane

106. The orbital angular velocity vector of a geo-stationary satellite and the spin angular velocity vector of the earth are

1) always in the same direction
2) always in opposite direction
3) always mutually perpendicular
4) inclined at 23 1/2° to each other

107. It is not possible to keep a geo-stationary satellite over Delhi. Since Delhi

1) is not present in A.P 2) is capital of India
3) is not in the equatorial plane of the earth
4) is near Agra.

108. The angle between the equatorial plane and the orbital plane of a geo-stationary satellite is

1) 45^0 2) 0^0 3) 90^0 4) 60^0

109. The angle between the equatorial plane and the orbital plane of a polar satellite is

1) 45^0 2) 0^0 3) 90^0 4) 60^0

WEIGHTLESSNESS

110. Pseudo force also called fictitious force such as centrifugal force arises only in

1) Inertial frames 2) Non-inertial frames
3) Both inertial and non-inertial frames
4) Rigid frames

111. Feeling of weightlessness in a satellite is due to

1) absence of inertia 2) absence of gravity
3) absence of accelerating force
4) free fall of satellite

C.U.Q - KEY

1) 1	2) 2	3) 1	4) 3	5) 3	6) 3
7) 3	8) 2	9) 2	10)2	11) 4	12)3
13) 4	14)1	15)3	16) 4	17) 2	18) 3
19) 2	20) 3	21) 3	22) 2	23) 2	24) 2
25) 1	26)4	27) 3	28) 3	29) 3	30) 1
31) 1	32) 2	33) 2	34) 1	35) 3	36) 1
37) 3	38) 3	39) 1	40) 4	41) 4	42) 3
43) 3	44) 3	45) 3	46) 4	47) 1	48) 4
49) 3	50) 1	51) 3	52) 2	53) 1	54) 2
55) 4	56) 2	57) 1	58) 1	59) 2	60) 3
61) 2	62) 1	63) 1	64) 2	65)4	66) 4
67) 4	68) 2	69) 4	70) 2	71) 2	72) 2
73) 3	74) 1	75) 1	76) 3	77) 3	78) 3
79) 3	80) 1	81) 4	82) 4	83) 1	84) 4
85) 1	86) 4	87) 2	88) 1	89) 2	90) 2
91) 4	92) 4	93) 4	94) 1	95) 2	96) 3
97) 3	98) 3	99) 3	100)1	101)4	102) 4
103) 3	104) 3	105)1	106) 1	107) 3	108) 2
109) 3	110) 2	111) 4			

LEVEL - I (C.W)

KEPLER'S LAWS

1. **If 'A' is areal velocity of a planet of mass M, its angular momentum is**

   1) M/A 2) 2MA 3) A^2M 4) AM^2

2. **A planet revolves round the sun in an elliptical orbit of semi minor and semi major axes x and y respectively. Then the time period of revolution is proportional to**

   1) $(x+y)^{\frac{3}{2}}$ 2) $(y-x)^{\frac{3}{2}}$ 3) $x^{\frac{3}{2}}$ 4) $y^{\frac{3}{2}}$

3. **Let 'A' be the area swept by the line joining the earth and the sun during Feb 2012. The area swept by the same line during the first week of that month is**

   1) A/4 2) 7A/29 3) A 4) 7A/30

4. **A satellite moving in a circular path of radius 'r' around earth has a time period T. If its radius slightly increases by 4%, then percentage change in its time period is**

   1) 1% 2) 6% 3) 3% 4) 9%

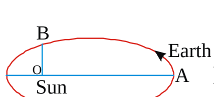
5. **The time of revolution of planet A round the sun is 8 times that of another planet B. The distance of planet A from the sun is how many times greater than that of the planet B from the sun (2002A)**

   1) 2 2) 3 3) 4 4) 5

6. **The distance of Neptune and Saturn from the Sun are respectively 10^{13} and 10^{12} meters and their periodic times are respectively T_n and T_s. If their orbits are circular, then the value of T_n/T_s is**

   1) 100 2) $10\sqrt{10}$ 3) $\frac{1}{10\sqrt{10}}$ 4) 10

7. **The Earth moves around the Sun in an elliptical orbit as shown in the figure. The ratio $\frac{OA}{OB}=x$. Then, ratio of the speed of the Earth at B and at A is nearly**



   1) $\sqrt{x}$ 2) x 3) $x\sqrt{x}$ 4) x^2

8. **The period of moon's rotation around the earth is nearly 29 days. If moon's mass were 2 fold its present value and all other things remain unchanged, the period of moon's rotation would be nearly (in days)**

   1) $29\sqrt{2}$ 2) $29/\sqrt{2}$ 3) $29\sqrt{3}$ 4) 29

9. **If the mass of earth were 2 times the present mass, the mass of the moon were half the present mass and the moon were revolving round the earth at the same present distance, the time period of revolution of the moon would be (in days)**

   1) 56 2) 28 3) $14\sqrt{2}$ 4) 7

LAW OF GRAVITATION

10. **Two spheres of masses m and M are situated in air and the gravitational force between them is F. The space between the masses is now filled with a liquid of specific gravity 3. The gravitational force will now be**

    1) $\frac{F}{9}$ 2) $3F$ 3) F 4) $\frac{F}{3}$

11. **The gravitational force between two bodies is $6.67\times10^{-7}N$ when the distance between their centres is 10m. If the mass of first body is 800 kg, then the mass of second body is**

    1) 1000 kg 2) 1250 kg 3) 1500 kg 4) 2000 kg

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

    1) $1/R^4$ 2) $1/R^2$ 3) R^2 4) R^4

13. **A satellite is orbiting round the earth. If both gravitational force and centripetal force on the satellite is F, then, net force acting on the satellite to revolve round the earth is**

    1) F/2 2)F 3)2F 4) Zero

14. **Mass M=1 unit is divided into two parts X and (1–X). For a given separation the value of X for which the gravitational force between them becomes maximum is**

    1) 1/2 2) 3/5 3) 1 4) 2

ACCELERATION DUE TO GRAVITY AND ITS VARIATION

15. **If g on the surface of the earth is 9.8 m/s^2, its value at a height of 6400 km is (Radius of the earth = 6400km).**

    1)$4.9ms^{-2}$ 2)$9.8ms^{-2}$ 3)$2.45ms^{-2}$ 4)$19.6ms^{-2}$

16. **If g on the surface of the earth is $9.8ms^{-2}$, its value at a depth of 3200km (Radius of the earth = 6400km) is**

1) $9.8ms^{-2}$ 2) zero 3) $4.9ms^{-2}$ 4) $2.45ms^{-2}$

17. **If mass of the planet is 10% less than that of earth and radius of the planet is 20% greater than that of earth then the weight of 40kg person on that planet is**

1)10 kg wt 2)25 kg wt 3)40 kg wt 4)60 kg wt

18. **The angular velocity of the earth with which it has to rotate so that the acceleration due to gravity on 60^0 latitude becomes zero is**

1) $2.5\times10^{-3}\ rad\ s^{-1}$ 2) $1.5\times10^{-3}\ rad\ s^{-1}$

3) $4.5\times10^{-3}\ rad\ s^{-1}$ 4) $0.5\times10^{-3}\ rad\ s^{-1}$

19. **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**

1) $0.2R_e$ 2) $2R_e$ 3) $0.5R_e$ 4) $5R_e$

20. **The value of acceleration due to gravity on the surface of earth is x. At an altitude of 'h' from the surface of earth, its value is y. If R is the radius of earth, then the value of h is**

1) $\left(\sqrt{\frac{x}{y}}-1\right)R$ 2) $\left(\sqrt{\frac{y}{x}}-1\right)R$ 3) $\sqrt{\frac{y}{x}}R$ 4) $\sqrt{\frac{x}{y}}R$

GRAVITATIONAL FIELD INTENSITY

21. **The point at which the gravitational force acting on any mass is zero due to the earth and the moon system is (The mass of the earth is approximately 81 times the mass of the moon and the distance between the earth and the moon is 3,85,000km.)**

1) 36,000km from the moon
2) 38,500km from the moon
3) 34500km from the moon
4) 30,000km from the moon

22. **Masses 2 kg and 8 kg are 18 cm apart. The point where the gravitational field due to them is zero is**

1)6 cm from 8 kg mass 2) 6 cm from 2 kg mass
3)1.8 cm from 8 kg mass 4) 9 cm from each mass

23. **Particles of masses m_1 and m_2 are at a fixed distance apart. If the gravitational field strength at m_1 and m_2 are $\vec{I}_1$ and $\vec{I}_2$ respectively. Then,**

1) $m_1\vec{I}_1+m_2\vec{I}_2=0$ 2) $m_1\vec{I}_2+m_2\vec{I}_1=0$

3) $m_1\vec{I}_1-m_2\vec{I}_2=0$ 4) $m_1\vec{I}_2-m_2\vec{I}_1=0$

GRAVITATIONAL POTENTIAL, POTENTIAL ENERGY

24. **The PE of three objects of masses 1kg, 2kg and 3kg placed at the three vertices of an equilateral triangle of side 20cm is**

1) 25G 2) 35G 3) 45G 4) 55G

25. **A small body is initially at a distance 'r' from the centre of earth. 'r' is greater than the radius of the earth. If it takes W joule of work to move the body from this position to another position at a distance 2r measured from the centre of earth, how many joules would be required to move it from this position to a new position at a distance of 3r from the centre of the earth.**

1) W/5 2) W/3 3) W/2 4) W/6

26. **A body of mass 'm' is raised from the surface of the earth to a height 'nR' (R -radius of earth). Magnitude of the change in the gravitational potential energy of the body is (g - acceleration due to gravity on the surface of earth) (2007M)**

1) $\left(\frac{n}{n+1}\right)mgR$ 2) $\left(\frac{n-1}{n}\right)mgR$ 3) $\frac{mgR}{n}$ 4) $\frac{mgR}{(n-1)}$

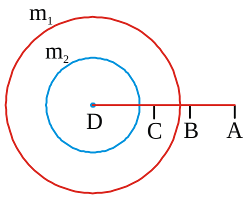
27. **A person brings a mass 2 kg from A to B. The increase in kinetic energy of mass is 4J and work done by the person on the mass is $-10J$. The potential difference between B and A is .... J/kg**

1) 4 2) 7 3) -3 4) -7

28. **The work done in lifting a particle of mass 'm' from the centre of earth to the surface of the earth is**

1) –mgR 2) $\frac{1}{2}mgR$ 3) Zero 4) mgR

29. **The figure shows two shells of masses m_1 and m_2. The shells are concentric. At which point, a particle of mass m shall experience zero force?**



1) A 2) B 3) C 4) D

30. Energy required to shift a body of mass 'm' from an orbit of radius 2R to 3R is (2002A)

1) $\frac{GMm}{12R}$ 2) $\frac{GMm}{3R^2}$ 3) $\frac{GMm}{8R}$ 4) $\frac{GMm}{6R}$

ESCAPE & ORBITAL VELOCITIES

31. The ratio of escape velocities of two planets if g value on the two planets are $9.9 m/s^2$ and $3.3 m/s^2$ and their radii are 6400km and 3200km respectively is

1) 2.36 : 1 2) 1.36 : 1 3) 3.36 : 1 4) 4.36 : 1

32. The escape velocity from the surface of the earth of radius R and density r

1) $2R\sqrt{\frac{2p\ r\ G}{3}}$ 2) $2\sqrt{\frac{2p\ r\ G}{3}}$

3) $2p\sqrt{\frac{R}{g}}$ 4) $\sqrt{\frac{2p\ Gr}{R^2}}$

33. A body is projected vertically up from surface of the earth with a velocity half of escape velocity. The ratio of its maximum height of ascent and radius of earth is

1) 1 : 1 2) 1 : 2 3) 1 : 3 4) 1 : 4

34. A spaceship is launched in to a circular orbit of radius 'R' close to the surface of earth. The additional velocity to be imparted to the spaceship in the orbit to overcome the earth's gravitational pull is (g = acceleration due to gravity)

1) 1.414Rg 2) $1.414\sqrt{Rg}$

3) 0.414Rg 4) $0.414\sqrt{gR}$

35. The escape velocity from the earth is 11 km/s. The escape velocity from a planet having twice the radius and same density as that of the earth is (in km/sec)

1) 22 2) 15.5 3) 11 4) 5.5

36. An object of mass 'm' is at rest on earth's surface. Escape speed of this object is V_e . Same object is orbiting earth with $h = R$, then escape speed is V_e^1. Then

1) $V_e^1 = \frac{V_e}{4}$ 2) $V_e = 2V_e^1$

3) $V_e = \sqrt{2}V_e^1$ 4) $V_e^1 = \sqrt{2}V_e$

37. A satellite revolves in a circular orbit with speed $V = \frac{1}{\sqrt{3}}V_e$. If satellite is suddenly stopped and allowed to fall freely on to earth, the speed with which it hits earth's surface is

1) $\sqrt{gR}$ 2) $\sqrt{\frac{gR}{3}}$ 3) $\sqrt{2gR}$ 4) $\sqrt{\frac{2}{3}gR}$

38. A space station is set up in space at a distance equal to earth's radius from the surface of earth. Suppose a satellite can be launched from the space station also. Let v_1 and v_2 be the escape velocities of the satellite on the earth's surface and space station respectively, then

1) $v_2 = v_1$ 2) $v_2 < v_1$ 3) $v_2 > v_1$

4) 1, 2 and 3 are valid depending on the mass of satellite.

EARTH SATELLITE

39. The orbital speed for an earth satellite near the surface of the earth is 7 km/sec. If the radius of the orbit is 4 times the radius of the earth, the orbital speed would be

1) 3.5 km/sec 2) 7 km/sec

3) $7\sqrt{2}$ km/sec 4) 14 km/sec

40. Two satellites are revolving round the earth at different heights. The ratio of their orbital speeds is 2 : 1. If one of them is at a height of 100km, the height of the other satellite is (in km)

1) 19600 2) 24600 3) 29600 4) 14600

41. A satellite of mass m revolves around the earth of radius R at a height x from its surface. If g is the acceleration due to gravity on the surface of the earth, the orbital speed of the satellite is

1) gx 2) $\left(\frac{gR^2}{R+x}\right)^{1/2}$ 3) $\frac{gR^2}{R+x}$ 4) $\frac{gR}{R-x}$

42. Two satellites M and N go around the earth in circular orbits at heights of R_M and R_N respectively from the surface of the earth. Assuming the earth to be a uniform sphere of radius R_E, the ratio of velocities of the satellites $\frac{V_M}{V_N}$ is

1) $\left(\frac{R_M}{R_N}\right)^2$ 2) $\sqrt{\frac{R_N+R_E}{R_M+R_E}}$ 3) $\frac{R_N+R_E}{R_M+R_E}$ 4) $\sqrt{\frac{R_N}{R_M}}$

43. A satellite of mass 'm' revolves round the earth of mass 'M' in a circular orbit of radius 'r' with an angular velocity 'w'. If the angular velocity is w/8 then the radius of the orbit will be

1) 4r 2) 2r 3) 8r 4) r

44. The moon revolves round the earth 13 times in one year. If the ratio of sun-earth distance to earth-moon distance is 392, then the ratio of masses of sun and earth will be

1) 365 2) 356×10^{-12} 3) 3.56×10^{5} 4) 1

45. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius 1.01 R. The time period of the second satellite is larger than that of the first one by approximately

1) 0.5% 2) 1.5% 3) 1% 4) 3%

46. An astronaut orbiting in a spaceship round the earth has a centripetal acceleration of $2.45 m/s^2$. The height of spaceship from earth's surface is (R= radius of earth)

1) 3R 2) 2R 3) R 4) $R/2$

ENERGY OF SATELLITES

47. A satellite moves around the earth in a circular orbit with speed 'v'. If 'm' is mass of the satellite then its total energy is

1) $\frac{1}{2}mv^2$ 2) mv^2 3) $-\frac{1}{2}mv^2$ 4) $\frac{3}{2}mv^2$

48. The K.E. of a satellite in an orbit close to the surface of the earth is E. Its max K.E. so as to escape from the gravitational field of the earth is.

1) 2E 2) 4E 3) $2\sqrt{2}$ E 4) $\sqrt{2}$ E

49. Two satellites of masses 400 kg, 500 kg are revolving around earth in different circular orbits of radii r_1, r_2 such that their kinetic energies are equal. The ratio of r_1 to r_2 is

1) 4 : 5 2) 16 : 25 3) 5 : 4 4) 25 : 16

50. The kinetic energy needed to project a body of mass m from earth's surface (radius R) to infinity is

1) $\frac{mgR}{2}$ 2) $2mgR$ 3) mgR 4) $\frac{mgR}{4}$

GEOSTATIONARY AND POLAR SATELLITES

51. Orbital speed of geo-stationary satellite is

1) 8km/sec from west to east
2) 11.2km/sec from east to west
3) 3.1km/sec from west to east
4) Zero

LEVEL-1 (C.W) - KEY

1)2	2)4	3) 2	4)2	5)3	6)2
7)2	8)4	9)3	10)3	11)2	12)4
13)2	14)1	15)3	16)3	17)2	18)1
19)4	20)1	21)2	22)2	23)1	24)4
25)2	26)1	27)4	28)2	29)4	30)1
31)1	32)1	33)3	34)4	35)1	36)3
37)4	38)2	39)1	40)1	41)2	42)2
43)1	44)3	45)2	46)3	47)3	48)1
49)1	50)3	51)3			

LEVEL-1(C.W) - HINTS

1. $\frac{dA}{dt}=\frac{L}{2M}$

2. From Kepler's 3rd law, $T^2 a r^3$

3. For 29 days - A, For 1 day - A/29 , For 1 week - 7A/29,

4. $T^2 a r^3$, $\frac{\Delta T}{T}\times100=\frac{3}{2}\frac{\Delta R}{R}\times100$

5. From Kepler's 3rd law, $T^2 a r^3$, $\frac{T_1}{T_2}=\left[\frac{r_2}{r_1}\right]^{\frac{3}{2}}$

6. From Kepler's 3rd law, $T^2 a r^3$, $\frac{T_1}{T_2}=\left[\frac{r_2}{r_1}\right]^{\frac{3}{2}}$

7. From conservation of angular momentum

   mv r = Constant, $v_1r_1=v_2r_2$

8. Time period does not depend upon the mass of the satellite

9. From Kepler's 3rd law, $T=2p\sqrt{\frac{r^3}{GM}}$

10. Gravitational force does not depend upon the medium between the masses.

11. $F_g=\frac{Gm_1m_2}{R^2} \Rightarrow m_2=\frac{F_g\times R^2}{Gm_1}$

12. $F=\frac{Gm_1m_2}{R^2}; Here\, m=\frac{4}{3}p\,R^3$

13. Gravitational force provides centripetal force.

14. $F=\frac{G\times m(1-x)mx}{R^2}$ is maximum when $x=\frac{1}{2}$

15. $\frac{g_h}{g}=\frac{R^2}{(R+h)^2}$; 16. $g'=g\left(1-\frac{d}{R}\right)$

17. $g=\frac{GM}{R^2} \Rightarrow g\ a\ \frac{M}{R^2}$

18. $g-Rw^2\cos^2 l=0$, given $l=60^0$, Find w

19. $R_{\max}=\frac{u^2}{g} \Rightarrow R_{\max}\propto\frac{1}{g}$

20. $x=\frac{G\ M}{R^2}, \ y=\frac{G\ M}{(R+h)^2}$

21. distance of null point $x=\frac{d}{\sqrt{\frac{m_2}{m_1}}+1}$

22. distance of null point $x=\frac{d}{\sqrt{\frac{m_2}{m_1}}+1}$

23. $\vec{I}_1=\frac{Gm_2}{d^2}$ and $\vec{I}_2=-\frac{Gm_1}{d^2}$

24. $GPE(U)=\frac{Gm_1m_2}{r_{12}}$ $Use, U_{net}=U_1+U_2+U_3$

25. $W=GPE_2-GPE_1$ Here, $GPE=\frac{Gm_1m_2}{r_{12}}$

26. $\Delta GPE=\frac{mgh}{1+\frac{h}{R}}$

27. $W=m(\Delta V)+\Delta KE$

28. $W=GPE_2-GPE_1$; $\Delta GPE=\frac{mgh}{1+\frac{h}{R}}$

29. The gravitational field intensity at a point inside the spherical shell is zero.

30. $W=T.E_2-T.E_1=\frac{GMm}{2}\left(\frac{1}{r_2}-\frac{1}{r_1}\right)$

31. $V_e=\sqrt{2gR} \Rightarrow V_e\propto\sqrt{gR}$

32. $V_e=\sqrt{\frac{2GM}{R}}$ but $M=\frac{4}{3}p\,R^3 r$

33. $h=\frac{R}{n^2-1}$ $Here\ n=2$

34. $V=V_e-V_0=\sqrt{2gR}-\sqrt{gR}=\sqrt{gR}\left(\sqrt{2}-1\right)$

35. $V_e\propto R\sqrt{r}$; 36. $\frac{1}{2}mv_0^2-\frac{Gmn}{(R+h)}=O$;

37. $V=\sqrt{V_e^2-2V_0^2}$

38. From the surface of earth

Escape velocity $v_1=\sqrt{\frac{2GM}{R}}$

$\frac{1}{2}mv_2^2-\frac{GMm}{2R}=0$

39. $V_0=\sqrt{\frac{GM}{r}} \Rightarrow V_0\propto\frac{1}{\sqrt{r}}$; 40. $V_0=\sqrt{\frac{GM}{R+h}} \Rightarrow V_0\propto\frac{1}{\sqrt{R+h}}$

41. $V_0=\sqrt{\frac{GM}{R+h}}=\sqrt{\frac{gR^2}{R+x}}$;42. $V_0=\sqrt{\frac{GM}{R+h}} \Rightarrow V_0\propto\frac{1}{\sqrt{R+h}}$

43. From Kepler's 3rd law, $T^2\propto r^3 \Rightarrow w^2 a\frac{1}{r^3}$

44. From Kepler's 3rd law, $T^2 a\frac{r^3}{M}$

45. $T\propto R^{3/2} \Rightarrow \frac{\Delta T}{T}\times 100=\frac{3}{2}\frac{\Delta r}{r}\times 100$

46. $a=\frac{gR^2}{(R+h)^2}$; 47. TE = -KE = $-\frac{1}{2}mv^2$

48. $\frac{K_e}{K_0}=\frac{2gR}{gR} \Rightarrow K_e=2K_0$

49. $KE=\frac{GMm}{2r} \Rightarrow KE\propto\frac{m}{r} \Rightarrow m\propto r$

50. $KE=\frac{1}{2}mV_e^2$; 51. $V_o=\sqrt{g(R+h)}$

LEVEL - I (H.W)

KEPLER'S LAWS

1. In planetary motion, the areal velocity of position vector of a planet depends on angular velocity (w) and the distance of the planet from sun (r). If so, the correct relation for areal velocity is (2003E)

1) $\frac{dA}{dt} \propto wr$ 2) $\frac{dA}{dt} \propto w^2 r$

3) $\frac{dA}{dt} \propto wr^2$ 4) $\frac{dA}{dt} \propto \sqrt{wr}$

2. If a and b are the nearest and farthest distances of a planet from the sun and the planet is revolving in elliptical orbit, then square of the time period of revolution of that planet is proportional to

1) a^3 2) b^3 3) $(a+b)^3$ 4) $(a-b)^3$

3. Let 'A' be the area swept by the line joining the earth and the sun during Feb 2007. The area swept by the same line during the first week of that month is

1) A/4 2) 7A/29 3) A 4) 7A/30

4. The period of a satellite in an orbit of radius R is T. Its period of revolution in an orbit of radius 4R will be

1) 2T 2) $2\sqrt{2}T$ 3) 4T 4) 8T

5. The period of revolution of an earth's satellite close to the surface of earth is 60 minutes. The period of another earth's satellite in an orbit at a distance of three times earth's radius from its surface will be (in minutes)

1) 90 2) $90\times\sqrt{8}$ 3) 270 4) 480

6. If a planet of mass m is revolving around the sun in a circular orbit of radius r with time period T, then mass of the sun is

1) $4p^2r^3/GT$ 2) $4p^2r^3/GT^2$

3) $4p^2r/GT$ 4) $4p^2r^3/G^2T^2$

7. The period of revolution of a planet around the sun in a circular orbit is same as that of period of similar planet revolving around a star of twice the radius of first orbit and 'M' is the mass of the sun and mass of star is

1) 2M 2) 4M 3) 8M 4) 16M

8. A planet moves around the sun in elliptical orbit. When earth is closest from the sun, it is at a distance r having a speed v. When it is at a distance 4r from the sun its speed is

1) 4v 2) $\frac{v}{4}$ 3) 2v 4) $\frac{v}{2}$

9. A planet of mass 'm' is in an elliptical orbit about the sun $(m << M)$ with an orbital time period 'T'. If 'A' be the area of the orbit then its angular momentum is

1) $\frac{2mA}{T}$ 2) mAT 3) $\frac{mA}{2T}$ 4) $2mAT$

LAW OF GRAVITATION

10. The gravitational force between two particles of masses m_1 and m_2 seperated by certain distance in air medium is F. If they are taken to vacuum and separated by the same distance, then the gravitational force between them will be

1) greater than F 2) less than F

3) F 4) Zero

11. The mass of a ball is four times the mass of another ball. When these balls are separated by a distance of 10cm, the gravitational force between them is $6.67\times10^{-7}N$. The masses of the two balls are (in kg)

1) 10 , 20 2) 5 , 20 3) 20 , 30 4) 20 , 40

12. Gravitational force between two point masses m and M separated by a distance r is F. Now if a point mass 3m is placed next to m, the force on M due to m becomes

1) F 2) 2F 3) 3F 4) 4F

13. Three uniform spheres each of mass m and diameter D are kept in such a way that each touches the other two, then magnitude of the gravitational force on any one sphere due to the other two is

1) $\frac{3Gm^2}{D^2}$ 2) $\frac{2\sqrt{3}Gm^2}{D^2}$ 3) $\frac{\sqrt{3Gm^2}}{4D^2}$ 4) $\frac{\sqrt{3}Gm^2}{D^2}$

14. A 3 kg mass and a 4 kg mass are placed on x and y axes at a distance of 1 metre from the origin and a 1 kg mass is placed at the origin. Then the resultant gravitational force on 1 kg mass is

1) 7G 2) G 3) 5G 4) 3G

ACCELERATION DUE TO GRAVITY AND ITS VARIATION

15. The height at which the value of g is half that on the surface of earth of radius R is

1) R 2) 2R 3) 0.414R 4) 0.75R

16. The depth at which the value of g becomes 25% of that at the surface of earth is (in Km)

1)4800 2)2400 3) 3600 4) 1200

17. If the radius of earth decreases by 10%, the mass remaining unchanged, then the acceleration due to gravity

1) decreases by 19% 2) increases by 19%

3) decreases by more than 19%

4) increases by more than 19%

18. The acceleration due to gravity at the poles is $10ms^{-2}$ and equatorial radius is 6400km for the earth. Then the angular velocity of rotation of the earth about its axis so that the weight of a body at the equator reduces to 75% is

1) $\frac{1}{1600}$ rads^{-1} 2) $\frac{1}{800}$ rads^{-1} 3) $\frac{1}{400}$ rads^{-1} 4) $\frac{1}{200}$ rads^{-1}

19. The maximum horizontal range of a projectile on the earth is R. Then for the same velocity of projection, its maximum range on another planet is $\frac{5R}{4}$. Then, ratio of acceleration due to gravity on that planet and on the earth is

1) 5:4 2) 4:5 3) 25:16 4) 16:25

20. A particle hanging from a massless spring stretches it by 2 cm at earth's surface. How much will the same particle stretch the spring at a height of 2624 Km from the surface of the earth? (Radius of earth = 6400 Km)

1) 1cm 2) 2cm 3) 3cm 4) 4cm

21. The value of acceleration due to gravity 'g' on the surface of a planet with radius double that of earth and same mean density as that of the earth is (g_e = acceleration due to gravity on the surface of earth)

1) $g_p = 2g_e$ 2) $g_p = g_e/2$ 3) $g_p = g_e/4$ 4) $g_p = 4g_e$

22. If g is acceleration due to gravity on the surface of the earth, having radius R, the height at which the acceleration due to gravity reduces to g/2 is

1) R/2 2) $\sqrt{2}R$ 3) $\frac{R}{\sqrt{2}}$ 4) $\left(\sqrt{2}-1\right)R$

GRAVITATIONAL FIELD INTENSITY

23. There are two bodies of masses 100Kg and 1000Kg separated by a distance 1m. The intensity of gravitational field at the mid point of the line joining them will be

1) $2.4\times10^{-6}\,N/kg$ 2) $2.4\times10^{-7}\,N/kg$

3) $2.4\times10^{-8}\,N/kg$ 4) $2.4\times10^{-9}\,N/kg$

24. Masses 4 kg and 36 kg are 16 cm apart. The point where the gravitational field due to them is zero is

1)6 cm from 4 kg mass 2)4 cm from 4 kg mass

3)1.8 cm from 36 kg mass 4)9 cm from each mass

25. Two particles of masses 4Kg and 8Kg are kept at x = - 2m and x = 4m respectively. Then, the gravitational field intensity at the origin is

1) G 2) 2G 3) G/2 4) G/4

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

1) Zero 2) $\frac{3GM}{L^2}$ 3) $\frac{9GM}{L^2}$ 4) $\frac{2GM}{L^2}$

GRAVITATIONAL POTENTIAL, POTENTIAL ENERGY

27. Three particles each of mass m are placed at the corners of an equilateral triangle of side b. The gravitational potential energy of the system of particles is

1) $\frac{-3Gm^2}{2b}$ 2) $\frac{-Gm^2}{2b}$ 3) $\frac{-3Gm^2}{b}$ 4) $\frac{-Gm^2}{b}$

28. If W is the weight of a satellite on the surface of the earth, then the energy required to launch that satellite from the surface of earth into a circular orbit of radius 3R is (here R is the radius of earth)

1) 5WR/6 2) 6WR/5 3) 2WR/3 4) 3WR/2

29. A body of mass m is lifted from the surface of earth to a height equal to R/3 where R is the radius of earth, potential energy of the body increases by

1) mgR/3 2) mgR/4 3) 2mgR/3 4) mgR/9

30. An object of mass 2 Kg is moved from infinity to a point P. Initially that object was at rest but on reaching P its speed is 2m/s. The workdone in moving that object is -4J. Then potential at P is ....J/Kg.

1) 8 2) - 8 3) 4 4) - 4

31. If mass of earth is M, radius is R, and gravitational constant is G, then workdone to take 1Kg mass from earth surface to infinity will be

1) $\sqrt{\frac{GM}{2R}}$ 2) $\frac{GM}{R}$ 3) $\sqrt{\frac{2GM}{R}}$ 4) $\frac{GM}{2R}$

32. A body of mass m is placed on the earth surface is taken to a height of h = 3R, then, change in gravitational potential energy is

1) $\frac{mgR}{4}$ 2) $\frac{2mgR}{3}$ 3) $\frac{3mgR}{4}$ 4) $\frac{mgR}{6}$

33. A body is released from height 5R where R is the radius of the earth. Then that body reaches the ground with a velocity equal to

1) $\sqrt{\frac{5gR}{3}}$ 2) $\sqrt{\frac{3gR}{5}}$ 3) $\sqrt{5gR}$ 4) $\sqrt{3gR}$

34. The difference in PE of an object of mass 10kg when it is taken from a height of 6400km to 12800 km from the surface of the earth is $\left(M_E = 6\times10^{24} kg\right)$

1) $1.045\times10^8 J$ 2) $1.565\times10^8 J$

3) $2.65\times10^8 J$ 4) $4.5\times10^8 J$

35. If the gravitational potential energy of a body at a distance r from the centre of the earth is U, then its weight at that point is

1) U 2) $\frac{U^2}{r}$ 3) $U^2 r$ 4) $\frac{U}{r}$

ESCAPE & ORBITAL SPEEDS

36. The escape velocity of an object on a planet whose radius is 4times that of the earth and 'g' value 9 times that on the earth, in kms^{-1}, is

1) 33.6 2) 67.2 3) 16.8 4) 25.2

37. The escape velocity of a sphere of mass 'm' is given by

1) $\sqrt{\frac{2GMm}{R_e}}$ 2) $\sqrt{\frac{2GM}{R_e^2}}$ 3) $\sqrt{\frac{2GMm}{R_e^2}}$ 4) $\sqrt{\frac{2GM}{R_e}}$

38. A body is projected up with a velocity equal to 3/4th of the escape velocity from the surface of the earth. The height it reaches is (Radius of the earth is R)

1) 10R/9 2) 9R/7 3) 9R/8 4) 10R/3

39. A space craft is launched in a circular orbit very close to earth. What additional velocity should be given to the space craft so that it might escape the earth's gravitational pull

1) $20.2 Kms^{-1}$ 2) $3.25 Kms^{-1}$ 3) $8 Kms^{-1}$ 4) $11.2 Kms^{-1}$

40. If the escape velocity on earth is 11.2 km/s, its value for a planet having double the radius and 8 times the mass of earth is..(in km/sec)

1) 11.2 2) 22.4 3) 5.6 4) 8

41. The escape velocity of a body from earth surface is V_e. The escape velocity of the same body from a height equal to 7R from earth surface will be

1) $\frac{V_e}{\sqrt{2}}$ 2) $\frac{V_e}{2}$ 3) $\frac{V_e}{2\sqrt{2}}$ 4) $\frac{V_e}{4}$

42. Escape velocity of a body from the surface of the earth is V_1 and from an altitude equal to twice the radius of the earth , escape velocity is V_2. Then,

1) $V_1 = V_2$ 2) $V_1 = 7V_2$ 3) $V_1 = \sqrt{3}V_2$ 4) $V_1 = \sqrt{2}V_2$

EARTH SATELLITES

43. The ratio of the orbital speeds of two satellites of the earth if the satellites are at heights 6400km and 19200km (Radius of the earth = 6400 km)

1) $\sqrt{2}:1$ 2) $\sqrt{3}:1$ 3) 2:1 4) 3:1

44. An artificial satellite is revolving in a circular orbit at height of 1200 km above the surface of the earth. If the radius of the earth is 6400km and mass is 6×10^{24} kg, the orbital velocity is $\left(G = 6.67\times10^{-11} Nm^2/kg^2\right)$

1) $7.26 kms^{-1}$ 2) $4.26 kms^{-1}$

3) $9.26 kms^{-1}$ 4) $2.26 kms^{-1}$

45. The mean radius of the orbit of a satellite is 4 times as great as that of a parking orbit of the earth. Then its period of revolution around the earth is

1) 4 days 2) 8 days 3) 16 days 4) 96 days

46. If the mass of earth were 4 times the present mass, the mass of the moon were half the present mass and the moon were revolving round the earth at twice the present distance, the time period of revolution of the moon would be (in days)

1) $56\sqrt{2}$ 2) $28\sqrt{2}$ 3) $14\sqrt{2}$ 4) $7\sqrt{2}$

47. **A satellite of mass 'm' revolves around earth of mass M in a circular orbit of radius,'r' with angular velocity w. If radius of the orbit becomes 9r, then angular velocity of this orbit is**

1) $9w$ 2) $\frac{w}{9}$ 3) $27w$ 4) $\frac{w}{27}$

48. **An artificial satellite of mass 'm' is revolving around in a circular orbit of radius 'r'. If the mass of earth is M, angular momentum of the satellite with respect to the centre of earth is (2012M)**

1) $\sqrt{GM\ m^2 r}$ 2) $2m\sqrt{GMr}$

3) $2M\sqrt{Gmr}$ 4) $\sqrt{\frac{GM}{r}}$

49. **Two satellites of masses 400kg, 500 kg are revolving around earth in different circular orbits of radii r_1, r_2 such that their kinetic energies are equal. The ratio of r_1, r_2 is**

1) $\sqrt{5}:\sqrt{4}$ 2) 16:25 3) $\sqrt{45}:\sqrt{4}$ 4) 25:16

50. **Angular momentum of a satellite revolving round the earth in a circular orbit at a height R above the surface is L. Here R is radius of the earth. The magnitude of angular momentum of another satellite of the same mass revolving very close to the surface of the earth is**

1)L/2 2)L/$\sqrt{2}$ 3) $\sqrt{2}$ L 4)2L

ENERGY OF SATELLITES

51. **The K.E. of a satellite is $10^4 J$. Its P.E. is**

1) $-10^4 J$ 2) $2\times10^4 J$ 3) $-2\times10^4 J$ 4) $-4\times10^4 J$

52. **Energy required to move a body of mass 'm' from an orbit of radius 3R to 4R is**

1) $\frac{GMm}{2R}$ 2) $\frac{GMm}{6R}$ 3) $\frac{GMm}{12R}$ 4) $\frac{GMm}{24R}$

53. **K.E. of an orbiting satellite is K. The minimum additional K.E. required so that it goes to infinity is**

1) K 2) 2K 3) 3K 4) K/2

GEO-STATIONARY AND POLAR SATELLITES

54. **Imagine a geo-stationary satellite of earth which is used as an inter continental telecast station. At what height will it have to be established**

1) $10^3 m$ 2) $6.4\times10^3 m$ 3) $35.94\times10^6 m$ 4)infinity

55. **The height of geo-stationary satellite above the centre of earth is (in km)**

1) 6400 2) 12800 3) 36000 4) 42000

WEIGHTLESSNESS

56. **How much faster than its normal rate should the earth rotate about its axis so that the weight of the body at the equator becomes zero (R** $= 6.4\times10^6 m, g = 9.8 m/s^2$ **) (in times)**

1)nearly17 2)nearly12 3)nearly 10 4)nearly 14

LEVEL-1(H.W) - KEY

1) 3	2) 3	3) 1	4) 4	5) 4	6) 2
7) 3	8) 2	9) 1	10) 3	11) 2	12) 1
13) 4	14) 3	15) 3	16) 1	17) 4	18) 1
19) 2	20) 1	21) 1	22) 4	23) 2	24) 2
25) 3	26) 1	27) 3	28) 1	29) 2	30) 2
31) 2	32) 3	33) 1	34) 1	35) 4	36) 2
37) 4	38) 2	39) 2	40) 2	41) 3	42) 3
43) 1	44) 1	45) 2	46) 2	47) 4	48) 1
49) 1	50) 2	51) 3	52) 4	53) 1	54) 3
55) 4	56) 1				

LEVEL-1(H.W) - HINTS

1. $\frac{dA}{dt} = \frac{L}{2m} \Rightarrow \frac{dA}{dt} \propto vr \propto wr^2$
2. From Kepler's 3rd law, $T^2 \propto r^3$
3. $\frac{dA}{dt} = \text{constant} \Rightarrow \frac{A}{28} = \frac{A'}{7} \Rightarrow A' = \frac{A}{4}$
4. From Kepler's 3rd law, $T^2 \propto r^3$
5. From Kepler's 3rd law, $T^2 \propto r^3$
6. From Kepler's 3rd law, $mrw^2 = \frac{GMm}{r^2}$ $T = 2p\sqrt{\frac{r^3}{GM}}$
7. From Kepler's 3rd law, $mrw^2 = \frac{GMm}{r^2}$ $T = 2p\sqrt{\frac{r^3}{GM}}$
8. From Kepler's 2nd law, $\frac{1}{2}r\text{v} =$ Constant
9. $\frac{dA}{dt} = \frac{L}{2m}$
10. Gravitational force does not depend upon the medium between the masses.
11. $F_g = \frac{Gm_1m_2}{R^2}$ Given, $m_2 = 4m_1$
12. $F = \frac{G\,m_1 m_2}{r^2}$; Gravitational force between two point masses is independent of the presence of other masses.

13. Gravitational force on one sphere due to the other two is $F=\sqrt{F_1^2+F_2^2+2F_1F_2\,Cosq}=\sqrt{3}F_1$

But $F_1=\frac{Gm^2}{D^2}\Rightarrow F=\frac{\sqrt{3}Gm^2}{D^2}\quad(\because F_1=F_2)$

14. $q=90^0\ ,\ F_1=\frac{3G}{1^2},\ F_2=\frac{4G}{1^2}$

$F=\sqrt{F_1^2+F_2^2+2F_1F_2\,Cosq}$

15. $\frac{g_h}{g}=\frac{R^2}{(R+h)^2}$ Given h= R/2

16. $g'=g\left(1-\frac{d}{R}\right)$ Given $g'=\frac{25}{100}g$

17. $g=\frac{GM}{R^2}\Rightarrow g\propto\frac{1}{R^2}$

18. $g_f=g-Rw^2$ Given $g_f=\frac{75}{100}g$

19. $R_{max}=\frac{u^2}{g}\Rightarrow R_{max}\propto\frac{1}{g}$

20. mg=Kx , $x\propto g$ Here, $\frac{g_h}{g}=\frac{R^2}{(R+h)^2}$

21. $g=\frac{4}{3}Gp\,R\,r\Rightarrow g\propto R\,r$

22. $\frac{g_h}{g}=\frac{R^2}{(R+h)^2}$ Given $g_h=\frac{g}{2}$

23. $I=\left(\frac{G\times1000}{(1/2)^2}\right)-\left(\frac{G\times100}{(1/2)^2}\right)$

24. Distance of null point $x=\frac{r}{\sqrt{\frac{m_2}{m_1}}+1}$

25. $\vec{I}=\vec{I}_1+\vec{I}_2$; 26. $\vec{I}=\vec{I}_1+\vec{I}_2+\vec{I}_3=0$

27. $GPE(U)=\frac{Gm_1m_2}{r_{12}}$ $Use, U_{net}=U_1+U_2+U_3$

28. w = Total energy in orbit - gravitational potential energy on surface of planet

29. $\Delta GPE=\frac{mgh}{1+\frac{h}{R}}$

30. $W=m(\Delta v)+\Delta KE$

31. P.E of 1kg mass placed at the earth surface $=-\frac{GM}{R}$. Its P.E at infinity = 0.

$\therefore$ Workdone = $\Delta P.E=\frac{GM}{R}$

32. $\Delta GPE=\frac{mgh}{1+\frac{h}{R}}$

33. From conservation of energy, (P.E + K.E) on the surface of the earth = P.E at height 5R

$-\frac{GMm}{R}+\frac{1}{2}mv^2=\frac{-GMm}{(R+5R)}\Rightarrow v=\sqrt{\frac{5gR}{3}}$

34. $P.E=-GMm\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$

35. As U =mgr, weight mg = U/r

36. $v_e=\sqrt{2gR}\Rightarrow v_e\propto\sqrt{gR}$

37. $v=\sqrt{\frac{2GM}{R}}$ Escape velocity does not depend upon the mass of the projected body.

38. $\frac{1}{2}mv_e^2=\frac{mgh}{1+\frac{h}{R}}$; 39. $v=\sqrt{2gR}-\sqrt{gR};v=\sqrt{gR}(\sqrt{2}-1)$

40. $v_e=\sqrt{\frac{2GM}{R}}\Rightarrow\frac{v_1}{v_2}=\sqrt{\frac{M_1}{M_2}\frac{R_2}{R_1}}$

41. $v_e=\sqrt{\frac{2GM}{R}}$

at height $v_e^1=\sqrt{\frac{2GM}{R+h}}=\sqrt{\frac{2GM}{R+7R}}$

42. $\frac{1}{2}mv^2=\frac{GmM}{(R+h)}$;

43 . $v_0=\sqrt{\frac{GM}{R+h}}\Rightarrow v_0\propto\frac{1}{\sqrt{R+h}}$

44. $v_0=\sqrt{\frac{GM}{R+h}}$; 45. $v_0=\sqrt{\frac{GM}{R+h}}$ and $T=\frac{2p\,r}{v_0}$

46. $T^2=4p^2\frac{r^3}{GM}\Rightarrow T\,a\sqrt{\frac{r^3}{M}}$

47. From Kepler's 3rd law, $T^2\propto r^3\Rightarrow w^2a\,\frac{1}{r^3}$

48. $L=mv_0r$; 49. $KE_1=KE_2$ $L=mvr^1$ and $\frac{r_1}{r_2}=\frac{\sqrt{m_2}}{\sqrt{m_1}}$

50. $L=mv_0r$; 51. $P.E.=-2(K.E.)$

52. $W=(U_2-U_1)\Rightarrow U=-\frac{GMm}{2r}$; 53. $\frac{KE_2}{KE_1}=\frac{v_e^2}{v_o^2}$

54. $T=2p\sqrt{\frac{(R+h)^3}{GM}}\Rightarrow h=\left(\frac{T^2gR^2}{4p^2}\right)^{\frac{1}{3}}-R$

55. $R+h=(6400+36000)km\cong42000km$

56. $g^1=g-Rw^2$