PHYSICS

BOOKS - TARGET PHYSICS (HINGLISH)

GRAVITATION

Classical Thinking

1. Newton's law of gravitation

A. It is always attractive

B. it is not affected by the medium

C. acts on all masses at nay distances

D. all of these

Answer: D

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2. The force of attraction between any two particles in the universe is directly proportional to

A. square of distance between two particles.

B. product of masses of these two particles

C. universal gravitational constant

D. distance between two particles

Answer: B

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3. Which of the following represent the Newton's law of universal gravitation correctly?

A. $\overrightarrow{F} = \frac{Gm_1m_2}{r^2}\overrightarrow{r}$

B. $\overrightarrow{F} = \frac{Gm_1m_2}{r^3}\hat{r}$

C. $\overrightarrow{F} = \frac{Gm_1m_2}{r^3}\overrightarrow{r}$

D. $\overrightarrow{F} = \frac{Gm_1m_2}{r}\overrightarrow{r}$

Answer: C

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4. Tides are formed due to gravitational force of

A. earth on the sea

B. sun on the earth

C. earth on the moon

D. moon on the earth

Answer: D

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5. A satellite is moving in an orbit around the earth due to

A. Burning of fuel

B. gravitational attraction between sun and earth

C. ejection of gases from the exhaust of the satellite

D. gravitational attraction between earth and the satellite

Answer: D

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6. The atmosphere is held to the earth by

A. winds

B. gravity

C. clouds

D. nature

Answer: B

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7. The force of attraction between two unit point masses separated by a unit distance is numerically equal to

A. acceleration due to gravity

B. garvitational potential

C. universal gravitational constant

D. gravitational intensity

Answer: C

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8. What is the value of universal gravitational constant?

A. 10^{-11}

B. 10^{-19}

C. 10^{-13}

D. 10^{-24}

Answer: A

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9. The SI unit of gravitational constant is

A. Nm/kg^2

B. Nm^2 / kg

C. Nm / kg

D. Nm^2 / kg^2

Answer: D

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10. The C.G.S. unit of universal gravitational constant is

A. $dyne cm^2 / g^2$

B. $dyneg^2 / cm^2$

C. $dyne^2 cm / g$

D. $g^2 / dynecm^2$

Answer: A

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11. Two bodies of masses m and 2m are kept at distance r apart from each other. Then the value of G varies as

A. r^2

B. r^4

C. r^{-2}

D. r^{th}

Answer: D

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12. The gravitational constant G is equal to $6.67 \times 10^{-11} Nm^2 / kg^2$ in vacuum. Its value in a dense matter of density $10^{10} g / cm^3$ will be

A. $6.67 \times 10^{-1} Nm^2 / kg^2$

B. $6.67 \times 10^{-11} Nm^2 / kg^2$

C. $6.67 \times 10^{-21} Nm^2 / kg^2$

D. $6.67 \times 10^{-10} Nm^2 / kg^2$

Answer: B

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13. The gravitational force exerted by the earth on a body is called

A. weight of the body

B. acceleration of that body

C. mass of the body

D. gravitational constant

Answer: A

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14. The gravitational force between two stones of mass 1 kg each separated by a distance of 1 me tre in vacuum is

A. $6.67 \times 10^{-9} N$

B. $6.67 \times 10^{-10} N$

C. $6.67 \times 10^{-11} N$

D. $6.67 \times 10^{-12} N$

Answer: C

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15. The mass of a planet is $(1/10)^{th}$ that of earth and its diameter is half that of earth the acceleration due to gravity is

A. `9.8ms^(-2)

B. `1.96ms^(-2)

C. $3.92ms^{-2}$

D. $4.9ms^{-2}$

Answer: C

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16. A body detached gently from the outer wall of a satellite orbiting around the earth will

A. fall to the earth

B. follow an irregular earth

C. continue to move along with the satellite.

D. escape from earth's field

Answer: C

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

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 continously depending upon the mass of the satellite.

Answer: B

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18. The nature of the path of the satellite depends upon

A. the horizontal velocity

B. the escape velocity

C. the critical velocity

D. all of the above

Answer: A

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19. If the horizontal velocity is less than critical velocity, then the satellite will travel in

A. parabolic path

B. straight path

C. elliptical path

D. circular path

Answer: A

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20. The maximum possible velocity of a satellite orbiting round the earth in a stable orbit is

A. $\sqrt{2R_e g}$

B. $\sqrt{R_e g}$

C. $\sqrt{\dfrac{R_e g}{2}}$

D. infinite

Answer: B

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21. If the gravitational force were proportional to $\frac{1}{r}$, then a particle in a circular orbit under such a force would have its original speed:

A. $\propto \frac{1}{r^2}$

B. $\propto \frac{1}{r}$

C. $\propto \frac{1}{r^2}$

D. $\propto^{23}$

Answer: A

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22. 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 geo-stationary satellite will be

A. $R^2 g / \omega$

B. $R^2 \omega^2 / g$

C. Rg / ω^2

D. $R^2 g / \omega^2$

Answer: D

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23. 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

A. $v_1 = v_2$

B. $v_1 > v_2$

C. $v_1 < v_2$

D. $\frac{v_1}{r_1} = \frac{v_2}{r_2}$

Answer: C

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24. The orbit of geo-stationary satellite is circular, the time period of satellite depended on

A. the mass of the statellite

B. radius of orbit

C. both the mass and radius of the orbit

D. shape of satellite

Answer: B

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25. In the case of a satellite moving along a circular orbit, a larger orbit corresponds to

A. longer period and smaller velocity

B. larger velocity and longer period

C. smaller period and smaller velocity

D. smaller period and larger velocity

Answer: A

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26. A satellite is orbiting very close to a planet. Its periodic time depends only on

A. density of the planet

B. mass of the planet

C. radius of the planet

D. mass of the satellite

Answer: A

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27. The earth revolves about the sun in an elliptical orbit with mean radius $9.3 \times 10^7 m$ in a period of 1 year. Assuming that there are no outside influences

A. the earth's kinetic energy remains constant

B. the earth's angular momentum remains constant

C. the earth's potential energy remains

D. all the statements above are correct.

Answer: B

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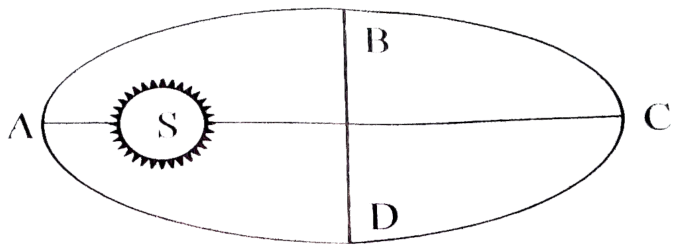
28. The earth rotates about the sun in an elliptical orbit. At which point will its velocity be maximum?



A. At A

B. At B

C. At C

D. At D

Answer: A

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29. Kepler's third law i.e. $T^2 \propto R^3$, is a consequence of law of conservation of

A. linear momentum

B. angular momentum

C. energy

D. law of quantisation of angular momentum

Answer: B

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30. 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. $(r_1 / r_2)^{3/2}$

Answer: D

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31. The gravitational potential energy per unit mass at a point gives ___ at that point.

A. gravitational field

B. gravitational potential

C. gravitational potential energy

D. none of these

Answer: B

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32. Satellite revolving around the earth loses some energy due to collision. What would be the effect on its velocity and distance from the centre of the earth?

A. velocity increases and distance decreases

B. Both velocity and distance increases

C. Both velociy and distance decreases

D. Velocity decreases and distance increases

Answer: A

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33. B .E. of a satellite is always

A. infinity

B. positive

C. zero

D. negative

Answer: B

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

A. potential energy

B. linear speed

C. gravitational force

D. centripetal acceleration

Answer: A

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35. The binding energy of a body does not depend upon

A. mass of the planet

B. its distance from the centre of the planet

C. mas of the body

D. shape of the body

Answer: D

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36. The angular velocity of rotation of star (of mass M and radius R) at which the matter start to escape from its equator will be

A. $\sqrt{\frac{4g}{R}}$

B. $4\sqrt{\frac{g}{R}}$

C. $\sqrt{\frac{2g}{R}}$

D. $8\sqrt{\frac{g}{R}}$

Answer: B

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37. The escape velocity from the surface of the earth of radius R and density ρ

A. $\sqrt{2\pi G\rho R}$

B. $2R\sqrt{\frac{2G\pi\rho}{3}}$

C. $\sqrt{4\pi G\rho R}$

D. $\sqrt{\frac{4}{3}\pi G\rho R}$

Answer: B

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38. The escape velocity of a body from the surface of the earth is V_e and the escape velocity of the body from a satellite orbiting at a height 'h' above the surface of the earth is v_e' then

A. $v_e = v_e'$

B. $v_e < v_e'$

C. $v_e > v_e'$

D. $v_e \leq v_e'$

Answer: C

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39. The ratio of the radii of the planets P_1 and P_2 is k. the ratio of the accelerationn due to gravity is r. the ratio of the escape velocities from them will be

A. $\sqrt{K_1 K_2}$

B. $\sqrt{2K_1 K_2}$

C. $\sqrt{\frac{K_1}{K_2}}$

D. $\sqrt{\frac{K_2}{K_1}}$

Answer: A

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40. The escape velocity of a body from the surface of the earth is equal to

A. 3 times critical velocity of a body close to surface of the earth

B. $\sqrt{2}$ times critical velocity of a body orbiting very close to surface of the earth.

C. critical velocity of a body orbiting very close to surface of the earth.

D. $\frac{1}{2}$ times critical velocity of a body orbiting very close to surface of the earth

Answer: B

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41. The escape velocity of a body from the surface of earth is

A. 11.2 km/s

B. 11.4 km/s

C. 11.6 km/s

D. 11.0 km/s

Answer: A

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42. An astronaut inside a satellite is in a state of weightlessness because of the effect of

A. inertia

B. no acceleration

C. zero gravity

D. free fall towards the earth

Answer: D

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43. A person sitting in a chair in a satellite feels weightless because

A. The earth does not attract the object in a satellite

B. the normal force by the chair on the person balances the earth's attraction.

C. the normal force is zero

D. the person in the satellite is not accelerated

Answer: C

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44. The acceleration due to gravity on the surface of earth varies

A. directly with longitude

B. directly with latitude

C. inversely with longitude

D. inversely with latitude

Answer: B

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45. The acceleration due to gravity at the equatorial plane is

A. greater than the polar value

B. less than the polar value

C. can be less or greater than polar value

D. equal to polar value

Answer: B

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46. If the earth shrinks without change in mass, what will be the effect on the value of acceleration due to gravity g?

A. It will decrease

B. It will increase

C. It will become zero

D. It will become infinite

Answer: B

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47. A point mass of 10 kg is placed at the centre of earth. The weight of the point mass is

A. zero

B. infinity

C. 98 N

D. 980 N

Answer: A

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48. If the earth were to stop rotating, the value of acceleration due to gravity at Mumbai will

A. increase

B. decrease

C. become zero

D. remain unchanged

Answer: A

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49. 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

A. r

B. r^2

C. 1/r

D. $1/r^2$

Answer: A

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50. 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

Answer: A

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

A. 2 hr

B. 6 hr

C. 12 hr

D. 24 hr

Answer: D

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52. When a satellite moves around the earth in a certain orbit, the quantity which remains constant is

A. its angular momentum remains constant

B. its angular speed remains constant

C. its linear speed remains constant

D. its linear momentum remains constant

Answer: A

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53. 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

Answer: D

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54. Statement-1 : Two soild sphere of radius r and $2r$, made of same material, are kept in contact. The mutual grvitational force to attraction between them is proportional to $1/r^4$

.

Statement-2 : Gravitational attraction between two point mass bodies varies inversely as the square of the distance between them.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is no a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but Reason is True

Answer: D

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55. Statement-1 : A body weight W newton on the surface of the earth. Its weight at a height equal to half the radius of the earth will be

$2W/5$.

Statement-2 : $g' = g.\dfrac{R^2}{(R+h)^2}$

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is no a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but Reason is True

Answer: D

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Critical Thinking

1. Who among the following gave first the experimental value of G

A. cavendish

B. Copernicus

C. Brook Taylor

D. none of these

Answer: A

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2. Acceleration due to gravity at earth's surface is $10ms^{-2}$. The value of acceleration due to gravity at the surface of a planet of mass $\left(\frac{1}{5}\right)^{th}$ and radius $\frac{1}{2}$ of the earth is

A. $4ms^{-2}$

B. $6ms^{-2}$

C. $8ms^{-2}$

D. $12ms^{-2}$

Answer: C

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3. If the distance between two masses is doubled, then the gravitational attraction between them will be

A. becomes four times

B. is doubled

C. is reduced to one-fourth

D. is reduced to half

Answer: C

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4. Two spheres, each of mass 625 kg, are placed with their centres 50 cm apart. The gravitational force between them is

A. 10.42 dyne

B. 15.42 dyne

C. 20.42 dyne

D. 5.42 dyne

Answer: A

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5. If the value of universal gravitational constant is $6.67 \times 10^{11} Nm^2 kg^{-2}$, then find its value in CGS system.

A. 6.67×10^{-5}

B. 6.67×10^{-9}

C. 6.67×10^{-8}

D. 6.67×10^{-13}

Answer: C

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6. The gravitational force on a body of mass 5 kg at the surface of the earth is 50 N. If earth is a perfect sphere, the gravitational force on a satellite of mass 200 kg in a circular orbit of radius same as diameter of the earth is

A. 200 N

B. 400 N

C. 500 N

D. 800 N

Answer: C

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7. The mass of planet Jupiter is $1.9 \times 10^7 kg$ and that of the Sun is $1.9x10^{30} kg$. The mean distance of Jupiter from the Sun is 7.8×10^{11}m. Calculate te gravitational force which Sun exerts on Jupiter. Assuming that Jupiter moves in circular orbit around the Sun, also calculate the speed of Jupiter $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

A. 4.1×10^{23} N

B. 4.1×10^{34} N

C. 2.2×10^{23} N

D. 2.2×10^{34} N

Answer: A

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8. If the distance between the sun and the earth is increased by three times, then attraction between two will

A. remain constant

B. decrease by 63%

C. decrease by 83%

D. decrease by 89%

Answer: D

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9. A body weighs 81 N on the surface of the earth. What is the gravitational force on it due to earth at a height equal to half the radius of the earth from the surface ?

A. 72 N

B. 28 N

C. 36 N

D. 32 N

Answer: C

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10. Two point masses each equal to 1 kg attract one another with a force of 9.8×10^{-9} kg-wt. the distance between the two point masses is approximately $\left(G = 6.6 \times 10^{-11} \text{MKS units}\right)$

A. 8 cm

B. 0.8 cm

C. 80 cm

D. 0.08 cm

Answer: A

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11. Gravitational force between two objects separated by 20 cm is 1.0×10^{-8} N . If total mass of the two objects is 5.0 kg, then the mass of the objects in kg, are

A. 4,1

B. 3,2

C. 2.5,2.5

D. 3.5,1.5

Answer: B

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12. The ratio between masses of two planets is 2:3 and ratio between their radii is 3:2. The ratio between acceleration due to gravity on these two planets is

A. $4:9$

B. $8:27$

C. $9:4$

D. $27:8$

Answer: B

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13. A body weighs 63 kg-wt on the surface of earth. Its weight on the surface of Mars will be (Mass of Mars $=\frac{1}{9}$ mass of earth, Radius of 9 Mars $=\frac{1}{2}$ Radius of earth)

A. 25 kg-wt

B. 28kg-wt

C. 30kg-wt

D. 40kg-wt

Answer: B

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14. Consider a planet in some solar system which has a mass double the mass of the earth and density equal to the average density of the earth. An object weighing W on the earth will weigh

A. W

B. 2W

C. W/2

D. $2^{1/3}$W

Answer: D

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15. The radius of the Earth is about 6400 km and that of Mars is about 3200 km. The mass of the Earth is about 20 times the mass of Mars. An object weighs 500 Non the surface of Earth. Its weight on the surface of Mars would be

A. 100 N

B. 200 N

C. 150 N

D. 20 N

Answer: A

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16. The mean radius of a planet is 6.67×10^3 km. The acceleration due to gravity on its surface is $10 m / s^2$. If $G = 6.67 \times 10^{-11} Nm^2 / kg^2$, then the mass of the planet will be $\left[R = 6.67 \times 10^6 m\right]$

A. $6 \times 10^{24} kg$

B. $5.3 \times 10^{24} kg$

C. $5.9 \times 10^{24} kg$

D. $6.6 \times 10^{24} kg$

Answer: B

17. The orbital speed of Jupiter is

A. greater than the orbital speed of earth

B. less than the orbital speed of earth

C. equal to orbital speed of the earth

D. twice the orbital speed of earth

Answer: B

18. The critical velocity of a satellite of mass l 00 kg is 20 km/hr. The critical velocity of another satellite of mass 200 kg in the same orbit is

A. 20 km/hr

B. 14.14 km/hr

C. 72 km/hr

D. 10 km/hr

Answer: A

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19. Two satellite fo masses m and 4m orbit the earth in circular orbits of radii 4r and r respectively. The ratio of their orbital speed is

A. 1

B. $\frac{1}{2}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{1}{\sqrt{5}}$

Answer: B

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20. Two satellites P and Q go round a planet in circular orbits of radii 9R and R respectively. If the speed of the satellite P is 4V, then speed of satellite Q will be

A. 12v

B. 6v

C. $\frac{4}{3}v$

D. $\frac{3}{2}$v

Answer: A

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21. The orbital velocity of a satellite very near to the surface of earth is v. What will be its orbital velocity at an altitude 7 times the radius of the earth?

A. $v. \ / \sqrt{2}$

B. $v\sqrt{2}$

C. $v / 2\sqrt{2}$

D. $v / 4$

Answer: C

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22. A small satellite revolves around a planet in an orbit just above planet's surface. Taking the mean density of the planet $8000 kgm^{-3}$ and $G = 6.67 \times 10^{-11} N / kg^{-2}$. find the time period of the satellite.

A. 420s

B. 4200s

C. 1 hour

D. 1 day

Answer: B

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23. The time period of a satellite in a circular orbit of radius R is T. The radius of the orbit in which time period is 8 T is

A. 2 R

B. 3 R

C. 4 R

D. 5 R

Answer: C

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24. Time period of revolution of a nearest satellite around a planet of radius R is T . Period of revolution around another planet, whose radius is 3R but having same density is

A. T

B. 3T

C. 9T

D. $3\sqrt{3}T$

Answer: A

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25. 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

Answer: C

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26. Two satellites are orbiting around the Earth in circular orbits of the same radius. The mass of satellite A is five times greater than the mass of satellite B. Their periods of revolution are in the ratio

A. $1:1$

B. $1:10$

C. $5:1$

D. $1:5$

Answer: A

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27. Two satellites S1 and S2 revolve round a planet in coplanar circular orbits in the same sense. TI1eir periods of revolution are 2 hours and 16 hours respectively. If the radius of the orbit of S_1 is 10^4, then the radius of the orbit of S_2 is

A. 8×10^4 Km

B. 2×10^4 Km

C. 16×10^4 Km

D. 4×10^4 km

Answer: D

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28. If the earth is at one-fourth of its present distance from the sun, the duration of the year would be

A. half the present year

B. one-eight the present year

C. one-fourth the present year

D. one-sixth the present year

Answer: B

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29. Two planets revolve round the sun with frequencies N_1 and N_2 revolutions per year. If their average orbital radii be R_1 and R_2 respectively, then R_1 / R_2 is equal to

A. $(n_1 / n_2)^{3/2}$

B. $(n_2 / n_1)^{3/2}$

C. $(n_1 / n_2)^{2/3}$

D. $(n_2 / n_1)^{2/3}$

Answer: D

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30. A satellite of mass m moving around the earth of mass m_E in a circular orbit of radius R has angular momentum L. The rate of the area swept by the line joining the centre of the earth and satellite is

A. L/2m

B. L/m

C. 2 L/m

D. 2L/m_E

Answer: A

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31. The period of revolution of planet A round from the sun is 8 times that of B. The distance of A from the sun is how many times greater then tht of B from the sun ?

A. 4

B. 8

C. 12

D. 6

Answer: A

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32. The mean distance of Mars from the sun in 1.524 times that of the Earth from the sun. Find the number of years requires for Mars make one revolution about the Sun.

A. 1.833

B. 2

C. 3.766

D. 4

Answer: A

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33. A body falls freely under gravity. Its speed is v when it has lost an amount U of the gravitational energy. Then its mass is

A. $\frac{Ug}{v^2}$

B. $\frac{U^2}{g}$

C. $\frac{2U}{v^2}$

D. $2Ugv^2$

Answer: C

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34. Two identical satellite are at R and $7R$ away from earth surface, the wrong statement is (R =radius of earth)

A. Ratio of their total energy will be 4.

B. Ratio of their kinetic energies will be 4

C. Ratio of their potential energies will be 4.

D. Ratio of their total energy will be 4 but ratio of potential and kinetic energies will be 2.

Answer: D

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35. A satellite of mass m moves around the Earth in a circular orbit with speed v. The potential energy of the satellite is

A. mv^2

B. $-mv^2$

C. $\frac{3}{2}mv^2$

D. $-\frac{3}{2}mv^2$

Answer: B

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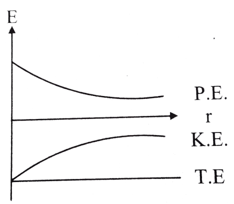
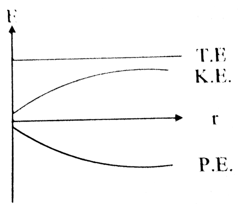
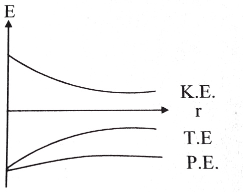
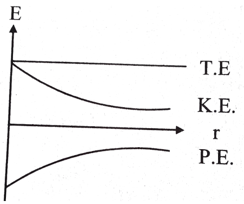
36. The correct graph representing the variation of total energy (E_t), kinetic energy (E_k) and potential energy (U) of a satellite with its distance form the centre of earth is

A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

37. If g is the acceleration due to gravity and R is radius of earth, the minimum kinetic energy required to make a satellite to move to infinity from orbit which is close to earth is

A. infinite

B. $\frac{1}{2}$ mgR

C. mgR

D. 2mgR

Answer: B

Watch Video Solution

38. The ratio of the K.E. required to the given to the satellite to escape earth's gravitational field to the K.E. required to be given so that the satellite moves in a circular orbit just above earth atmosphere is

A. $1:1$

B. $2:1$

C. $1:2$

D. $3:2$

Answer: B

Watch Video Solution

39. The maximum vertical distance through which a full dressed astronaut can jump on the earth is 0.5m. Estimate the maximum vertical distance through which he can jump on the motion, which has a mean density 2/3 rd that of the earth and radius one-quarter that of the earth.

A. 1.5m

B. 3 m

C. 6 m

D. 7.5 m

Answer: B

Watch Video Solution

40. Planet A has a mass and radius twice that of Planet B. The escape velocity from Planet A is

A. twice that from B

B. four times that from B

C. equal to that from B

D. half that from B

Answer: C

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41. v_e and v_p denotes the escape velocity from the earth and another planet having twice the radius and the same mean density as the earth. Then

A. $v_e = v_p$

B. $v_e = \frac{v_p}{2}$

C. $v_e = 2v_p$

D. $v_e = \frac{v_p}{4}$

Answer: B

Watch Video Solution

42. Escape velocity of a satellite of the earth at an altitude equal to radius of the earth is v. What will be the escape velocity at an altitude equal to 7R, where R = radius of the earth?

A. v/4

B. v/2

C. 2v

D. 4v

Answer: B

Watch Video Solution

43. A satellite orbiting close to earth surface will escape, if

A. its speed is increased by 41.4%

B. it speed in the orbit is $(\sqrt{1.5})$ times of its initial value.

C. its K.E is 1.5 times

D. it stops moving in the orbit

Answer: A

Watch Video Solution

44. The orbital velocity of a body at height h above the surface of Earth is 36% of that near the surface of the Earth of radius R. If the escape velocity at the surface of Earth is 11.2 km s_{-1},

then its value at the height h will be

A. $11.2kms^{-1}$

B. $\sqrt{\frac{h}{R}} \times 11.2kms^{-1}$

C. $\frac{9}{25} \times 11.2kms^{-1}$

D. $\sqrt{\frac{R}{h} \times 11.2kma^{-1}}$

Answer: C

Watch Video Solution

45. The moon revolves around the earth in a circular orbit of radius - 3.84×10^5 km with velocity 1 km/s. The additional velocity required to escape from influencing earth satellite is

A. 2.414 km/s

B. 1.414 km/s

C. 0.414 km/s

D. 1.000 km/s

Answer: C

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46. If the earth suddenly contracts so that its radius reduces by 4% with mass remaining same, then what will happen to the escape velocity from earth's surface now?

A. Increases by 4%

B. Decreases by 4%

C. Increases by 2%

D. Decrease by 2%

Answer: C

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

A. At poles

B. At equator

C. At 45° latitude

D. At 40° latitude

Answer: B

48. Find the value of acceleration due to gravity in a mine at a depth of 80 km from the surface of the earth . Radius of the earth = 6400 km .

A. 900 cm/s^2

B. 980cm/s^2

C. 987.5cm/s^2

D. 1000cm/s^2

Answer: C

Watch Video Solution

49. 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

Answer: D

Watch Video Solution

50. Cosider earth to be a homogeneous sphere. Scientist A goes deep down in a mine and scientist B goes high up in a bollon. The value of g measured by

A. A goes on decreasing and that by B goes on increasing

B. B goes on decreasing and that by A goes on increasing

C. Each decrease at the same rate

D. Each decrease at different rates.

Answer: D

Watch Video Solution

51. The value of 'g' at a certain height above the surface of the earth is 16% of its va lue on the surface. The height is (R = 6300 km)

A. 10500 km

B. 12500 km

C. 3000 km

D. 9450 km

Answer: D

Watch Video Solution

52. Assuming the earth as a sphere of unifonn density. the acceleration due to gravity half way towards the centre of the earth will be

A. 0.75 g

B. 0.50 g

C. 0.25 g

D. 0.125 g

Answer: B

Watch Video Solution

53. If change in the value of g at a depth d below the surface of the earth is equal to that on the surface of the earth at latitude of angle ϕ, then,

A. $\phi = \cos^{-1}\left[\sqrt{\frac{R\omega}{gd}}\right]$

B. $\phi = \cos^{-1}\left[\frac{\sqrt{d}}{R^2\omega^2}\right]$

C. $\phi = \cos^{-1}\left[\frac{gd}{R\omega}\right]$

D. $\phi = \cos^{-1}\left[\frac{\sqrt{gd}}{R\omega}\right]$

Answer: D

Watch Video Solution

54. If the earth of radius R, while rotating with angular velocity ro becomes stand still, what will be the effect on the weight of a body of mass rn at a latitude of 45°?

A. Remains unchanged

B. Decreases by R ω^2

C. Increases by R ω^2

D. Increases by R $\omega^2 / 2$

Answer: D

Watch Video Solution

55. The mass of the moon is $\frac{1}{81}$ of the earth but the gravitational pull is $\frac{1}{6}$ of the earth. It is due to the fact that

A. the radius of the moon is $\frac{81}{6}$ of the earth

B. the radius of the earth moon is $\frac{9}{\sqrt{6}}$ of the moon.

C. moon is the satellite of the earth

D. moon rotates round the earth

Answer: B

Watch Video Solution

56. A body weights 63 N on the surface of the earth At a height h above the surface of Earth, its weight is 28 N While at a depth h below the surface Earth, the weight is 31.5 N. The value of h is

A. 0.4 R

B. 0.5 R

C. 0.8 R

D. R

Answer: B

Watch Video Solution

57. If the earth were assumed to have uniform density and spherical symmetry, then the value of g in ms^{-2} halfway towards the centre of earth would be $\left[g = 10m / s^2\right]$

A. 0

B. 1.25

C. 5

D. 10

Answer: C

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58. If the radius of the earth were to shrink by 1% its mass remaining the same, the acceleration due to gravity on the earth's surface would

A. -0.02

B. 0.02

C. -0.03

D. 0.04

Answer: B

Watch Video Solution

59. The value of acceleration due to gravity will be 1% of its value at the surface of earth at a height of $(R_e = 6400 km)$

A. 6400 km

B. 57600 km

C. 2560 km

D. 6400 km

Answer: B

Watch Video Solution

60. he value of 'g' at a certain height h above the free surface of Earth is $\frac{x}{16}$ where x is the value 16 of 'g' at the surface of Earth. The height h is

A. R

B. 2R

C. 3R

D. 4R

Answer: C

Watch Video Solution

61. If both the mass and radius of the earth decrease by 1% the value of

A. 0.01

B. 0.015

C. 0.02

D. 0.025

Answer: A

Watch Video Solution

62. 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 $\lambda = 60^\circ$ 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. $g_p + \frac{1}{4}R\omega^2$

Answer: A

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63. What should be the angular speed of earth in radian/second so that a body of 5 kg weights zero at the equator? [Take g = $10m/s^2$ and radius of earth = 6400 km]

A. 1/1600

B. 1/800

C. 1/400

D. 29221

Answer: B

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Watch Video Solution

64. In order to find time, the astronaut orbiting in an earth satellite should use

A. a pendulum clock

B. a watch having main spring to keep it going.

C. either a pendulum clock or a watch

D. neither a pendulum clock nor a watch

Answer: B

Watch Video Solution

65. 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 continously

B. will go on decreasing continuously

C. will remain same

D. will first increase and then decrease

Answer: B

Watch Video Solution

66. A body is taken from the centre of the Earth to the Moon. What will be the changes in the weight of the body?

A. first decrease then increase

B. first increase then decrease

C. continuously increase

D. continuously decrease

Answer: A

Watch Video Solution

67. To have an earth satellite synchronous with the rotation of the earth, it must be launched at proper height moving

A. from west to east in an equatorial plane.

B. from north to south in a polar plane

C. from east to west in an equatorial plane

D. from south to north in a polar plane

Answer: A

Watch Video Solution

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

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.

Answer: D

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69. If a body is released from an artificial satellite then

A. it will fall on the earth

B. it will not fall on the earth but will be attracted towards the earth

C. it will escape in the universe

D. it will continue orbiting along with satellite

Answer: D

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70. If a satellite orbits as close to the earth's surface as possible,

A. Its speed is maximum

B. Time period of its rotation is minimum

C. The total energy of the 'earth plus satellite' system is minimum.

D. The total energy of the 'earth plus satellite' system is maximum

Answer: D

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71. At a given place where acceleration due to gravity is $g\, m / \sec^2$, a sphere of lead of density d kg / m^3 is gently released in a column of liquid of density $'\rho' kg / m^3$. If $d > \rho$, the sphere will

A. fall vertically with an acceleration 'g' m / s^2

B. fall vertically with no acceleration.

C. fall vertically with an acceleration $g\left(\frac{d-p}{d}\right)$

D. fall vertically with an acceleration

`g((rho)/(d))

Answer: C

Watch Video Solution

72. 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. $7.4 \times 10^{-4} rad/s$

B. $6.7 \times 10^{-4} rad/s$

C. $7.9 \times 10^{-4} rad/s$

D. $8.7 \times 10^{-4} rad / s$

Answer: C

Watch Video Solution

73. A planet is revolving around the sun in a circular orbit with a radius r. The time period is T .If the force between the planet and star is proportional to $r^{-3/2}$ then the quare of time period is proportional to

A. $R^{\frac{7}{2}}$

B. $R^{-\frac{7}{2}}$

C. $R^{\frac{5}{2}}$

D. $R^{\frac{2}{5}}$

Answer: C

Watch Video Solution

74. Assertion: The artifical satellite does not have any fuel but even then it remains orbiting around the earth.

Reason: The necessary centripetal force required to move the satellite in an ·orbit around the earth is provided by the gravitational force of attraction between the satellite and the earth.

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is no a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but Reason is True

Answer: A

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75. Assertion: When an object is weighed with a physical balance, then its mass will be same both at the pole and at the equator.

Reason: When body is weighed with a spring balance, then its weight will be maximum at pole

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is no a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but Reason is True

Answer: B

Watch Video Solution

76. A satellite is placed in a circular orbit about Earth with radius equal to half the radius of the moon· s orbit. Period of rotation of the satellite is n times that of the lunar month (lunar month is the period of revolution of the. moon). The value of n is

A. $2^{-3/2}$

B. $2^{3/2}$

C. $2^{1/2}$

D. $2^{-1/2}$

Answer: A

View Text Solution

77. A diametrical tunnel is dug across the earth. A ball dropped into the tunnel from one side. The velocity of the ball when it reaches the centre of the earth is [Given: gravitational potential at the centre of earth $= -3/2(GM/R)$]

A. $\sqrt{R}$

B. $\sqrt{gR}$

C. $\sqrt{2.5gR}$

D. $\sqrt{7.1gR}$

Answer: B

Watch Video Solution

78. The acceleration due to gravity at a height $(1/20)^{th}$ the radius of the earth above earth s surface is $9m/s^2$ Find out its approximate value at a point at an equal distance below the surface of the earth .

A. 8.5

B. 9.5

C. 9.8

D. 11.5

Answer: B

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Competitive Thinking

1. Which of the following statements about the gravitational constant is true ?

A. It is a force

B. It has same value in all systems of units

C. It depends on the value of the masses.

D. It does not depend on the nature of the medium in which the bodies are kept.

Answer: D

Watch Video Solution

2. Two astronauts are floating in gravitational free space after having lost contanct with their spaceship. The two will:

A. keep floating at the same distance between them.

B. move towards each other.

C. move away from each other

D. will become stationary

Answer: B

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3. The dimension of universal gravitational constant are

A. $[M^1L^{-3}T^2]$

B. $[M^{-1}L^3T^2]$

C. $[M^{-1}L^{-3}T^2]$

D. $\left[M^1 L^3 T^2\right]$

Answer: B

Watch Video Solution

4. The gravitational acceleration on the surface of earth of radius R and mean density ρ is

A. $\frac{4}{3} G\pi R^2 \rho$

B. $\frac{4}{3} G\pi^2 R^2 \rho$

C. $\frac{2}{3} G\pi R\rho$

D. $\frac{4}{3}G\pi R\rho$

Answer: D

Watch Video Solution

5. Two identical solid copper spheres of radius R placed in contact with each other. The gravitational attracton between them is proportional to

A. R^2

B. R^{-2}

C. R^4

D. $R(-4)$

Answer: C

Watch Video Solution

6. For particles of equal masses M that move along a circle of radius R under the action of their mutual gravitational attraction. Find the speed of each particle.

A. $\sqrt{\frac{GM}{R}}$

B. $\frac{1}{2}\sqrt{\frac{GM}{R}}$

C. $\frac{1}{3}\sqrt{\frac{GM}{R}}$

D. $\frac{1}{4}\sqrt{\frac{GM}{R}}$

Answer: B

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7. A body weighs $700gm$ wt on the surface of the earth. How much will it weigh on the surface of a planet whose mass is $\frac{1}{7}$ and radius is half that of the earth

A. 200 gm-wt

B. 400 gm-wt

C. 50 gm-wt

D. 300 gm-wt

Answer: B

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8. If R is the radius of the earth and g the acceleration due to gravity on the earth's surface, the mean density of the earth is

A. $4\pi G / 3gR$

B. $3\pi R / 4gG$

C. $3g / 4\pi RG$

D. $\pi RG / 12g$

Answer: C

Watch Video Solution

9. If the density of the earth is doubled keeping its radius constant then acceleration due to gravity will be $\left(g = 9.8m / s^2\right)$

A. $9.8m/s^2$

B. $19.6m/s^2$

C. $4.9m/s^2$

D. $39.2m/s^2$

Answer: B

Watch Video Solution

10. The mass and diameter of a planet have twice the value of the corresponding parameters of earth. Acceleration due to gravity on the surface of the planet is

A. $9.8m/s^2$

B. $4.9m/s^2$

C. $980m/s^2$

D. $19.6m/s^2$

Answer: B

Watch Video Solution

11. The moon's radius is $1/4$ that of the earth and its mass $1/80$ 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

Answer: B

Watch Video Solution

12. Four particles, each of mass M and equidistant from each other, move along a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is:

A. $\sqrt{\frac{GM}{R}}$

B. $\sqrt{2\sqrt{2}\frac{GM}{R}}$

C. $\sqrt{\frac{GM}{R}(1+2\sqrt{2})}$

D. $\frac{1}{2}$sqrt((GM)/R(1+2sqrt2)`

Answer: D

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13. A spherical planet far out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely near the surface of this planet will experience an accelertion due to gravity which is equal to

A. GM_0 / D_0^2

B. $4mGM_0 / D_0^2$

C. $4GM_0 / D_0^2$

D. GmM_0 / D_0^2

Answer: C

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14. The densities of two planets are in the ratio of 2 : 3 and their radii are in the ratio of 1 : 2. What is the ratio of acceleration due to gravity at their surfaces ?

A. $1:3$

B. $3:1$

C. $1:9$

D. $9:4$

Answer: A

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15. 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.

A. The acceleration of S is always directed towards the centre of the earth

B. The angular momentum of S about the centre of the earth changes in direction, but its magnitude remains constant

C. the total mechanical energy of S varies periodically with time

D. the linear momentum of S remains constant in magnitude

Answer: A

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

A. Increase by 1%

B. increase by 0.5%

C. decrease by 1%

D. decrease by 0.5%

Answer: B

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Watch Video Solution

17. A satellite of mass 200 kg is orbiting with a critical velocity of 20 mis. Another satellite of mass 100 kg orbiting in same orbit will have critical velocity

A. 10 m/s

B. 72 m/s

C. 20 m/s

D. 40 m/s

Answer: C

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18. Two satellite A and B are moving round a planet in circular orbit having radii R and 3R respectively, if the speed of satellite A is v the speed f satellite B will be :

A. $\frac{3v}{2}$

B. $\frac{4v}{2}$

C. 6v

D. 12v

Answer: C

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19. Time period of a satellite in a circular obbit around a planet is independent of

A. the mass of the planet

B. the radius of the planet

C. the mass of the satellite

D. all of these

Answer: C

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20. In a satellite if the time of revolution is T, then kinetic energy is proportional to

A. $T^{-1/2}$

B. T^{-2}

C. $T^{-3/2}$

D. $T^{-2/3}$

Answer: D

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21. The earth (mass $= 6 \times 10^{24} kg$) revolves round the sun with an angular velocity of $2 \times 10^{-7} \text{rad/s}$ in a circular orbit of radius $1.5 \times 10^{8} km$. The gravitational force exerted by the sun on the earth, in newtons, is

A. zero

B. 18×10^{25}

C. 36×10^{21}

D. 27×10^{39}

Answer: C

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22. Given raduis of earth $'R'$ and length of a day $'T'$ the height of a geostationary satellite is [G-Gravitational constant M-mass of earth]

A. $\left(\dfrac{4\pi^2 GM}{T^2}\right)^{1/3}$

B. $\left(\dfrac{4\pi GM}{R^2}\right)^{1/3} - R$

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

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

Answer: C

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23. 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^2r=constant

Answer: B

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24. The earth revolves round the sun in one year. If the distance between them becomes double, the new period of revolution will be

A. 1/2 year

B. $2\sqrt{2}$ years

C. 4 years

D. 8 years

Answer: B

Watch Video Solution

25. If the distance between the earth and sun becomes $1/4^{th}$ then its period of revolution around the sun wi ll become

A. 6 hr

B. 8 hr

C. 16 hr

D. 3 hr

Answer: D

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26. 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 period of the second satellite is larger than the first one by approximately

A. 0.005

B. 0.01

C. 0.015

D. 0.03

Answer: C

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27. A geo-stationary stellite orbits around the earth in a circular orbit of radius 36,000km. Then, the time period of a spy stellite orbitting a few hundred km above the earth's surface $(R_{earth} = 6400km)$ will approximately be

A. 1/2 h

B. 1 h

C. 2 h

D. 4 h

Answer: C

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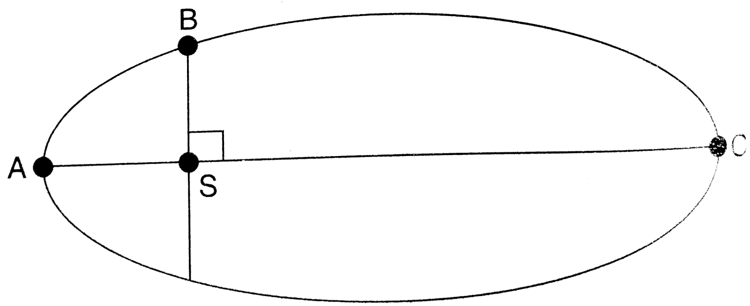
28. The kinetic energies of a planet in an elliptical orbit about the Sun, at positions A, B and C are K_A, K_B and K_C respectively. AC is the major axis and SB is perpendicular to AC at the position of the sun as shown in the figure. Then



A. $K_A < K_B < K_C$

B. $K_A > K_B > K_C$

C. $K_B < K_A < K_C$

D. $K_B > K_A > K_C$

Answer: B

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29. Two small satellies move in a circular orbits around the earth, at disatnce r and $(r + dr)$ from the centre of the earth. Their time periods of rotation ate T and $T + dT(\Delta r < < r, \Delta T < < T)$. Then

A. $\triangle T = \frac{3}{2} T \frac{\triangle r}{r}$

B. $\triangle T = -\frac{3}{2}T\frac{\triangle r}{r}$

C. $\triangle T = \frac{2}{3}T\frac{\triangle r}{r}$

D. $\triangle T = T\frac{\triangle r}{r}$

Answer: A

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30. A satellite has kinetic energy K, potential energy V and total energy E. Which of the following statements is true?

A. K=-V/2

B. K=V/2

C. E=K/2

D. E=-K/2

Answer: A

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31. The ratio of binding energy of a satellite at rest on earth's surface to the binding energy of a satellite of same mass revolving around of the earth at a height h above the earth's surface is (R = radius of the earth).

A. $\frac{2(R+h)}{R}$

B. $\frac{R+h}{2R}$

C. $\frac{R+h}{R}$

D. $\frac{R}{R+h}$

Answer: A

Watch Video Solution

32. Gas escaps from the surface of a planet because it acquires an escape velocity. The escape velocity will depend on which of the following factors :

I. Mass of the planet

II. Mass pf the particle escaping

III. Temperature of the planet

IV. Radius of the planet

Select the correct answer from the codes given below.

A. I and II

B. II and IV

C. I and IV

D. I,III and IV

Answer: C

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

A. m^2

B. m

C. m^{0}

D. m^{-1}

Answer: C

Watch Video Solution

34. The angular velocity of rotation of a planet of mass M and radius R, at which the matter start to escape from its equator is

A. $\sqrt{\frac{2GR}{M}}$

B. $\sqrt{\frac{2GM}{R^3}}$

C. $\sqrt{\frac{2GM}{R}}$

D. $\sqrt{\frac{2GM^2}{R}}$

Answer: B

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35. Escape velocity on a planet is e v . If radius of the planet remains same and mass becomes 4 times, the escape velocity becomes

A. $4v_e$

B. $2v_e$

C. v_e

D. $\frac{1}{2}v_e$

Answer: B

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36. The escape velocity from the surface of earth is V_e. The escape velocity from the surface of a planet whose mass and radius are 3 times those of the earth will be

A. v_e

B. $3v_e$

C. $9v_e$

D. $27v_e$

Answer: A

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

A. $\frac{v_1}{v_2} = \frac{\rho_1}{\rho_2}$

B. $\frac{v_2}{v_1} = \frac{\rho_2}{\rho_1}$

C. $\frac{v_1}{v_2} = \left(\frac{\rho_1}{\rho_2}\right)^2$

D. $\frac{v_1}{v_2} = \sqrt{\frac{\rho_1}{\rho_2}}$

Answer: D

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38. The ratio of escape velocity at earth (v_e) to the escape velocity at a planet (v_y) whose radius and density are twice

A. $1:4$

B. $1 : \sqrt{2}$

C. $1 : 2$

D. 1:$2\sqrt{2}$

Answer: D

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39. A satellite is revolving in a circular orbit at a height 'h' from the earth's surface (radius of earth R, h ltltR). The minimum increase in its orbital velocity required, So that the satellite could escape from the erth's gravitational field, is close to :(Neglect the effect of atomsphere.)

A. $\sqrt{gR}$

B. $\sqrt{gR/2}$

C. $\sqrt{gR(\sqrt{2}-1)}$

D. $\sqrt{2gR}$

Answer: C

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40. A satellite is moving with a constant speed 'V' in a circular orbit about the earth. An object of mass 'm' is ejected from the satellite such that it just escapes form the gravitational pull of the earth. At the tme of its ejection, the kinetic energy of the object is

A. $\frac{1}{2}mv^2$

B. mv^2

C. $\frac{3}{2}mv^2$

D. $2mv^2$

Answer: B

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41. Given mass of the moon is 1/81 of the mass of the earth and corresponding radius is 1/4 of the earth. If escape velocity on the earth surface is 11.2 km / s , the value of same on the surface of the moon is

A. 0.14 km/s

B. 0.5 km/s

C. 2.5 km/s

D. 5 km/s

Answer: C

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42. Two satellites A and B are rotating in same orbit. The ratio of their escape velocities, if radius and mass of A is twice to B, is

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: A

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43. 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. $\sqrt{\frac{2}{3}}v_e$

B. $\sqrt{\frac{3}{2}}v_e$

C. $\frac{\sqrt{2}}{3}v_e$

D. $\frac{2}{\sqrt{3}}v_e$

Answer: A

Watch Video Solution

44. 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

Answer: A

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

A. 10^{-9} m

B. 10^{-6}

C. 10^{-2}

D. 100 m

Answer: C

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46. 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. $1/\sqrt{2}$

B. $\sqrt{2}$

C. $2\sqrt{2}$

D. 2

Answer: A

Watch Video Solution

47. A space station is at a height equal to the radius of the Earth. If V_E is the escape velocity on the surface of the Earth, the same on the space station is ___ times V_E,

A. $\frac{1}{2}$

B. $\frac{1}{4}$

C. $\frac{1}{\sqrt{2}}$

D. $\frac{1}{\sqrt{3}}$

Answer: C

Watch Video Solution

48. A satelite is revolving in a circular orbit at a height h above the surface of the earth of radius R. The speed of the satellite in its orbit is one-fourth the escape velocity from the surface of the earth. The relation between h and R is

A. h=2R

B. h=3R

C. h=5R

D. h=7R

Answer: D

Watch Video Solution

49. Find the change in the gravitational potential energy when a body of mass m is raised to a height nR above the surface of the earth. (Here, R is the radius of the earth)

A. $mgR\left(\frac{n}{n-1}\right)$

B. nmgR

C. $mgR\left(\frac{n^2}{n^2+1}\right)$

D. $mgR\left(\frac{n}{n+1}\right)$

Answer: D

Watch Video Solution

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

A. $\frac{GMm}{12R^2}$

B. $\frac{GMm}{3R^2}$

C. $\frac{GMm}{8R}$

D. $\frac{GMm}{6R}$

Answer: D

Watch Video Solution

51. If g is the acceleration due to gravity on earth's surface, the gain of the potential energy of an object of mass m raised from the surface of the earth to a height equal to the radius R of the earth is

A. mgR

B. $\frac{1}{2}mgR$

C. $\frac{3}{2}mgR$

D. $\frac{1}{3}mgR$

Answer: B

Watch Video Solution

52. 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

A. $\frac{2}{3}mgR$

B. $\frac{3}{4}mgR$

C. $\frac{mgR}{2}$

D. $\frac{mgR}{4}$

Answer: B

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53. A body of mass m is raised to a height 10 R from the surface of the earth, where R is the radius of the earth. Find the increase in potential energy. (G = universal constant of gravitational, M = mass of the earth and g= acceleration due to gravity)

A. $\dfrac{GMm}{11R}$

B. $\dfrac{GMm}{10r}$

C. $\dfrac{mgR}{11G}$

D. $\dfrac{10GMm}{11R}$

Answer: D

Watch Video Solution

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

A. mg2R

B. $\dfrac{2}{3}mgR$

C. 3mgR

D. $\frac{1}{3}mgR$

Answer: B

Watch Video Solution

55. The acceleration due to gravity on the surface of the earth is g. If a body of mass m is raised from the surface of the earth to a height equal to the radius R of the earth, then the gain in its potential energy is given by

A. $\dfrac{mgR}{2}$

B. mgR

C. 2mgR

D. $\dfrac{mgR}{4}$

Answer: A

Watch Video Solution

56. A body of mass m rises to a height $h = R/5$ from the earth's surface where R is earth's radius. If g is acceleration due to gravity at the earth's surface, the increase in potential energy is

A. mgh

B. $\frac{4}{5}mgh$

C. $\frac{5}{6}mgh$

D. $\frac{6}{7}mgh$

Answer: C

Watch Video Solution

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

A. $\frac{5GmM}{6R}$

B. $\frac{2GmM}{3R}$

C. $\frac{GmM}{2R}$

D. $\frac{GmM}{3R}$

Answer: A

Watch Video Solution

58. A satellite of mass m is orbiting the earth (of radius R) at a height h from its surface. The total energy of the satellite in terms of g_0, the value of acceleration due to gravity at the earth's surface,

A. $-\dfrac{2mg_0R^2}{R+h}$

B. $\dfrac{mg_0R^2}{2(R+h)}$

C. $-\dfrac{mg_0R^2}{2(R+h)}$

D. $\dfrac{2mg_0R^2}{R+h}$

Answer: C

Watch Video Solution

59. If R is the radius of earth and g is acceleration due to gravity on the surface of the earth, then binding energy of the satellite of mass m at the height h above earth's surface is ·

(r is orbital radius of satellite)

A. $\frac{mgR^2}{r}$

B. $-\frac{mgR^2}{r}$

C. $\frac{mgR^2}{2r}$

D. $-\frac{mgR^2}{2r}$

Answer: C

View Text Solution

60. How much energy will be needed for a body of mass 100kg to escape from the earth- $(g = 10m/S^2$ and $radius of earth = 6.4 \times 10^6 m)$

A. 3.2×10^9 joule

B. 6.4×10^9 joule

C. 1.6×10^9 joule

D. 8×10^9 joule

Answer: B

Watch Video Solution

61. Considering earth's rotation, the value of g at the earth's surface is

A. maximum at the equator

B. least at the equator

C. same at all places

D. changes with latitude

Answer: D

Watch Video Solution

62. If earth were to rotate faster than its present speed, the weight of an object

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

Answer: B

Watch Video Solution

63. An extremely small and dense neutron star of mass M and radius R is rotating with angular velocity ω. If an object is placed at its equator, then it will remain stuck to it due to gravity, if

A. $M > \frac{R\omega}{G}$

B. $M > \frac{R^2\omega^2}{G}$

C. $M > \frac{R^3\omega^3}{G}$

D. $M > \frac{R^2\omega^2}{G}$

Answer: C

Watch Video Solution

64. Which of the following statements is not correct for the decrease in the value of acceleration due to gravity?

A. As we go down from the surface of the earth towards its centre.

B. As we go up from the surface of the earth

C. as we go from equator to the poles on the surface on the earth

D. As the rotational velocity of the earth is increased

Answer: C

Watch Video Solution

65. The acceleration due to gravity is g at a point distant r from the centre of earth of radius R. If $r < R$, then

A. $g \propto r$

B. $g \propto r^2$

C. $g \propto r^{-1}$

D. $g \propto r^{-2}$

Answer: A

Watch Video Solution

66. If the density of the earth is doubled keeping its radius constant then acceleration due to gravity will be $\left(g = 9.8m / s^2\right)$

A. $19.6m / s^2$

B. $9.8m / s^2$

C. $4.9m/s^2$

D. $2.45m/s^2$

Answer: A

Watch Video Solution

67. The depth 'd' at which the value of acceleration due to gravity becomes $\frac{1}{n}$ times the value at the earth's surface is (R = radius of earth)

A. $d = R\left(\frac{n}{n-1}\right)$

B. $d = R\left(\frac{n-1}{2n}\right)$

C. $d = R\left(\frac{n}{n}\right)$

D. $d = R\left(\frac{n-1}{n}\right)$

Answer: C

Watch Video Solution

68. The value of gravitational accelerationg at a height h above the earth's surface is One forth the value of gravitational acceleration at surface ,then (R = radius of earth)

A. h=R

B. $h = \frac{R}{2}$

C. $h = \frac{R}{3}$

D. $h = \frac{R}{4}$

Answer: A

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69. The acceleration due to gravity at a height $1km$ above the earth is the same as at a depth d below the surface of earth. Then :

A. d=h

B. $d = \frac{h}{2}$

C. $d = \frac{h}{4}$

D. d=2h

Answer: D

Watch Video Solution

70. The acceleration due to gravity at a height $1km$ above the earth is the same as at a depth d below the surface of earth. Then :

A. $d = \frac{1}{2} km$

B. d=1km

C. $d = \frac{3}{2}$ km

D. d=2km

Answer: D

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71. (a) Assuming the earth to be a sphere of uniform density, calculate the value of acceleration due to gravity at a point (i) $1600 km$

above the earth, (ii) $1600km$ below the earth, (b) Also find the rate of variation of acceleration due to gravity above and below the earth's surface. Radius of earth $= 6400km, g = 9.8m/s^2$.

A. $4.9ms^{-2}$

B. $9.8ms^{-2}$

C. $7.35ms^{-2}$

D. $19.6ms^{-2}$

Answer: C

Watch Video Solution

72. Calculate the value of acceleration due to gravity at a point a. 5.0 km above the earth's surface and b. 5.0 km below the earth's surface. Radius of earth =6400 km and the value of g at the surface of the earth is 9.80ms^2

A. $9.78ms^2, 9.79ms^2$

B. $9.78ms^2, 0$

C. $9.79ms^2, 0$

D. $9.78ms^2, 9.78ms^2$

Answer: A

Watch Video Solution

73. A body is taken to a height of nR from the surface of the earth . The ratio of acceleration due to gravity on the surface to that at the altitude is

A. $(n+1)^{-3}$

B. $(n+1)^{-2}$

C. $(n+1)^{2}$

D. $(n+1)$

Answer: C

Watch Video Solution

74. The diameters of two planets are in the ratio 4 : 1 and their mean densities in the ratio 1 : 2. The acceleration due to gravity on the planets will be in ratio

A. $1:2$

B. $2:3$

C. $2:1$

D. $4:1$

Answer: C

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75. The ratio of acceleration due to gravity at a height 3 R above earth's surface to the acceleration due to gravity on the surface of earth is

(R = radius of earth)

A. $\frac{1}{9}$

B. $\frac{1}{16}$

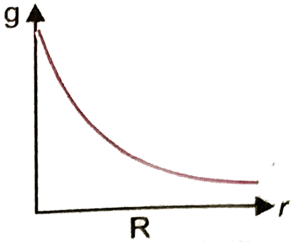
C. $\frac{1}{4}$

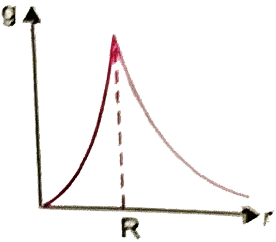
D. $\frac{1}{64}$

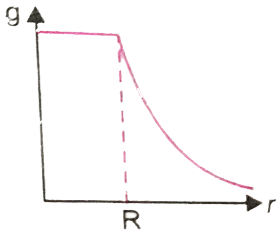
Answer: B

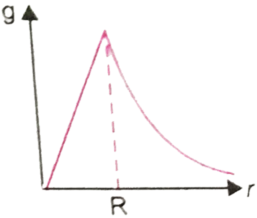
Watch Video Solution

76. The dependence of acceleration due to gravity g on the distance r from the centre of the earth, assumed to be a sphere of radius R of uniform density is as shown in Fig. below:

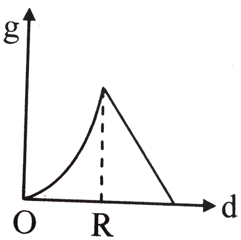
(1) 

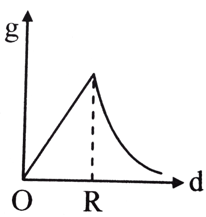
(2) 

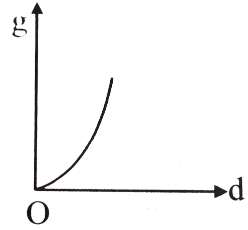
(3) 

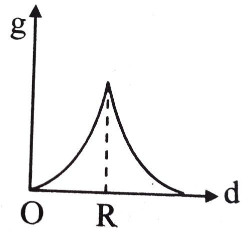
(4) 

The correct figure is

A. 

B. 

C. 

D. 

Answer: B

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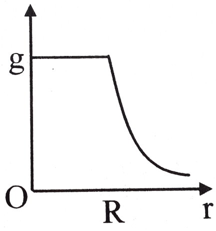
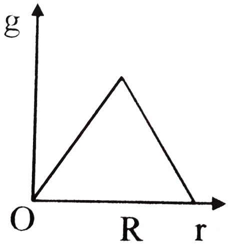
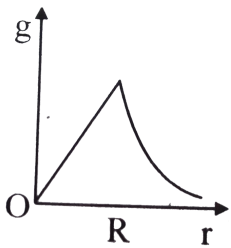
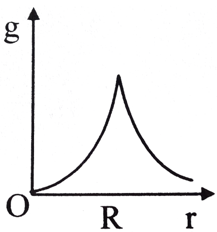
77. Starting from the centre of the earth having radius R, the variation of g (acceleration due to gravity) is shown by

A. 

B. 

C. 

D. 

Answer: C

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78. The value of gravitational acceleration at a height equal to radius of earth, is

A. 50% of value at earth's surface

B. 25% of value at earth's surface

C. 75% of value at earth's surface

D. same as value at earth's surface

Answer: B

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79. Time period of second pendulum on a planet, whose mass and diameter are twice that of earth, is

A. $2\sqrt{2}$s

B. 2s

C. $\sqrt{2}$s

D. $\frac{1}{\sqrt{2}}$s

Answer: A

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80. Calculate angular velocity of the earth so that acceleration due to gravity at 60° latitude becomes zero (radius of the earth = 6400 km, gravitational acceleration at poles = $10m/s^2$, $\cos 60^{\circ} = 0.5$)

A. 7.8×10^{-2} rad/s

B. 0.5×10^{-3} rad/s

C. 1×10^{-3} rad/s

D. 2.5×10^{-3} rad/s

Answer: D

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81. If the mass of the sun were ten times smaller and the universal gravitational constant were ten times larger in magnitude, which of the following is not correct?

A. Raindrops will fall faster

B. Walking on the ground would become more difficult

C. Time period of a simple pendulum on the Earth would decrease

D. g' on the Earth will not change

Answer: D

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82. Kepler's third law states that square of period revolution (T) of a planet around the sun is proportional to third power of average distance i between sun and planet i.e. $T^2 = Kr^3$ here K is constant

if the mass of sun and planet are M and m respectively then as per Newton's law of gravitational the force of alteaction between them is $F = \frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as

A. $GK = 4\pi^2$

B. $GMK = 4\pi^2$

C. $K = G$

D. $K = \frac{1}{G}$

Answer: B

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83. A planet of mass m revolves in elliptical orbit around the sun of mass M so that its maximum and minimum distance from the sun equal to r_a and r_p respectively. Find the angular momentum of this planet relative to the sun.

A. $m\sqrt{\frac{2GMr_1r_2}{r_1+r_2}}$

B. 0

C. $m\sqrt{\frac{2GM(r_1+r_2)}{r_1r_2}}$

D. $\sqrt{\frac{2GMmr_1}{(r_1+r_2)r_2}}$

Answer: A

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84. A remote-sensing satellite of earth revolves in a circular orbit at a hight of $0.25 \times 10^6 m$ above the surface of earth. If earth's radius is $6.38 \times 10^6 m$ and $g = 9.8 ms^{-2}$, then the orbital speed of the satellite is

A. $6.67 kms^{-1}$

B. $7.76 kms^{-1}$

C. $8.56 kms^{-1}$

D. $9.13 kms^{-1}$

Answer: B

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85. A mass M is broken into two parts of masses m_1 and m_2. How are m_1 and m_2 related so that force of gravitational attraction between the two parts is maximum?

A. $\frac{1}{2}$

B. $\frac{3}{5}$

C. 1

D. 2

Answer: A

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86. The ratio of accelerations due to gravity $g_1 : g_2$ on the surfaces of two planets is 5 : 2 and the ratio of their respective average densities $\rho_1 : \rho_2$ is 2 : 1. what is the ratio of respective escape velocities $v_1 : v_2$ from the surface of the planets?

A. $5 : 2$

B. $\sqrt{5} : \sqrt{2}$

C. $5 : 2\sqrt{2}$

D. $25 : 4$

Answer: C

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

A. g decreases by 2% and K.E. decreases by 4%

B. g decreases by 4% and K.E. increases by 2%

C. g increases by 4% and K.E. increases by 4%

D. g decreases by 4% and K.E. increases by 4%

Answer: C

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88. A stone is dropped from a height equal to nR, where R is the radius of the earth, from the surface of the earth. The velocity of the stone on reaching the surface of the earth is

A. $\sqrt{\dfrac{2gR}{n+1}}$

B. $\sqrt{\dfrac{2gR}{n-1}}$

C. $\sqrt{\dfrac{2gRn}{n-1}}$

D. $\sqrt{\dfrac{2gRn}{n+1}}$

Answer: D

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

A. 5R

B. 15R

C. 3R

D. 4R

Answer: C

Watch Video Solution

90. A spherical planet far out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely near the surface of this planet will experience an accelertion due to gravity which is equal to

A. $\frac{4GM_p}{D_p^2}$

B. $\frac{GM_\pm}{D_p^2}$

C. $\frac{Gm_p}{D_p^2}$

D. $\frac{4GM_\pm}{D_p^2}$

Answer: A

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

A. zero

B. $-\dfrac{4Gm}{r}$

C. $-\dfrac{6Gm}{r}$

D. $-\dfrac{9Gm}{r}$

Answer: D

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92. Two particles of masses 'm' and '9m' are separated by a distance 'r'. At a point on the line joining them the gravitational field is zero. The gravitational potential at that point is (G = Universal constant of gravitation)

A. $-\dfrac{4Gm}{r}$

B. $-\dfrac{8Gm}{r}$

C. $-\dfrac{16Gm}{r}$

D. $-\dfrac{32Gm}{r}$

Answer: C

Watch Video Solution

93. The bodies of mass 100 kg and 8100 kg are held at a distance of 1 m. The gravitational field at a point on the line joining them is zero. The gravitational potential at that point in J/kg is (G= $6.67 \times 10^{-11} Nm^2 / kg^2$)

A. -6.67×10^{-7}

B. -6.67×10^{-10}

C. -13.34×10^{-7}

D. -6.67×10^{-9}

Answer: A

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94. A body is thrown from the surface of the earth with velocity u m/s. The maximum height in metre above the surface of the earth upto which it will reac is (where, R = radish of earth, g=acceleration due to gravity)

A. $\dfrac{u^2R}{2gR - u^2}$

B. $\dfrac{2u^2R}{gR - u^2}$

C. $\dfrac{u^2R^2}{2gR^2 - u^2}$

D. $\dfrac{u^2R}{gR - u^2}$

Answer: A

Watch Video Solution

95. A particle of mass M is placed at the centre of a spherical shell of same mass and radius a. What will be the magnitude of the gravitational potential at a point situated at a/2 distance from the centre ?

A. $\dfrac{4GM}{a}$

B. $\dfrac{GM}{a}$

C. $\dfrac{2GM}{a}$

D. $\dfrac{3GM}{a}$

Answer: D

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96. An asteroid of mass m is approaching earth, initially at a distance $10R_E$ with speed v_i. It hits earth with a speed v_f (R_E and M_E are radius and mass of earth),. Then

A. $v_f^2 = v_i^2 + \frac{2GM}{M_e R}\left(1 - \frac{1}{10}\right)$

B. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 + \frac{1}{10}\right)$

C. $v_f^2 = v_i^2 + \frac{2GM_e}{R_e}\left(1 - \frac{1}{10}\right)$

D. $v_f^2 = v_i^2 + \frac{2GM}{R_e}\left(1 + \frac{1}{10}\right)$

Answer: C

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97. Mass M is split into two parts m and $(M-m)$, which are then separated by a certain distance. What is the ratio of (m/M) which maximises the gravitational force between the parts ?

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{1}{4}$

D. $\frac{1}{5}$

Answer: B

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98. Suppose the gravitational force varies inversely as the n^{th}power of distance. Then the time period of a planet in circular orbit of radius R around the sun will be proportional to-

A. $R^{\frac{n+1}{2}}$

B. $R^{\frac{n-1}{2}}$

C. R^{n}

D. $R^{\frac{n-1}{2}}$

Answer: A

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99. Imagine a light planet revolving around a very massive star in a circular orbit of radius R with a period of revolution T. if the gravitational force of attraction between the planet and the star is proportational to $R^{-5/2}$, then

(a) T^2 is proportional to R^2

(b) T^2 is proportional to $R^{7/2}$

(c) T^2 is proportional to $R^{3/3}$

(d) T^2 is proportional to $R^{3.75}$.

A. $r^{3/2}$

B. $r^{5/2}$

C. $r^{7/2}$

D. $r^{1/2}$

Answer: C

Watch Video Solution

100. Two stars of mass m_1 and m_2 are parts of a binary star system. The radii of their orbits are r_1 and r_2 respectivey, measured from the centre of mass of the system. The magnitude of gravitational force m_1 exerts on m_2 is

A. $\frac{m_1 m_2 G}{(r_1 + r_2)^2}$

B. $\frac{m_1 G}{(r_1 + r_2)^2}$

C. $\frac{m_2 G}{(r_1 + r_2)^2}$

D. $\left(m_1 m_2 \frac{G}{(r_1 + r_2)^2}\right.$

Answer: A

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101. A system of binary stars of mass m_A and m_B are moving in circular orbits of radii r_A and r_B respectively. If T_A and T_B are at the time periods of masses m_A and m_B respectively then

A. $\frac{T_A}{T_B} = \left(\frac{r_A}{r_B}\right)^{\frac{3}{2}}$

B. $T_A > T_B (\text{if} r_A > r_B)$

C. $T_A > T_B (\text{if} m_A > m_B)$

D. $T_A = T_B$

Answer: D

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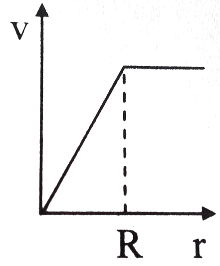
102. A spherically symmetric gravitational system of particles has a mass density $\rho = \begin{cases} \rho_0 & f \text{ or } \quad r \quad < \quad R \\ 0 & f \text{ or } \quad r \quad > \quad R \end{cases}$ where ρ_0 is a constant. A test mass can undergo circular motion under the influence of the gravitational field of particles. Its speed v as a function of distahce $r(0 < r < OO)$ form the centre of the system is represented by

A.



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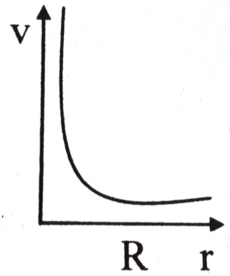

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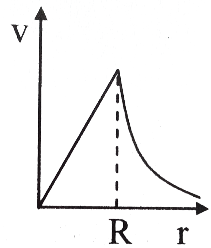

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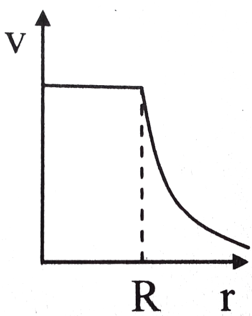

Answer: C

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103. Assertion : An astronaut in an orbiting space station above the earth experience weightlessness.

Reason : An object moving around the earth under the infuence of earth's gravitational force is in a state of 'free fall'

A. Assertion is True, Reason is True, Reason is a correct explanation for Assertion

B. Assertion is True, Reason is True, Reason is no a correct explanation for Assertion

C. Assertion is True, Reason is False

D. Assertion is False but Reason is True

Answer: A

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104. An infinite number of particles each of mass m are placed on the positive X-axis of $1m, 2m, 4m, 8m, \ldots$ from the origin. Find the magnitude of the resultant gravitational force on mass m kept at the origin.

A. $\frac{2}{3}Gm$

B. $\frac{4}{3}Gm$

C. Gm

D. 6Gm

Answer: B

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105. Infinite number of bodies, each of mass $2kg$, are situated on x-axis at distance $1m, 2m, 4m, 8m.........$ respectively, from the origin. The resulting gravitational potential the to this system at the origing will be

A. -G

B. $-\frac{8}{3}G$

C. $-\frac{4}{3}G$

D. -4G

Answer: D

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106. Two heavy spheres of mass m are kept separated by a distance 2r. The gravitational field and potential at the midpoint of the line joining the centres of the spheres are

A. $\dfrac{Gm^2}{r^2}$ and 0

B. 0 and $-\dfrac{2Gm}{r}$

C. 0 and $\dfrac{2Gm}{r}$

D. none of these

Answer: B

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

A. 1400 km

B. 2000 km

C. 2600 km

D. 1600 km

Answer: C

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108. A satellite of mass m is in a circular orbit of radius r round the Earth. Calculate its angular momentum with respect to the centre of the orbit in terms of the mass M of the Earth and G.

A. $(GMmr)^{\frac{1}{2}}$

B. $(GMm^2r)^{\frac{1}{2}}$

C. $\left(GMm^2r^2\right)^{\frac{1}{2}}$

D. $\left(GM^2m^2r^2\right)^{\frac{1}{2}}$

Answer: B

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109. The radii of a planet and its satellite are 2r and r and their densities are ρ and 2ρ respectively. Their centres are separated by a distance d. The minimum speed with which a body should be projected from the mid point of the line joining their centres so that the body escapes to infinity is (G-universal gravitational constant)

A. $4\left[\sqrt{\frac{10G\pi r^3\rho}{3d}}\right]$

B. $\sqrt{\frac{40G\pi r^3\rho}{3d}}\,\Big]$

C. $2\left[\sqrt{\frac{10G\pi r^3\rho}{d}}\right]$

D. $\frac{1}{4}\left[\sqrt{\frac{10G\pi r^3\rho}{3d}}\right]$

Answer: A

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Evaluation Test

1. Two masses m_1 and $m_2 (m_1 < m_2)$ are released from rest finite distance. They start under their mutual gravitational attraction-

A. acceleration of m_1 is more than of m_2

B. acceleration of m_2 is more than that of m_1

C. centre of mass remains at rest.

D. total energy of the system remains constant.

Answer: B

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2. The mass of the earth is 81 times the mass of the Moon and the distance between the earth and the Moon is 60 time the, radius of the earth. If R is the radius of the earth, then the distance between the Moon and the point on the in joining the Moon and the earth where the gravitational force becomes zero is

A. 30R

B. 15R

C. 6R

D. 5R

Answer: C

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3. A mass M is broken into two parts of masses m_1 and m_2. How are m_1 and m_2 related so that force of gravitational attraction between the two parts is maximum?

A. $m_1 = m_2$

B. $m_1 = M$

C. $m_2 = M$

D. none of these

Answer: A

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4. Suppose the gravitational force varies inversely as the n^{th} power of distance. Then the

time period of a planet in circular orbit of radius

R around the sun will be proportional to-

A. $r^{(n-1)/2}$

B. $r^{(n+1)/2}$

C. r^{n-1}

D. r^{n}

Answer: B

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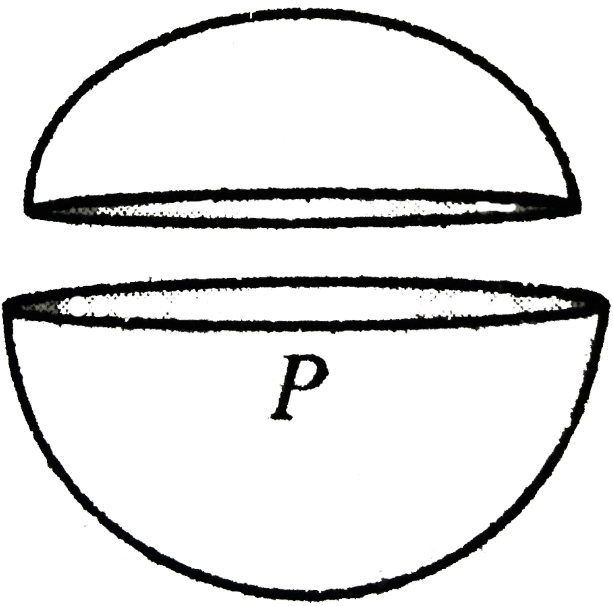
5. A spherical shell is cut into two pieces along a chord as shown in the figure. P is a point on the plane of the chord. The gravitational field at P due to the upper part is I_1, and that due to the lower part is I_2. What is the relation between them?



A. $I_1 > I_2$

B. I_1ltI_2`

C. $I_1 = I_2$

D. No definite relation

Answer: C

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6. Some aliens living beneath the surface of the earth want to send a parcel to their friends just outside earth's pull. What should be the velocity with which they must throw the parcel from a depth ofR/2?

A. 11.2 km/s

B. 15.84 km/s

C. 16.37 km/s

D. 12.8 km/s

Answer: B

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7. Distance between the centres of two stars is 10α. The masses of these stars are M and 16M and their radii a and 2a, respectively. A body of mass m is fired straight form the surface of the larger star towards the smaller star. What should be its minimum inital speed to reach the surface of the smaller star? Obtain the expression in terms of G,M and a.

A. $\frac{3}{2}\sqrt{\frac{5GM}{a}}$

B. $\sqrt{\frac{5}{4}\frac{5GM}{a}}$

C. $3\sqrt{\frac{GM}{2a}}$

D. $\frac{3}{4}\sqrt{\frac{GM}{a}}$

Answer: A

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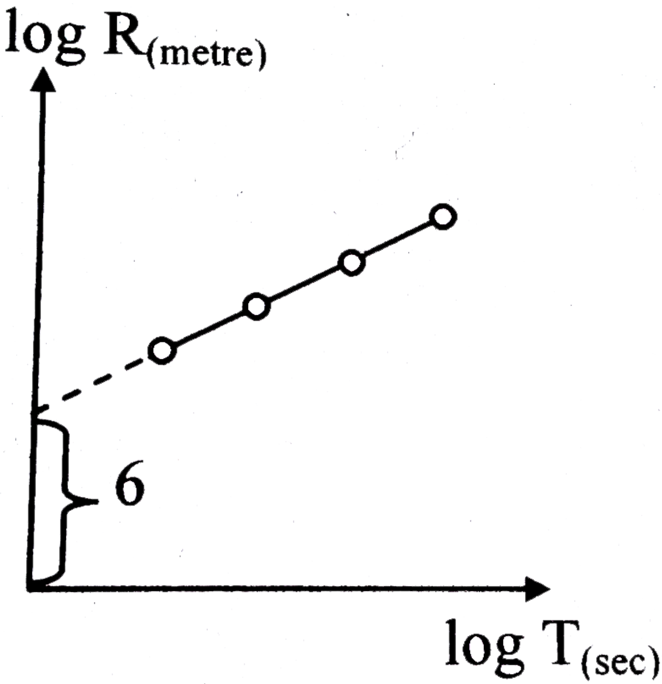
8. For many planets revolving around the stationary sun in circular orbits of different radii (R), the time periods (T) were noted. Then log(R) v/s log· (T) curve was plotted

$\left[G = \frac{20}{3} \times 10^{-11}\right.$ in M.K.S system, π^2=10]

Estimate the mass of the sun.



A. $6 \times 10^{29} kg$

B. $5 \times 10^{20} kg$

C. $8 \times 10^{25} kg$

D. $3 \times 10^{25} kg$

Answer: A

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9. Let ω be the angular velocity of the earth's rotation about its axis. Assume that the acceleration due to gravity on the earth's surface has the same value at the equator and the poles. An object weighed at the equator gives the same reading as a reading taken at a depth d below earth's surface at a pole $(d < < R)$. the value of d is-

A. $\dfrac{\omega^2 R^2}{g}$

B. $\dfrac{\omega^2 R^2}{2g}$

C. $\dfrac{2\omega^2 R^2}{g}$

D. $\dfrac{\sqrt{Rg}}{g}$

Answer:

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10. Suppose universal gravitational constant starts to decrease, then

A. length of the day does not change

B. length of the year will increase

C. the earth will follow a spiral path of decreasing radius

D. Kinetic energy of the earth will decrease

Answer: C

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11. A satellite of mass m is orbiting the earth in a circular orbit of radius r. It starts losing energy due to small air resistance at the rate of CJ/s.

Then the time teken for the satellite to reach the

earth is...........

A. $\frac{GMm}{c}\left(\frac{1}{R}-\frac{1}{r}\right)$

B. $\frac{GMm}{2c}\left(\frac{1}{R}-\frac{1}{r}\right)$

C. $\frac{GMm}{2CR}$

D. $\frac{3GMm}{2c}\left(\frac{1}{R}-\frac{1}{r}\right)$

Answer: B

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12. Two equal masses each in are hung from a balance whose scale pans differ in vertical height by h. The error in weighing in terms of density of the earth ρ is

A. $\pi G\rho mh$

B. $\frac{1}{3}\pi G\rho mh$

C. $\frac{8}{3}\pi G\rho mh$

D. $\frac{1}{4}\pi G\rho mh$

Answer: C

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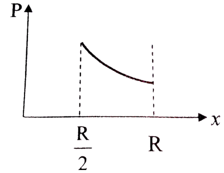
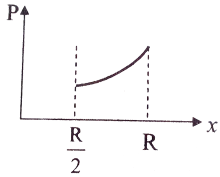
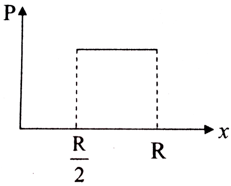
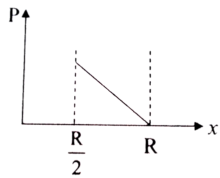
13. A tunnel is dug along a chord of the earth at a perpendicular distance $R/2$ from the earth's centre. The wall of the tunnel may be assumed to be frictionless. A particle is released from one end of the tunnel. The pressing force by the particle on the wall, and the acceleration of the particle vary with x (distance of the particle from the centre) according to

A. 

B. 

C. 

D. 

Answer: C

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14. A particle of mass m is subjected to an attractive central force of magnitude k/r^2, k

being a constant. If at the instant when the particle is at an extreme position in its closed orbit, at a distance a from the centre of force, its speed is $\sqrt{k/2ma}$, if the distance of other extreme position is b. Find a/b.

A. -1

B. 2

C. 3

D. 4

Answer: C

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15. The percentage change in the acceleration of the earth towards the Sun from a total eclipse of the Sun to the point where the Moon is on a side of earth directly opposite to the Sun is

A. $\dfrac{M_s r_2}{M_m r_1} \times 100$

B. $\dfrac{M_s}{M_m}\left(\dfrac{r_2}{r_1}\right)^2 \times 100$

C. $2\left(\dfrac{r_1}{r_2}\right)^1 \dfrac{M_m}{M_s} \times 100$

D. $\left(\dfrac{r_1}{r_2}\right)^2 \dfrac{M_m}{M_s} \times 100$

Answer: C

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16. The escape velocity for a body projected vertically upwards from the surface of the earth is $11.2kms^{-1}$. If the body is projected in a direction making an angle 45° with the vertical, the escape velocity will be

A. $\frac{11.2}{\sqrt{2}}km/s$

B. $11.2 \times \sqrt{2}km/s$

C. $11.2 \times 2km/s$

D. $11.2km/s$

Answer: D

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17. For a particle projected in a transverse direction from a height h above earth's surface, find the minimum initial velocity so that it just grazes the surface of earth such that path of this particle would be an ellipse with centre of earth as the farther focus, point of projection as the apogee and a diametrically opposite point on earth's surface as perigee.

A. $\sqrt{2GM_e \frac{R.}{r(R+r)}}$

B. $\sqrt{2GM_e \frac{R.}{R(R+r)}}$

C. $\sqrt{2GM_e \frac{r}{r(R+r)}}$

D. $\sqrt{2GM_e \left(\frac{.R}{r^2} \right.}$

Answer: A

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18. A particle is dropped on Earth from height R (radius of earth) and it bounces back to height h.

If the coefficient of restitution of collision is $\sqrt{\frac{2}{3}}$,

then find h.

A. $\frac{R}{3}$

B. $\frac{R}{4}$

C. R

D. $\frac{R}{2}$

Answer: D

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19. A uniform spherical planet · (Radius R) has acceleration due to gravity at its surface as g. Points P and Q located inside and outside the planet respectively have acceleration due to gravity $\frac{g}{4}$. Maximum possible separation 4 between P and Q is,

A. $\frac{3R}{2}$

B. $\frac{9R}{4}$

C. $\frac{7R}{4}$

D. None

Answer: C

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20. A comet is moving around the earth in.highly elliptical orbit. Identify the incorrect statement

A. Its K.E. and P.E. both change over the orbit.

B. Its T.E. changes over the orbit

C. Its linear momentum changes in magnitude as well as in direction over the orbit.

D. Its angular momentum remains constant over the orbit

Answer: B

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21. Two particles are projected from the surface of the earth with velocities $\sqrt{\frac{5}{7}gR}$ and $\sqrt{\frac{2}{5}gR}$ where, R is the radius of the earth what should be the ratio of maximum heights attained?

A. $\frac{2}{5}$

B. $\frac{5}{3}$

C. $\frac{3}{5}$

D. $\frac{5}{2}$

Answer: C

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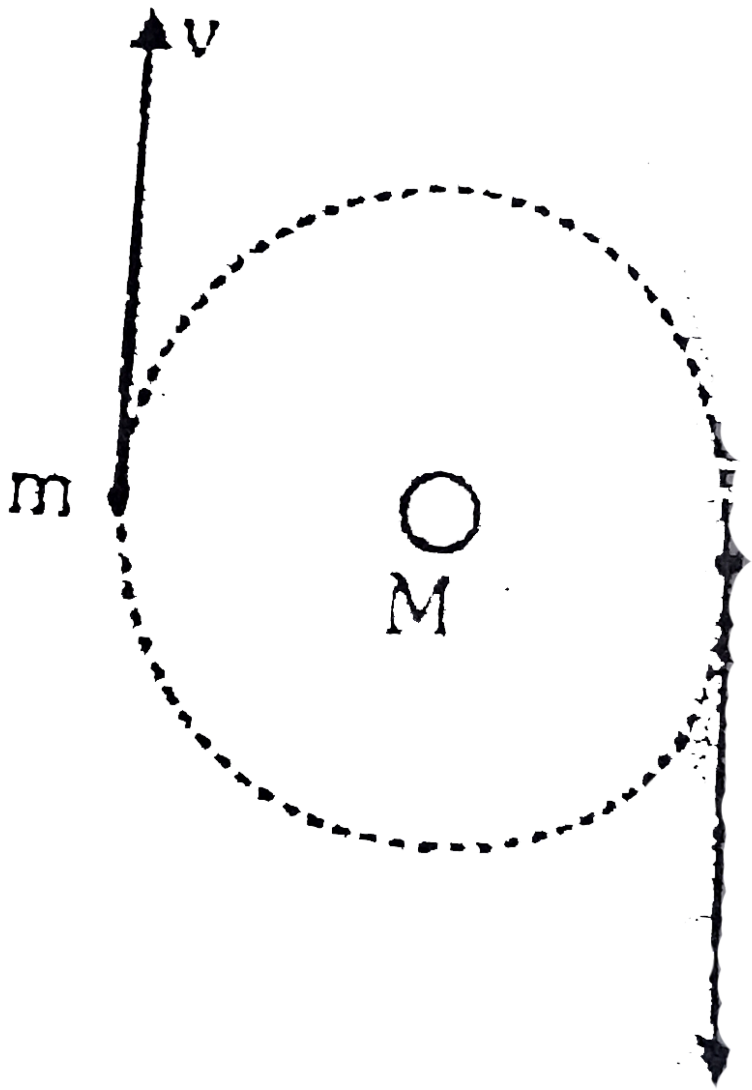

22.

A triple star system consists of two stars each of

mass m in the same circular orbit about central star with mass $M = 2 \times 10^{33} kg$. The two outer stars always lie at opposite ends of a diameter of their common circular orbit the radius of the circular orbit is $r = 10^{11}$ m and the orbital period each star is $1.6 \times 10^7 s$ [take $\pi^2 = 10$ and $G = \frac{20}{3} \times 10^{-11} Mn^2 kg^{-2}$]

Q. The mass m of the outer stars is:

A. $\frac{11}{8} \times 10^{30}$

B. $\frac{15}{16} \times 10^{30}$

C. $\frac{40}{3} \times 10^{30}$

D. $\frac{20}{3} \times 10^{30}$

Answer: C

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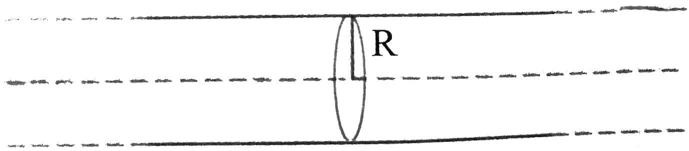
23. Consider a hypothetical planet which is very long and cylinderical. The density of the planet is ρ, its radius is R.



What is the possible orbital speed of the satellite in moving around the planet in circular orbit in a plane which is perpendicular to the axis of planet?

A. $2\pi R\sqrt{G\rho}$

B. $R\sqrt{2\pi G\rho}$

C. $2\sqrt{\pi R G\rho}$

D. $\sqrt{2RG\rho}$

Answer: B

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24. If a satellite is travelling in the same direction as the rotation of earth i.e., west to east, what is the interval between two successive times at which it will appear vertically overhead to an observer at a fixed point on the equator? (R = 6400 km, h = 1400 km)

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