PHYSICS

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GRAVITATION

Evaluation Textbook Question Answers Multiple Choie Questions

1. The linear momentum and position vector of the planet is perpendicular to each other at

A. perihelion and aphelion

B. at all points

C. only at perihelion

D. no point

Answer: A

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2. If the masses of the Earth and Sun suddenly double, the gravitational force between them will

A. remain the same

B. increase 2 times

C. increase 4 times

D. decrese 2 times

Answer: C

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3. A planet moving along an elliptical orbit is closest to the Sun at distance r_1 and farthest away at a distance of r_2. If v_1 and v_2 are linear speeds at these points respectively. Then the ratio $\frac{v_1}{v_2}$ is

A. $\frac{r_2}{r_1}$

B. $\left(\frac{r_2}{r_1}\right)^2$

C. $\frac{r_1}{r_2}$

D. $\left(\frac{r_1}{r_2}\right)^2$

Answer: A

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4. The time period of a satellite orbiting Earth in a circular orbit is independent of

A. Radius of the orbit

B. The mass of the satellite

C. Both the mass and radius of the orbit

D. Neither the mass nor the radius of its orbit

Answer: B

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5. If the distance between the Earth and Sun were to be doubled from its present value, the number of days in a year would be

A. 64.5

B. 1032

C. 182.5

D. 730

Answer: B

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6. According to Kepler's second law, the radial vector to a planet from the Sun sweeps out equal areas in equal intervals of time. This law is a consequence of:

A. conservation of linear momentum

B. conservation of angular momentum

C. conservation of energy

D. conservation of kinetic energy

Answer: B

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7. Binding energy of moon and earth is :-

A. always positive

B. always negative

C. can be positive or negative

D. always zero

Answer: B

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8. 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 S as shown in the figure. Then:

A. $K_A > K_B > K_C$

B. $K_B < K_A < K_C$

C. $K_A < K_B < K_C$

D. $K_B > K_A > K_C$

Answer: A

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9. The work done by the Sun's gravitational force on the Earth is:

A. always zero

B. always positive

C. can be positive or negative

D. always negative

Answer: C

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10. If the mass and radius of the Earth are both doubled, then the accelration due to gravity g

A. remains same

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

C. 2 g

D. 4 g

Answer: B

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11. The magnitude of the Sun's gravitational field as experienced by Earth is:

A. same over the year

B. decreases in the month of January and increases in the month of July

C. decreases in the month of July and increases in the month of January

D. increases during day time and decreases during night time.

Answer: C

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12. If a person moves from Chennai to Trichy, his weight:

A. increases

B. decreases

C. remains same

D. increases and then decreases

Answer: A

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13. An object of mass 10 kg is hanging on a spring scale which is attached to the roof of a lift. If the lift is in free fall, the reading in the spring scale is

A. 98 N

B. zero

C. 49 N

D. 9.8 N

Answer: B

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14. If the accelaration due to gravity becomes 4 times its original value, then escape speed

A. remains same

B. 2 times of original value

C. becomes halved

D. 4 times of original value

Answer: B

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15. The kinetic energy of the satellite orbiting around the Earth is

A. equal to potential energy

B. less than potential energy

C. greater than kinetic energy

D. zero

Answer: B

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16. The linear momentum and position vector of the planet is perpendicular to each other at

A. perihelion and aphelion

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B. conservation of angular momentum

C. conservation of energy

D. conservation of kinetic energy

Answer: B

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22. The gravitational potential energy of the Moon with respect to Earth is:

A. always positive

B. always negative

C. can be positive or negative

D. always zero

Answer: B

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23. 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 S as shown in the figure. Then:

A. $K_A > K_B > K_C$

B. $K_B < K_A < K_C$

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D. $K_B > K_A > K_C$

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A. equal to potential energy

B. less than potential energy

C. greater than kinetic energy

D. zero

Answer: B

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Evaluation Textbook Question Answers Short Answer Questions

1. State Kepler's three laws.

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2. State Newtons Universal law of gravitaion.

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3. Will the angular momentum of a planet be conserved? Justify your answer.

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4. Define the gravitational field. Give its unit.

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5. What is meant by superposition of gravitational field?

Watch Video Solution

Watch Video Solution

6. Define gravitational potential energy.

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7. Is potential energy the property of a single object? Justify.

Watch Video Solution

8. Define gravitational potential.

Watch Video Solution

9. What is the difference between gravitational potential and gravitational potential energy?

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10. What is meant by escape speed in the case of the Earth?

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11. Why is the energy of a satellite negative?

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12. What are geostationary and polar satellites?

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13. WEIGHT

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14. Why is there no lunar eclipse and solar eclipse every month?

Watch Video Solution

15. How will you prove that Earth itself is spinning?

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Evaluation Textbook Question Answers Long Answer Questions

1. Discuss the important features of the law of gravitation

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2. Explain how Newton derived his law of gravitation from Kepler's third law.

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3. Explain how Newton verified his law of gravitation.

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4. Derive the expression for gravitational potential energy.

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5. Prove that at points near the surface of the Earth, the gravitational potential energy of the object is U = mgh.

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6. Explain in detail the idea of weightlessness using lift as an example.

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7. Derive an expression for escape speed.

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8. Explain the variation of 'g' with latitude.

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9. Explain the variation of 'g' with altitude.

Watch Video Solution

10. Explain the variation of g with depth from the Earth's surface.

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11. The time period of a satellite orbiting Earth in a circular orbit is independent of

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12. Derive an expression for energy of satellite.

Watch Video Solution

13. What are geostationary and polar satellites?

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14. Explain how geocentric theory is replaced by heliocentric theory using the idea of retrograde motion of planets.

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15. Explain in detail the Eratosthenes method of finding the radius of Earth.

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16. Describe the measurement of Earth's shadow (umbra) radius during total lunar eclipse.

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Evaluation Textbook Question Answers Conceptual Questions

1. In the following what are the quantities which that are conserved?

A. linear momentum of planet

B. angular momentum of planet

C. total energy of planet

D. potential energy of a planet

Answer: B

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2. The work done by Sun on Earth in one year will be:

A. zero

B. non-zero

C. positive

D. negative

Answer: A

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3. The work done by sun on Earth at any finite interval of time is

A. positive, negative or zero

B. strictly positive

C. strictly negative

D. it is always zero

Answer: C

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4. If a comet suddenly hits the Moon and imparts energy which is more than the total energy of the Moon, what will happen?

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5. If the Earth's pull on the Moon suddenly disappears, what will happen to the Moon?

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6. If the Earth has no tilt what happens to the seasons of the Earth?

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7. A student was asked a question why are there summer and winter for us? He replied as since

Earth is orbiting in an elliptical orbit. When the Earth is very far away from the Sun(aphelion) there will be winter, when the Earth is nearer to the Sun(perihelion) there will be winter. Is this answer correct? If not, what is the correct explanation for the occurrence of summer and winter?

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8. The following photographs are taken from the recent lunar eclipse which occurred on January 31, 2018. Is it possible to prove that Earth is a sphere from these photographs?

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9. In the following what are the quantities which that are conserved?

A. linear momentum of planet

B. angular momentum of planet

C. total energy of planet

D. potential energy of a planet

Answer: B

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10. The work done by Sun on Earth in one year will be:

A. zero

B. non-zero

C. positive

D. negative

Answer: D

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11. The work done by sun on Earth at any finite interval of time is

A. positive, negative or zero

B. strictly positive

C. strictly negative

D. it is always zero

Answer: C

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Evaluation Textbook Question Answers Numerical Problems

1. An unknown planet orbits the Sun with distance twice the semi major axis distance of the Earth's orbit. If the Earth's time period is T_2, what is the time period of this unknown planet.

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2. Assume that you are in another solar system and provided with the set of data given below consisting of the planet's semi major axes and time periods. Can you infer the relation connecting semi major axis and time period?

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3. If the masses and mutual distance between the two objects are doubled, what is the change in the gravitational force between them?

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

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5. If the ratio of the orbital distance of two planets $\frac{d_1}{d_2} = 2$, what is the ratio of gravitational field experienced by these two planets?

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6. The Moon Io orbits Jupiter once in 1.769 days. The orbital radius of the Moon Io is 421700 km. Calculate the mass of Jupiter?

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7. If the angular momentum of a planet is given by $\overrightarrow{L} = 5t^2\hat{i} - 6t\hat{j} + 3\hat{k}$. What is the torque experienced by the planet? Will the torque be in the same direction as that of the angular momentum?

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8. 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. Calculate the speed of each particle

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9. Suppose unknowingly you wrote the universal gravitational constant value as $G = 6.67 \times 10^{11}$ instead of the correct value $G = 6.67 \times 10^{-11}$, what is the acceleration due to gravity g' for this incorrect G? According to this new acceleration due to gravity, what will be your weight W?

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10. Calculate the gravitational field at point O due to three masses m_1, m_2 and m_3 whose positions are given by the following figure. If the masses m_1 and m_2 are equal what is the change in gravitational field at the point O?

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11. What is the gravitational potential energy of the Earth and sun ? The Earth to sun distance is arouund 150 million Km . The mass of the Earth is 5.9×10^{24}kg and the mass of the sun is 1.9×10^{30} kg.

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12. Earth revolves around the sun at 30 kms^{-1} calculated the kinetic energy of the Earth.What is the total energy of the Earth in that case? Is the total energy positive?Give reasons.(Potential energy of earth = -49.84×10^{32})

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13. An object is thrown from Earth is such a way that it reaches a point at infinity with non-zero kinetic energy $\left[K.E(r=\infty)=\frac{1}{2}MV_{\infty}^{0}\right]$, with what velocity should the object be thrown from Earth?

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14. Suppose we go 200 km above and below the surface of the Earth, what are the g values at these two points? In which case, is the value of g small?

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15. Calculated the change in g value in your district of Tamil nadu. (Hint : Get the latitude of your district of Tamil nadu from the Google). What is the difference in g values at Chennair and Kanyakumari?

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Other Important Question Answers Multiple Choice Questions

1. A body is acted upon by a force towards a point. The magnitude of the force is inversely proportional to the square of the distance. The path of body will be:

A. ellipse

B. hyperbola

C. circle

D. parabola

Answer: A

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2. Which of the following statements is an incorrect statement?

If M_E is the mass of the Earth,

G - Gravitational constant

R_E is the radius of the Earth and

g is acceleration due to gravity the:

A. gravitational field intensity is $E = -\frac{GM_E}{m}\vec{r}$

B. Relation between g and G is $G = -\frac{gM}{r^2}$

C. Gravitational potential is $V = \frac{GM_E}{R_E}$

D. Time period of a satellite is $T = 2\pi\sqrt{\frac{R_E}{g}}$

Answer: B

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3. Accorrding to Kepler, the period of revolution of a planet (T) and its mean distance from the Sun ® related by the equation.

A. $T^2 r^{-3}$ = constant

B. $T^2 r$ = constant

C. $T^3 r^3$ = constant

D. $T r^3$ = constant

Answer: A

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4. The force of gravitation is:

A. repulsive force

B. electrostatic force

C. conservative force

D. non-conservative force

Answer: C

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5. Which of the following pairs is a correct pair with reference to a satellite?

A. Potential energy $= -\frac{GmM}{R}$,

Kinetic energy $= \frac{GMm}{R+h}$

B. Potential energy $= -\frac{GMm}{R+h}$,

Kinetic energy $= \frac{GMm}{2(R+h)}$

C. Potential energy = mgh,

Kinetic energy $= \frac{1}{2}mv^2$

D. Potential energy $= -\dfrac{GM}{R^2}$

Kinetic energy $= \dfrac{1}{2}\dfrac{GM}{(R+h)^2}$

Answer: B

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6. The distance of two planets from the Sun are 10^{13} and 10^{12} metres respectively. The ratio of time periods of these two planets is:

A. 100

B. $\sqrt{10}$

C. $10\sqrt{10}$

D. $\dfrac{1}{\sqrt{10}}$

Answer: C

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7. The period of a planet around Sun is 27 times that of Earth. The ratio of radius if planet's orbit to the radius of Earth's orbit is:

A. 4

B. 9

C. 27

D. 64

Answer: B

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8. A planet moves around the Sun. It is closest to Sun at a distant d_1 and has velocity v_1 and farthest with distance d_2, its speed at this point will be:

A. $\frac{d_1^2 v_1}{d_2^2}$

B. $\dfrac{d_2 v_1}{d_1}$

C. $\dfrac{d_1 v_1}{d_2}$

D. $\dfrac{d_2^2 v_1}{d_1^2}$

Answer: C

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9. Assertion: A planet is a heavenly body revolving around the sun.

Reason: Star is a self-luminous body made up of gaseous material.

Select the correct statement from the following statements.

A. Assertion and reason are true and reason is the correct explanation of assertion.

B. Assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is true but reason is false.

D. Assertion is false and reason is true.

Answer: B

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10. Assertion: The earth is slowing down and as a result the moon is coming nearer to it.

Reason: The angular momentum of the earth moon system is not conserved.

Which one of the following statements is a correct staement?

A. Both assertion and reason are true and reason explains assertion correctly.

B. Both assertion and reason are true but reason does not explain assertion correctly.

C. Both assertion and reason are false.

D. Assertion is true but reason is false.

Answer: C

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11. A man waves his arms, while walking. This is due:

A. to keep constant velocity

B. to ease the tension

C. to increase the velociy

D. to balance the effect of Earth's gravity

Answer: D

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12. Two spheres of same size, one of mass 2 kg and another of mass 4 kg are dropped simultaneously from the top of Qutab Minar (height = 72 km) when they are 1 m above the ground, the two spheres have the same:

A. kinetic energy

B. potential energy

C. momentum

D. acceleration

Answer: D

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13. Choose the odd man out from the following laws.

A. Newton's first law of motion

B. Kepler's third law of planetary motion

C. Law of conservation of momentum

D. Law of conservation of energy

Answer: B

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14. The figure shows elliptical orbit of a planet M about the Sun S. The shaded area of SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B, then, which one of the following relations is correct?

A. $t_1 = 4t_2$

B. $t_1 > t_2$

C. $t_1 = 2t_2$

D. $t_1 = t_2$

Answer: C

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15. When the elevator is moving uniformly in the upward and then in downward directions, which of the following pairs is a correct pair?

A. Apparent weight = Actual weight and

Apparent weight $>$ Actual weight

B. Apparent weight $>$ Actual weight and

Apparent weight $<$ Actual weight

C. Apparent weight $>$ Actual weight and

Apparent weight = Actual weight

D. Apparent weight $<$ Actual weight and

Apparent weight $>$ Actual weight

Answer: B

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16. The height at which the acceleration due to gravity becomes $\frac{g}{9}$ (where g = the acceleration due to gravity on the surface of the Earth) in terms of R, the radius of the Earth, is:

A. 2R

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

C. $\sqrt{2}R$

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

Answer: A

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17. Two particles of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

A. $v=\sqrt{\frac{1}{GM}}$

B. $v=\sqrt{\frac{4GM}{R}}$

C. $v=\frac{1}{2}\sqrt{\frac{GM}{R}}$

D. $v=\frac{1}{2R}\sqrt{\frac{1}{GM}}$

Answer: C

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18. A seconds pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket:

A. moves round the Earth in geo-stationary orbit

B. moves up with uniform acceleration

C. comes down with uniform acceleration

D. moves up with a unifrom velocity

Answer: B

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19. Which of the following statements is an incorrect statement?

A. Radius of Moon R_m = 1737 km

B. Radius of Earth R_E = 6436 km

C. Distance between Sun and Venus is 0.38 AU

D. Distance between Sun and Mercury is 0.38 AU

Answer: C

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20. Assertion: The time period of a pendulum on a satellite orbiting the Earth is infinity.

Reasons: Time period of a pendulum is inversely proportional to square root of acceleration due to gravity.

Which of the following statements is correct?

A. Both assertion and reason are true and reason explain assertion correctly.

B. Both assertion and reason are true and reason does not explain assertion correctly.

C. Assertion is true but reason is false.

D. Assertion is false and reason also false.

Answer: A

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21. There are two bodies of masses 1kg and 100 kg separated by a distance 1 m. At what distance from the smaller body, the intensity of gravitational field will be zero?

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

B. $\frac{10}{11}$ m

C. $\frac{1}{10}$ m

D. $\frac{1}{11}$ m

Answer: D

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22. A wire of length l and mass m is bent in the form of a semicircle. The gravitational field intensity at the centre of semicircle is:

A. $\frac{Gm}{\pi l}$ along x-axis

B. $\frac{2\pi Gm}{l^2}$ along y-axis

C. $\frac{Gm}{\pi l}$ along y-axis

D. $\frac{2\pi Gm}{l^2}$ along x-axis

Answer: B

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23. Two stars of masses m_1 and m_2 are parts of a binary solar system. The radii of their orbits are r_1 and r_2 respectively. The magnitude of the gravitational force m_1 exerts on m_2 is:

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

B. $\dfrac{(m_1+m_2)}{(r_1+r_2)^2}$

C. $\dfrac{m_1 G}{(r_1+r_2)^2}$

D. $\dfrac{m_2 G}{(r_1+r_2)^2}$

Answer: A

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24. A spherical planet has a mass M_p and diameter D_p. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to:

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

B. $\frac{GM_p m}{D_p^2}$

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

D. $\frac{4GM_p m}{D_p^2}$

Answer: A

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25. Which of the following graphs shows the variation of acceleration due to gravity g with depth d from the surface of the Earth?

A.

B.

C.

D.

Answer: B

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26. Two particles of mass m_1 and m_2, approach each other due to their mutual gravitational attraction only. Then:

A. acceleration of the particle of mass m_1 is inversely proportional to m_1

B. acceleration of the particle of mass m_1 is proportional to m_2

C. acceleration of the particle of mass m_1 is proportional to m_1

D. acceleration of both the particles are equal

Answer: B

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27. A planet is moving in an elliptical orbit around the Sun. If T, V, E and L stand respectively for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the centre of force, then which of the following is correct?

A. V is always positive

B. E is always negative

C. T is conserved

D. L is conserved but direction of vector L changes continuously.

Answer: B

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28. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a.

The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre will be:

A. $\frac{-3GM}{a}$

B. $\frac{-4GM}{a}$

C. $\frac{-2GM}{a}$

D. $\frac{-GM}{a}$

Answer: A

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29. Which one of the following statements is incorrect with reference to the weight of an object?

A. The magnitude of weight of an object is $W = mg$

B. The magnitude of weight is not equal to the gravitational force acting on it.

C. The direction of weight of an object is in the direction of gravitational force.

D. The weight of an object is a downward force

Answer: B

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30. The kinetic energy needed to project a body of mass m from the Earth surface (radius R) to infinity is:

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

B. $2mgR$

C. mgR

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

Answer: C

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31. The mass of the Earth is 6.0×10^{24} kg. The potential energy of a body of mass 50 kg at a distance of 6.3×10^{9} m from the centre of the Earth is:

A. $-3.23 \times 10^{9} J$

B. $-3.19 \times 10^6 J$

C. $-2.5 \times 10^6 J$

D. $-4.0 \times 10^{11} J$

Answer: B

Watch Video Solution

32. A body of mass m falls from earth's surface at a height equal to twice the radius (R) each. Then the change in P.E. of body will be

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

B. $3mgR$

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

D. $2mgR$

Answer: C

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33. Assertion: When a satellite is moving in a circular orbit around the Earth, total energy of a satellite, is half of its potential energy.

Reason: The gravitational force obeys the inverse square law of distance.

Select the correct statement of the following.

A. Assertion and reason are true and reason explains assertions correctly.

B. Assertion and reason are true but reason does not explain assertion correctly.

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A

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34. Work done is taking a mass from one point to another in a gravitational field depends on:

A. the end points only

B. the path followed

C. the velocity of the mass

D. both the length of the path and the end points

Answer: A

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35. Three particles each of mass m are placed at the three corners of an equilateral triangle of side a. The work done on the system to increase the sides of the triangle to 2a is:

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

B. $\frac{3Gm^2}{2a}$

C. $\frac{2Gm^2}{3a}$

D. $\frac{Gm^2}{2a}$

Answer: B

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36. Two small and heavy sheres, each of mass M, are placed at a distance r apart on a horizontal surface. The gravitational potential at the midpoint on the line joining the centre of the spheres is:

A. zero

B. $-\frac{GM}{r}$

C. $-\frac{2GM}{r}$

D. $-\frac{4GM}{r}$

Answer: D

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37. The radius and mass of Earth are increased by 0.5%. Which of the following statements is false at the surface of the Earth?

A. g will increase

B. g will not change

C. escape velocity will remain unchanged

D. potential energy will remain unchanged

Answer: D

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38. The velocity of a projectile that must be projected by a rocket so that it escapes earth's gravitation, is independent of:

A. radius of the projectile orbit

B. mass of the projectile only

C. mass of the earth

D. gravitational constant

Answer: B

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39. Select the odd man out from the following parameters.

A. Gravitational force

B. Gravitational potential

C. Electric potential

D. Gravitational potential energy

Answer: C

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40. At what height from the surface of Earth the gravitational potential and the value of g are $-5.4 \times 10^7 J \quad kg^{-1}$ and $6.0 ms^{-2}$ respectively? Take the radius of the Earth as 6400 km.

A. 2600 km

B. 1600 km

C. 1400 km

D. 2000 km

Answer: A

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41. Two satellites of masses m_1 and $m_2(m_1 > m_2)$ are moving around the earth in orbits of radii r_1 and $r_2(r_1 > r_2)$. Which one of the following statements about their velocities is correct?

A. $v_1 > v_2$

B. $v_1 = v_2$

C. $v_1 < v_2$

D. $\frac{v_1}{m_1} = \frac{v_2}{m_2}$

Answer: C

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42. A person brings a mass of 1 kg from infinity to a point P. Initially the mass was at rest but it moves at a speed of 2 ms^{-1} as it reaches at P. The work done by the person on the mass is -3 J. The potential at P is:

A. $-2J/kg$

B. $-3J/kg$

C. $-5J/kg$

D. $-7J/kg$

Answer: C

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43. A body of mass m is placed on Earth surface which is taken from Earth surface to a height h = 3R, then change in gravitaional potential energy is:

A. $\frac{1}{4}mgR$

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

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

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

Answer: C

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44. Which one of the following plots represents the variation of gravitational field on a particle with distance r due to a thin spherical shell of radius R? (r is measured from the centre of the spherical shell)

A.

B.

C.

D.

Answer: B

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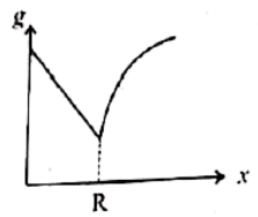
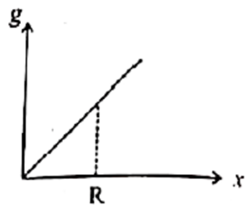
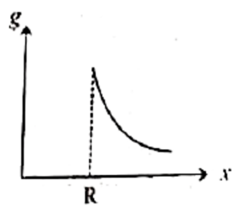
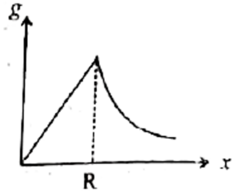
45. Variation of acceleration due to gravity (g) with distance x from the centre of the Earth is best represented by (R $\rightarrow$ Radius of the Earth)

A. 

B. 

C. 

D. 

Answer: D

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46. Assertion : If a pendulum is suspended in a lift and lift is falling freely , then its time period becomes infinite .

Reason : Free falling body has acceleration equal to acceleration due to gravity .

A. Both assertion and reason are true and reason explains assertion correctly.

B. Both assertion and reason are true and reason does not explain assertion correctly.

C. Both assertion and reason are false.

D. Assertion is true but reason is false.

Answer: B

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47. The gravitational field strength at the surface of a certain planet is g. Which of the following is the gravitational field strength at the surface of a planet with twice the radius and twice of the mass?

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

B. g

C. 2g

D. 4g

Answer: A

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48. The gravitational potential energy of a rocket of mass 200kg at a height of 10^7m from the earth's surface is 10^9s. The potential energy of the rocket at a height of 26.4×10^6m from the surface of earth is:

A. $-1.5 \times 10^9 J$

B. $-0.5 \times 10^9 J$

C. $-2.5 \times 10^9 J$

D. $-2 \times 10^9 J$

Answer: B

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49. When a body is taken from poles to equator on the Earth, its weight:

A. decreases

B. increases

C. remains the same

D. increases at South pole and decreases at North pole.

Answer: A

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50. If the mass of a body is M on the surface of the Earth, the mass of the same body on the surface of the Moon is:

A. M

B. zero

C. $\frac{M}{6}$

D. 6M

Answer: A

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51. A satellite is in an orbit around the earth. If its kinetic energy is doubled, then it will:

A. fall on the earth

B. rotates with a great speed

C. escape out of earth's gravitational field

D. maintain its path

Answer: C

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52. The reading of a spring balance corresponds to 100 N while situated at the North pole and a body is kept on it. The weight recorded on the same scale if it is shifted to the equator (take, $g = 10m / s^2$ and radius of the Earth $R = 6.4 \times 10^6 m$) is:

A. 99.66 N

B. 110 N

C. 97.66 N

D. 106 N

Answer: A

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53. The radii of two planets are respectively R_1 and R_2 and their densities are respectively ρ_1 and ρ_2. The ratio of the accelerations due to gravity (g_1 / g_2) at their surfaces is:

A. $\dfrac{R_1 \rho_2}{R_2 \rho_1}$

B. $\dfrac{R_1\rho_1}{R_2\rho_2}$

C. $\dfrac{\rho_1 R_2^2}{\rho_2 R_1^2}$

D. $\dfrac{R_1 R_2}{\rho_1\rho_2}$

Answer: B

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54. Mass remaining constant, the radius of the Earth shrinks by 1%. The acceleration due to gravity on the Earth's surface would:

A. increase by 2%

B. increase by 1%

C. decrease by 1%

D. decrease by 1/2%

Answer: A

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55. What will be the effect on the weight of a body placed on the surface on the Earth, if Earth suddenly stops rotating?

A. no effect

B. weight will increase

C. weight will decrease

D. weight will become zero

Answer: B

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56. The value of acceleration due to gravity at the surface of Earth:

A. is maximum at the poles

B. is maximum at the equator

C. remains constant everywhere on the surface on the Earth

D. is maximum at the international timeline

Answer: A

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57. Two satellites of earth S_1 and S_2 are moving in the same orbit. If the mass of S_1 is four times the mass of S_2 then which one of the following statements is true?

A. The potential energies of earth and satellite in both cases are equal.

B. The kinetic energies of two satellites are equal.

C. The time period of S_1 is four times the time period of S_2.

D. Satellites S_1 and S_2 are moving with same speed.

Answer: D

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58. The mass ratio of two planets is 1:5 . They are revolving around the sun in circular paths of radii in the ratio 2:5. The ratio between the values of acceleration due to gravity on their surface is:

A. $2:5$

B. $3:5$

C. $5:2$

D. $5:4$

Answer: D

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

A. 0.11 km s^{-1}

B. 1.1 km s^{-1}

C. 11 km s^{-1}

D. 110 km s^{-1}

Answer: D

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60. The escape velocity of a body depends upon its mass (m) as:

A. m^0

B. m^1

C. m^2

D. m^3

Answer: A

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61. A satellite in free space sweeps stationary interplanetary dust at a rate $dM/dt = \alpha v$ where M is the mass and v is the velocity of the satellite and α is a constant. What is the deceleration of the satellite?

A. $-\alpha v^2$

B. $-\frac{\alpha v^2}{2M}$

C. $-\dfrac{\alpha v^2}{M}$

D. $-\dfrac{2\alpha v^2}{M}$

Answer: C

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62. A satellite is revolving in a stable orbit of radius r with orbital velocity v_0 around the earth. The time period of the satellite is T, angular momentum L and its total energy is E.

Then which one of the following statement is not correct?

A. V_0 is directly proportional to $r^{\frac{-3}{2}}$

B. T is directly proportional to $r^{\frac{3}{2}}$

C. L is directly proportional to r^{-1}

D. E is directly proportional to r

Answer: A

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63. A planet has the radius twice that of earth and has same density as that of earth. If V_p and V_e are the escape velocities for the planet and earth, then which of the following correct relation is:

A. $V_p = V_e$

B. $V_e = 2V_p$

C. $V_p = 2V_e$

D. $V_p = \sqrt{2}V_e$

Answer: C

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64. A satellite is to revolve around the Earth in a circle of radius 8000 km. The speed at which this satellite be projected into an orbit, will be:

A. 3 km/s

B. 16 km/s

C. 7.15 km/s

D. 8 km/s

Answer: C

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65. Assuming density d of a planet to be uniform, we can say that the time period of its artificial satellite is proportional to:

A. d

B. $\sqrt{d}$

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

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

Answer: C

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66. The time period of a satellite orbiting Earth in a circular orbit is independent of

A. the mass of the satellite

B. radius of its orbit

C. both the mass of satellite and radius of the orbit

D. neither the mass of satellite nor the radius of its orbit.

Answer: A

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67. An Earth satellite is moving around the Earth in circular orbit. In such case, which of the following is conserved?

A. velocity

B. linear momentum

C. angular momentum

D. none of these

Answer: C

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68. The kinetic energy of a satellite is 2 MJ. What is the total energy of the satellite?

A. $-2MJ$

B. $-1MJ$

C. $\frac{-1}{2}MJ$

D. $-4MJ$

Answer: A

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69. The distances of two satellites from the surface of the Earth are R and 7R. Their time periods of rotation are in the ratio:

A. $1:7$

B. $1:8$

C. $1:49$

D. $1:7^{3/2}$

Answer: B

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70. Select the correct pair from the following pairs with reference to acceleration due to gravity (g).

A. g is minimum at poles and it is maximum at equator.

B. g is maximum at poles and it is minimum at equator

C. g is maximum at equator and it is minimum at poles

D. g decreases with depth and it increases with height.

Answer: B

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71. 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 compressed to be a black hole?

A. $10^{-9}m$

B. $10^{-6}m$

C. $10^{-2}m$

D. 100m

Answer: C

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72. 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.Then, which one of the following statements is correct?

A. the linear momentum of S remains constant in the magnitude

B. the acceleration of S is always directed towards the centre of the Earth.

C. the angular momentum of S about the centre of the Earth changes in direction, but its magnitude remains constant

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

Answer: B

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73. Where should a geo-stationary satellite be launched?

A. At equator

B. At poles

C. Anywhere

D. None of these

Answer: A

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74. The value of escape velocity on a certain planet is 2 km/s. Then the value of orbital speed for a satellite orbiting close to its surface is:

A. 12 km/s

B. 1 km/s

C. $\sqrt{2}$ km/s

D. $2\sqrt{2}$ km/s

Answer: C

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75. For a satellite moving in an orbit around the earth, the ratio of kinetic energy of potential

A. $1 : \sqrt{2}$

B. $1 : 2$

C. $2 : 1$

D. $\sqrt{2} : 1$

Answer: B

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76. All the known planets move in:

A. straight path

B. circular path

C. hyperbolic path

D. elliptical path

Answer: D

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77. For a planet moving around the Sun in an elliptical orbit of semimajor and semiminor axes a and b respectively and Time period T.

For this situation which one of the following statements is correct?

A. The torque acting on the planet about the Sun in non-zero

B. The angular momentum of the planet about the Sun is constant

C. The planet moves with a constant speed around the Sun

D. The areal velocity is $\pi ab / T$

Answer: B

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78. An artificial satellite moving in a circular orbit around the Earth has a total (kinetic + potential) energy E_0. Its potential energy is:

A. $1.5E_0$

B. E_0

C. $2E_0$

D. $-E_0$

Answer: C

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79. A missile is launched with a velocity less than escape velocity. The sum of its kinetic and potential energies is:

A. zero

B. negative

C. positive

D. first(a) then (b)

Answer: B

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80. For a planet having mass equal to mass of the earth and radius is one fourth of radius of the earth. Then which one of the following statements is correct?

A. The escape velocity for this planet will be 11.2 km/sec

B. The escape velocity for this planet will be 5.6 km/sec

C. The escape velocity for this planet will be 22.4 km/sec

D. The escape velocity for this planet will be 44.8 km/sec

Answer: C

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81. Weightlessness in satellite is due to:

A. zero gravitational acceleration

B. zero acceleration

C. zero mass

D. none of these

Answer: A

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82. A body is acted upon by a force towards a point. The magnitude of the force is inversely proportional to the square of the distance. The path of body will be:

A. ellipse

B. hyperbola

C. circle

D. parabola

Answer: A

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83. Which of the following statements is an incorrect statement?

If M_E is the mass of the Earth,

G - Gravitational constant

R_E is the radius of the Earth and

g is acceleration due to gravity the:

A. gravitational field intensity is

$$E = -\frac{GM_E}{m}\overrightarrow{r}$$

B. Relation between g and G is $G = -\frac{gM}{r^2}$

C. Gravitational potential is $V = \frac{GM_E}{R_E}$

D. Time period of a satellite is $T = 2\pi\sqrt{\frac{R_E}{g}}$

Answer: B

View Text Solution

84. Accorrding to Kepler, the period of revolution of a planet (T) and its mean distance from the Sun ® related by the equation.

A. $T^2 r^{-3}$ = constant

B. $T^2 r$ = constant

C. $T^3 r^3$ = constant

D. Tr^3 = constant

Answer: A

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85. The force of gravitation is:

A. repulsive force

B. electrostatic force

C. conservative force

D. non-conservative force

Answer: C

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86. Which of the following pairs is a correct pair with reference to a satellite?

A. Potential energy $= -\dfrac{GmM}{R}$,

Kinetic energy $= \dfrac{GMm}{R+h}$

B. Potential energy $= -\dfrac{GMm}{R+h}$,

Kinetic energy $= \dfrac{GMm}{2(R+h)}$

C. Potential energy = mgh,

Kinetic energy $= \frac{1}{2}mv^2$

D. Potential energy $= -\frac{GM}{R^2}$

Kinetic energy $= \frac{1}{2}\frac{GM}{(R+h)^2}$

Answer: B

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87. The distance of two planets from the Sun are 10^{13} and 10^{12} metres respectively. The ratio of time periods of these two planets is:

A. 100

B. $\sqrt{10}$

C. $10\sqrt{10}$

D. $\frac{1}{\sqrt{10}}$

Answer: C

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88. The period of a planet around Sun is 27 times that of Earth. The ratio of radius if planet's orbit to the radius of Earth's orbit is:

A. 4

B. 9

C. 27

D. 64

Answer: B

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89. A planet moves around the Sun. It is closest to Sun at a distant d_1 and has velocity v_1 and farthest with distance d_2, its speed at this point will be:

A. $\frac{d_1^2 v_1}{d_2^2}$

B. $\frac{d_2 v_1}{d_1}$

C. $\frac{d_1 v_1}{d_2}$

D. $\frac{d_2^2 v_1}{d_1^2}$

Answer: C

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90. Assertion: A planet is a heavenly body revolving around the sun.

Reason: Star is a self-luminous body made up of gaseous material.

Select the correct statement from the following statements.

A. Assertion and reason are true and reason is the correct explanation of assertion.

B. Assertion and reason are true but reason is not the correct explanation of assertion.

C. Assertion is true but reason is false.

D. Assertion is false and reason is true.

Answer: B

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91. Assertion: The earth is slowing down and as a result the moon is coming nearer to it.

Reason: The angular momentum of the earth moon system is not conserved.

Which one of the following statements is a correct staement?

A. Both assertion and reason are true and reason explains assertion correctly.

B. Both assertion and reason are true but reason does not explain assertion correctly.

C. Both assertion and reason are false.

D. Assertion is true but reason is false.

Answer: C

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92. A man waves his arms, while walking. This is due:

A. to keep constant velocity

B. to ease the tension

C. to increase the velociy

D. to balance the effect of Earth's gravity

Answer: D

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93. Two spheres of same size, one of mass 2 kg and another of mass 4 kg are dropped simultaneously from the top of Qutab Minar (height = 72 km) when they are 1 m above the ground, the two spheres have the same:

A. kinetic energy

B. potential energy

C. momentum

D. acceleration

Answer: D

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94. Choose the odd man out from the following laws.

A. Newton's first law of motion

B. Kepler's third law of planetary motion

C. Law of conservation of momentum

D. Law of conservation of energy

Answer: B

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95. The figure shows elliptical orbit of a planet M about the Sun S. The shaded area of SCD is twice the shaded area SAB. If t_1 is the time for the planet to move from C to D and t_2 is the time to move from A to B, then, which one of the following relations is correct?

A. $t_1 = 4t_2$

B. $t_1 > t_2$

C. $t_1 = 2t_2$

D. $t_1 = t_2$

Answer: C

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96. When the elevator is moving uniformly in the upward and then in downward directions, which of the following pairs is a correct pair?

A. Apparent weight = Actual weight and Apparent weight $>$ Actual weight

B. Apparent weight $>$ Actual weight and Apparent weight $<$ Actual weight

C. Apparent weight $>$ Actual weight and

Apparent weight = Actual weight

D. Apparent weight $<$ Actual weight and

Apparent weight $>$ Actual weight

Answer: B

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97. The height at which the acceleration due to gravity becomes $\frac{g}{9}$ (where g = the acceleration due to gravity on the surface of the Earth) in terms of R, the radius of the Earth, is:

A. 2R

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

C. $\sqrt{2}R$

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

Answer: A

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98. Two particles of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

A. $v = \sqrt{\frac{1}{GM}}$

B. $v = \sqrt{\frac{4GM}{R}}$

C. $v = \frac{1}{2}\sqrt{\frac{GM}{R}}$

D. $v = \frac{1}{2R}\sqrt{\frac{1}{GM}}$

Answer: C

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99. A seconds pendulum is mounted in a rocket. Its period of oscillation decreases when the rocket:

A. moves round the Earth in geo-stationary orbit

B. moves up with uniform acceleration

C. comes down with uniform acceleration

D. moves up with a unifrom velocity

Answer: B

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100. Which of the following statements is an incorrect statement?

A. Radius of Moon R_m = 1737 km

B. Radius of Earth R_E = 6436 km

C. Distance between Sun and Venus is 0.38 AU

D. Distance between Sun and Mercury is 0.38 AU

Answer: C

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101. Assertion: The time period of a pendulum on a satellite orbiting the Earth is infinity.

Reasons: Time period of a pendulum is inversely proportional to square root of acceleration due to gravity.

Which of the following statements is correct?

A. Both assertion and reason are true and reason explain assertion correctly.

B. Both assertion and reason are true and reason does not explain assertion correctly.

C. Assertion is true but reason is false.

D. Assertion is false and reason also false.

Answer: A

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102. There are two bodies of masses 1kg and 100 kg separated by a distance 1 m. At what distance from the smaller body, the intensity of gravitational field will be zero?

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

B. $\frac{10}{11}$ m

C. $\frac{1}{10}$ m

D. $\frac{1}{11}$ m

Answer: D

Watch Video Solution

103. A wire of length l and mass m is bent in the form of a semicircle. The gravitational field intensity at the centre of semicircle is:

A. $\frac{Gm}{\pi l}$ along x-axis

B. $\frac{2\pi Gm}{l^2}$ along y-axis

C. $\frac{Gm}{\pi l}$ along y-axis

D. $\frac{2\pi Gm}{l^2}$ along x-axis

Answer: B

Watch Video Solution

104. Two stars of masses m_1 and m_2 are parts of a binary solar system. The radii of their orbits are r_1 and r_2 respectively. The magnitude of the gravitational force m_1 exerts on m_2 is:

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

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

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

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

Answer: A

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105. A spherical planet has a mass M_p and diameter D_p. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity, equal to:

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

B. $\frac{GM_p m}{D_p^2}$

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

D. $\frac{4GM_p m}{D_p^2}$

Answer: A

106. Draw graphs showing the variation of accleeration due to gravity with (a) height above the Earth's surface, (b) depth below the Earth's surface.

A.

B.

C.

D.

Answer: B

Watch Video Solution

107. Two particles of mass m_1 and m_2, approach each other due to their mutual gravitational attraction only. Then:

A. acceleration of the particle of mass m_1 is inversely proportional to m_1

B. acceleration of the particle of mass m_1 is proportional to m_2

C. acceleration of the particle of mass m_1 is proportional to m_1

D. acceleration of both the particles are equal

Answer: B

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108. A planet is moving in an elliptical orbit around the Sun. If T, V, E and L stand respectively for its kinetic energy, gravitational potential energy, total energy and magnitude of angular momentum about the centre of force, then which of the following is correct?

A. V is always positive

B. E is always negative

C. T is conserved

D. L is conserved but direction of vector L changes continuously.

Answer: B

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109. A particle of mass M is situated at the centre of a spherical shell of same mass and radius a. The gravitational potential at a point situated at $\frac{a}{2}$ distance from the centre will be:

A. $\frac{-3GM}{a}$

B. $\frac{-4GM}{a}$

C. $\frac{-2GM}{a}$

D. $\frac{-GM}{a}$

Answer: A

Watch Video Solution

110. Which one of the following statements is incorrect with reference to the weight of an object?

A. The magnitude of weight of an object is W = mg

B. The magnitude of weight is equal to the gravitational force acting on it.

C. The direction of weight of an object is in the direction of gravitational force.

D. The weight of an object is a downward force

Answer: B

Watch Video Solution

111. The kinetic energy needed to project a body of mass m from the Earth surface (radius R) to infinity is:

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

B. $2mgR$

C. mgR

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

Answer: C

Watch Video Solution

112. The mass of the Earth is 6.0×10^{24} kg. The potential energy of a body of mass 50 kg at a distance of 6.3×10^{9} m from the centre of the Earth is:

A. $-3.23 \times 10^{9} J$

B. $-3.19 \times 10^6 J$

C. $-2.5 \times 10^6 J$

D. $-4.0 \times 10^{11} J$

Answer: B

Watch Video Solution

113. A body of mass m falls from earth's surface at a height equal to twice the radius (R) each. Then the change in P.E. of body will be

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

B. $3mgR$

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

D. $2mgR$

Answer: C

Watch Video Solution

114. Assertion: When a satellite is moving in a circular orbit around the Earth, total energy of a satellite, is half of its potential energy.

Reason: The gravitational force obeys the inverse square law of distance.

Select the correct statement of the following.

A. Assertion and reason are true and reason explains assertions correctly.

B. Assertion and reason are true but reason does not explain assertion correctly.

C. Assertion is true but reason is false.

D. Assertion is false but reason is true.

Answer: A

Watch Video Solution

115. Work done is taking a mass from one point to another in a gravitational field depends on:

A. the end points only

B. the path followed

C. the velocity of the mass

D. both the length of the path and the end points

Answer: A

Watch Video Solution

116. Three particles each of mass m are placed at the three corners of an equilateral triangle of side a. The work done on the system to increase the sides of the triangle to 2a is:

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

B. $\frac{3Gm^2}{2a}$

C. $\frac{2Gm^2}{3a}$

D. $\frac{Gm^2}{2a}$

Answer: B

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117. Two small and heavy sheres, each of mass M, are placed at a distance r apart on a horizontal surface. The gravitational potential at the midpoint on the line joining the centre of the spheres is:

A. zero

B. $-\frac{GM}{r}$

C. $-\frac{2GM}{r}$

D. $-\frac{4GM}{r}$

Answer: D

Watch Video Solution

118. The radius and mass of Earth are increased by 0.5%. Which of the following statements is false at the surface of the Earth?

A. g will increase

B. g will decrease

C. escape velocity will remain unchanged

D. potential energy will remain unchanged

Answer: A

Watch Video Solution

119. The velocity of a projectile that must be projected by a rocket so that it escapes earth's gravitation, is independent of:

A. radius of the projectile orbit

B. mass of the projectile only

C. mass of the earth

D. gravitational constant

Answer: B

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120. Select the odd man out from the following parameters.

A. Gravitational force

B. Gravitational potential

C. Electric potential

D. Gravitational potential energy

Answer: C

121. At what height from the surface of Earth the gravitational potential and the value of g are $-5.4 \times 10^7 J \quad kg^{-1}$ and $6.0 ms^{-2}$ respectively? Take the radius of the Earth as 6400 km.

A. 2600 km

B. 1600 km

C. 1400 km

D. 2000 km

Answer: A

Watch Video Solution

122. Two satellites of masses m_1 and $m_2 (m_1 > m_2)$ are moving around the earth in orbits of radii r_1 and $r_2 (r_1 > r_2)$. Which one of the following statements about their velocities is correct?

A. $v_1 > v_2$

B. $v_1 = v_2$

C. $v_1 < v_2$

D. $\frac{v_1}{m_1} = \frac{v_2}{m_2}$

Answer: C

Watch Video Solution

123. A person brings a mass of 1 kg from infinity to a point P. Initially the mass was at rest but it moves at a speed of 2 ms^{-1} as it reaches at P. The work done by the person on the mass is -3 J. The potential at P is:

A. $-2J/kg$

B. $-3J/kg$

C. $-5J/kg$

D. $-7J/kg$

Answer: C

Watch Video Solution

124. A body of mass m is placed on Earth surface which is taken from Earth surface to a height h = 3R, then change in gravitaional potential energy is:

A. $\frac{1}{4}mgR$

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

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

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

Answer: C

Watch Video Solution

125. Which one of the following plots represents the variation of the gravitational field on a particle with distance r due to a thin spherical shell of raduis R? (r is measured from the centre of the spherical shell).

A.

B.

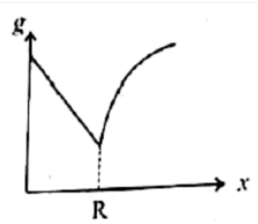
C.

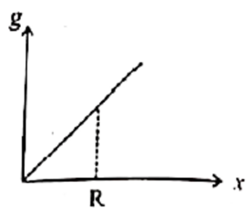
D.

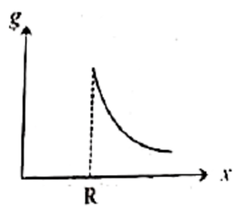
Answer: B

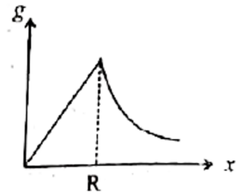
Watch Video Solution

126. Variation of acceleration due to gravity (g) with distance x from the centre of the Earth is best represented by ($R \rightarrow$ Radius of the Earth)

A. 

B. 

C. 

D. 

Answer: D

Watch Video Solution

127. Assertion : If a pendulum is suspended in a lift and lift is falling freely , then its time period becomes infinite .

Reason : Free falling body has acceleration equal to acceleration due to gravity .

A. Both assertion and reason are true and reason explains assertion correctly.

B. Both assertion and reason are true and reason does not explain assertion correctly.

C. Both assertion and reason are false.

D. Assertion is true but reason is false.

Answer: B

Watch Video Solution

128. The gravitational field strength at the surface of a certain planet is g. Which of the following is the gravitational field strength at the surface of a planet with twice the radius and twice of the mass?

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

B. g

C. 2g

D. 4g

Answer: A

Watch Video Solution

129. The gravitational potential energy of a rocket of mass 200kg at a height of 10^7m from the earth's surface is 10^9s. The potential energy of the rocket at a height of 26.4×10^6m from the surface of earth is:

A. $-1.5 \times 10^9 J$

B. $-0.5 \times 10^9 J$

C. $-2.5 \times 10^9 J$

D. $-2 \times 10^9 J$

Answer: B

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130. When a body is taken from poles to equator on the Earth, its weight:

A. decreases

B. increases

C. remains the same

D. increases at South pole and decreases at North pole.

Answer: A

Watch Video Solution

131. If the mass of a body is M on the surface of the Earth, the mass of the same body on the surface of the Moon is:

A. M

B. zero

C. $\frac{M}{6}$

D. 6M

Answer: A

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132. If the K.E. of a satellite revolving around the earth in any orbit is doubled then what will happen to satellite?

A. fall on the earth

B. rotates with a great speed

C. escape out of earth's gravitational field

D. maintain its path

Answer: C

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133. The reading of a spring balance corresponds to 100 N while situated at the North pole and a body is kept on it. The weight recorded on the same scale if it is shifted to the equator (take, $g = 10m/s^2$ and radius of the Earth $R = 6.4 \times 10^6 m$) is:

A. 99.66 N

B. 110 N

C. 97.66 N

D. 106 N

Answer: A

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134. The radii of two planets are respectively R_1 and R_2 and their densities are respectively ρ_1 and ρ_2. The ratio of the accelerations due to gravity (g_1 / g_2) at their surfaces is:

A. $\frac{R_1 \rho_2}{R_2 \rho_1}$

B. $\frac{R_1\rho_1}{R_2\rho_2}$

C. $\frac{\rho_1 R_2^2}{\rho_2 R_1^2}$

D. $\frac{R_1 R_2}{\rho_1\rho_2}$

Answer: B

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135. If the radius of the Earth were to shrink by one percent its mass remaining the same, the acceleration due to gravity on the Earth's surface would _______

A. increase by 2%

B. increase by 1%

C. decrease by 1%

D. decrease by 1/2%

Answer: A

Watch Video Solution

136. What will be the effect on the weight of a body placed on the surface on the Earth, if Earth suddenly stops rotating?

A. no effect

B. weight will increase

C. weight will decrease

D. weight will become zero

Answer: B

Watch Video Solution

137. The value of acceleration due to gravity at the surface of Earth:

A. is maximum at the poles

B. is maximum at the equator

C. remains constant everywhere on the surface on the Earth

D. is maximum at the international timeline

Answer: A

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138. Two satellites of earth S_1 and S_2 are moving in the same orbit. If the mass of S_1 is four times the mass of S_2 then which one of the following statements is true?

A. The potential energies of earth and satellite in both cases are equal.

B. The kinetic energies of two satellites are equal.

C. The time period of S_1 is four times the time period of S_2.

D. Satellites S_1 and S_2 are moving with same speed.

Answer: D

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139. The mass ratio of two planets is 1:5 . They are revolving around the sun in circular paths of radii in the ratio 2:5. The ratio between the values of acceleration due to gravity on their surface is:

A. $2:5$

B. $3:5$

C. $5:2$

D. $5:4$

Answer: D

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

A. 0.11 km s^{-1}

B. 1.1 km s^{-1}

C. 11 km s^{-1}

D. 110 km s^{-1}

Answer: D

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141. The escape velocity of a body depends upon its mass (m) as:

A. m^0

B. m^1

C. m^2

D. m^3

Answer: A

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142. A satellite in free space sweeps stationary interplanetary dust at a rate $dM/dt = \alpha v$ where M is the mass and v is the velocity of the satellite and α is a constant. What is the deceleration of the satellite?

A. $-\alpha v^2$

B. $-\frac{\alpha v^2}{2M}$

C. $-\frac{\alpha v^2}{M}$

D. $-\frac{2\alpha v^2}{M}$

Answer: C

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143. A satellite is revolving in a stable orbit of radius r with orbital velocity v_0 around the earth. The time period of the satellite is T, angular momentum L and its total energy is E.

Then which one of the following statement is not correct?

A. V_0 is directly proportional to $r^{\frac{-3}{2}}$

B. T is directly proportional to $r^{\frac{3}{2}}$

C. L is directly proportional to r^2

D. E is directly proportional to r^{-1}

Answer: A

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144. A planet has the radius twice that of earth and has same density as that of earth. If V_p and V_e are the escape velocities for the planet and earth, then which of the following correct relation is:

A. $V_p = V_e$

B. $V_e = 2V_p$

C. $V_p = 2V_e$

D. $V_p = \sqrt{2}V_e$

Answer: C

Watch Video Solution

145. A satellite is to revolve around the Earth in a circle of radius 8000 km. The speed at which this satellite be projected into an orbit, will be:

A. 3 km/s

B. 16 km/s

C. 7.15 km/s

D. 8 km/s

Answer: C

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146. Assuming density d of a planet to be uniform, we can say that the time period of its artificial satellite is proportional to:

A. d

B. $\sqrt{d}$

C. $\dfrac{1}{\sqrt{d}}$

D. $\dfrac{1}{d}$

Answer: C

Watch Video Solution

147. The time period of a satellite orbiting Earth in a circular orbit is independent of

A. the mass of the satellite

B. radius of its orbit

C. both the mass of satellite and radius of the orbit

D. neither the mass of satellite nor the radius of its orbit.

Answer: A

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148. An Earth satellite is moving around the Earth in circular orbit. In such case, which of the following is conserved?

A. velocity

B. linear momentum

C. angular momentum

D. none of these

Answer: C

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149. The kinetic energy of a satellite is 2 MJ. What is the total energy of the satellite?

A. $-2MJ$

B. $-1MJ$

C. $\frac{-1}{2}MJ$

D. $-4MJ$

Answer: A

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150. The distances of two satellites from the surface of the Earth are 2R and 8R. Their time periods of rotation are in the ratio:

A. $1:7$

B. $1:8$

C. $1:49$

D. $1:7^{3/2}$

Answer: B

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151. Select the correct pair from the following pairs with reference to acceleration due to gravity (g).

A. g is minimum at poles and it is maximum at equator.

B. g is maximum at poles and it is minimum at equator

C. g is maximum at equator and it is minimum at poles

D. g decreases with depth and it increases with height.

Answer: B

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152. 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 compressed to be a black hole?

A. $10^{-9} m$

B. $10^{-6} m$

C. $10^{-2} m$

D. 100m

Answer: C

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153. 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.Then, which one of the following statements is correct?

A. the linear momentum of S remains constant in the magnitude

B. the acceleration of S is always directed towards the centre of the Earth.

C. the angular momentum of S about the centre of the Earth changes in direction, but its magnitude remains constant

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

Answer: B

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154. Where should a geo-stationary satellite be launched?

A. At equator

B. At poles

C. Anywhere

D. None of these

Answer: A

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155. The value of escape velocity on a certain planet is 2 km/s. Then the value of orbital speed for a satellite orbiting close to its surface is:

A. 12 km/s

B. 1 km/s

C. $\sqrt{2}$ km/s

D. $2\sqrt{2}$ km/s

Answer: C

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156. For a satellite moving in an orbit around the earth, the ratio of kinetic energy of potential

A. $1 : \sqrt{2}$

B. $1:2$

C. $2:1$

D. $\sqrt{2}:1$

Answer: B

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157. All the known planets move in:

A. straight path

B. circular path

C. hyperbolic path

D. elliptical path

Answer: D

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158. For a planet moving around the Sun in an elliptical orbit of semimajor and semiminor axes a and b respectively and Time period T.

For this situation which one of the following statements is correct?

A. The torque acting on the planet about the Sun in non-zero

B. The angular momentum of the planet about the Sun is constant

C. The planet moves with a constant speed around the Sun

D. The areal velocity is $\pi ab/T$

Answer: B

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159. An artificial satellite moving in a circular orbit around the Earth has a total (kinetic + potential) energy E_0. Its potential energy is:

A. $1.5E_0$

B. E_0

C. $2E_0$

D. $-E_0$

Answer: C

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160. A missile is launched with a velocity less than escape velocity. The sum of its kinetic and potential energies is:

A. zero

B. negative

C. positive

D. first(a) then (b)

Answer: B

Watch Video Solution

161. For a planet having mass equal to mass of the earth and radius is one fourth of radius of the earth. Then which one of the following statements is correct?

A. The escape velocity for this planet will be 11.2 km/sec

B. The escape velocity for this planet will be 5.6 km/sec

C. The escape velocity for this planet will be 22.4 km/sec

D. The escape velocity for this planet will be 44.8 km/sec

Answer: C

Watch Video Solution

162. Weightlessness in satellite is due to:

A. zero gravitational acceleration

B. zero acceleration

C. zero mass

D. none of these

Answer: A

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Other Important Question Answers Very Short Answer Question

1. Distinguish between the terms gravitation and gravity.

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2. Distinguish between Geocentric model and Heliocentric model.

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3. What is free fall of a body ?

Watch Video Solution

4. What are the values of g and G at the centre of the earth?

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Watch Video Solution

5. Does the escape velocity depend on the location from where it is projected?

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6. Calculate the gravitational potential near the surface of the Earth.

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7. Does the acceleration with which a body falls towards the centre of the earth depend on the mass of the body?

Watch Video Solution

8. Explain how the mass of the Earth can be estimated from the knowledge of G?

Watch Video Solution

9. On what factors the value of "g" at any place on the Earth depends?

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10. What is the gravitational field strength of a planet where the weight of a 60kg astronaut is 300N?

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11. How much will be the weight of the object at the centre of the Earth?

Watch Video Solution

12. At the centre of the earth, does a simple pendulum oscillate?

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13. What is the use of measuring 'g' accurately on Earth surface?

Watch Video Solution

14. What is satellite?

Watch Video Solution

15. Draw a graph showing the variation of 'g' with distance from the centre of the Earth.

Watch Video Solution

16. Distinguish between natural and artificial satellite.

Watch Video Solution

17. A satellite revolving around the earth loses height. What happens to its time period?

Watch Video Solution

18. What is the relation between escape and orbital velocity?

Watch Video Solution

19. State the condition for satellite to be geostationary.

Watch Video Solution

20. At what circumstances weightlessness arise?

Watch Video Solution

21. What do you understand by the term 'epicycle' in geocentric theory?

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22. Distinguish between the terms gravitation and gravity.

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Watch Video Solution

27. What is the maximum number of electrons in the 'n' th orbit?

Watch Video Solution

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42. At what circumstances weightlessness arise?

Watch Video Solution

43. What do you understand by the term 'epicycle' in geocentric theory?

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Other Important Question Answers Short Answer Questions

1. Define 'G'. What are the units and dimensions of 'G' ?

Watch Video Solution

2. Two satellites are at different heights from the surface of earth. Which would have greater velocity?

Watch Video Solution

3. What is the gravitational field strength of a planet where the weight of a 60kg astronaut is 300N?

Watch Video Solution

4. A satellite does not need any fuel to move around the earth. Give reason.

Watch Video Solution

5. When a comet orbits the sun in highly elliptical orbit does a comet have a constant linear velocity?

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6. What is 'retrograde motion' of planets?

Watch Video Solution

7. On what factors does escape speed depends on?

Watch Video Solution

8. Does the escape speed depends on the direction in which object is thrown?

Watch Video Solution

9. Important points to remember

Watch Video Solution

10. What is meant by superposition of gravitational field?

Watch Video Solution

11. State the condition in which gravitational potential energy is said to be (i) Negative, (ii) Positive.

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12. Why hydrogen an helium are not found in abudance on the Earth's atmosphere?

Watch Video Solution

13. Derive the expression for gravitational potential energy.

Watch Video Solution

14. Why do we have seasons on Earth?

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Watch Video Solution

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Watch Video Solution

23. State the important points to be remembered in gravitational field.

Watch Video Solution

24. What is meant by superposition of gravitational field?

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Watch Video Solution

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Other Important Question Answers Long Answer Questions

1. Prove that gravitational field intensity at any point in equal to acceleration experienced at that point.

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2. Using Newton's law of gravitation, prove Kepler's III^{rd} law of planetary motion for circular orbits.

Watch Video Solution

3. Derive an expression for orbital velocity of the satellite.

Watch Video Solution

4. A man of mass "m" is standing on the floor of the lift. Find his apparent weight when:

(i) elevator is rest

(ii) elevator is accelerating upwards

(iii) elevator is accelerating downwards.

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5. Find the distance between Venus and Sun.

Watch Video Solution

6. Prove that gravitational field intensity at any point in equal to acceleration experienced at that point.

Watch Video Solution

Watch Video Solution

7. Using Newton's law of gravitation, prove Kepler's III^{rd} law of planetary motion for circular orbits.

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Watch Video Solution

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Watch Video Solution

Other Important Question Answers Numerical Problems

1. A satellite revolves round a planet in an elliptical orbit. Its maximum and minimum distance from planet are 1.5×10^7 metre and 0.5×10^7 metre respectively. If the speed of the satellite at the farthest point is $5 \times 10^3 m/s$. Calculate the speed at the nearest point.

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2. At what height from the surface of Earth the gravitational force will be reduced by 10% if the radius of Earth is 6400 km?

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3. Two particles of equal mass m go round a circle of radius R under the action of their mutual gravitational attraction. The speed of each particle is

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4. On a planet whose size is the same and mass 4 times as that of the Earth, find the amount of energy needed to lift a 2 kg mass vertically upwards through a distance 3 m of the planet. (value of g on the surface of th Earth is $10m/\sec^2$).

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5. If a planet were suddenly stopped in its circular orbit, how much time it would take to fall onto the Sun. Assume the planets time-period of revolution as T.

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6. An apple of mass 250 g falls from a tree. Calculate the acceleration of Earth towards the apple.

Mass of the Earth $= 5.983 \times 10^{24} kg$

Radius of the Earth $= 6.378 \times 10^{6} m$ and $G = 6.67 \times 10^{-11} Nm^{2} kg^{-2}$

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7. If the radius of the Earth were increased by a factor 5, by what factor would its density have to be changed to keep the value of acceleration due to gravity the same?

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8. Find the percentage decrease in the weight of the body when taken to a height of 16 km above the surface of Earth. Radius of the Earth is 6400 km.

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9. Determine the speed with which the Earth would have to rotate on is axis. So that a person on the equator would weigh $\frac{3^{th}}{5}$ as much as at present. Take the equatorial radius as 6400 km. $g = 9.8m / s^2$

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10. At a point above the surface of Earth, the gravitational potential is $-5.12 \times 10^7 Jkg^{-1}$ and the acceleration due to gravity is $6.4ms^{-2}$.

Assuming the mean radius of the Earth to be 6400 km, calculate the height of this point above the Earth's surface.

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11. A remote sensing satellite of the Earth revolves in a circular orbit at a height of 250 km above the Earth's surface. What is the (i) Orbital speed and (ii) period of revolution of the satellite. Radius of the Earth, $R = 6.38 \times 10^6 m$, and acceleration due to gravity on the surface of the Earth, $g = 9.8ms^{-2}$

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12. A body of mass 100 kg falls on the Earth from infinity. What will be its velocity on reaching the Earth? What will be its K.E. ? Radius of the Earth is 6400 km and $g = 9.8ms^{-2}$

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13. What is the relation between height h and depth d for the same change in g?

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14. A satellite orbits the earth at a height of 500km from its surface.

Mass of the earth $= 6 \times 10^{24} kg$

Radius of the earth $= 6.4 \times 10^{6} m$

Mass of the satellite = 300kg

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

Calculate (i) kinetic energy (ii) potential energy and (iii) total energy of the satellite.

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15. A satellite revolves round a planet in an elliptical orbit. Its maximum and minimum distance from planet are 1.5×10^7 metre and 0.5×10^7 metre respectively. If the speed of the satellite at the farthest point is $5 \times 10^3 m/s$. Calculate the speed at the nearest point.

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22. Find the percentage decrease in the weight of the body when taken to a height of 16 km above the surface of Earth. Radius of the Earth is 6400 km.

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26. A body of mass 100 kg falls on the Earth from infinity. What will be its velocity on reaching the Earth? What will be its K.E. ? Radius of the Earth is 6400 km and $g = 9.8ms^{-2}$

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Mass of the satellite = 300kg

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Calculate (i) kinetic energy (ii) potential energy and (iii) total energy of the satellite.

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Other Important Question Answers Conceptual Questions

1. Why a body weighs less at the equator than at the poles?

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2. Where does a body weigh less? At the sea level or on the mountains?

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3. Why do you feel giddy while moving on Raatinam (or) Carrousel?

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4. Explain why one can jump higher on the surface of the Moon than that on the Earth.

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5. A planet revolves in an elliptical orbit around the Sun. The semi-major and semi-minor axis are A and B. How time-period is related with them?

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6. If Earth be at one fourth its present distance from the Sun, how many days will there be in a year?

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7. State Newtons Universal law of gravitaion.

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8. Why does the gravitational potential energy U(r) is always negative?

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9. What happens to the acceleration due to gravity on account of rotation?

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10. Under what condition, the gravitational potential energy of a body will be zero?

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11. Can we determine the gravitational mass of a body inside an artificial satellite?

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12. Mention the factors which determine whether a planet would have an atmosphere or not.

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13. If the Earth stops rotating about its axis, then by what value will the acceleration due to gravity change at the equator?

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14. A hippopotamus and a frog are to be projected out of Earth into space. Do we need different velocities to do so?

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15. Tides arise in the ocean. Give reason.

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16. Why does an astronaut in a spacecraft feel weightlessness?

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17. Where does the weight of a body become zero?

Watch Video Solution

18. Why a body weighs less at the equator than at the poles?

Watch Video Solution

19. Where does a body weigh less? At the sea level or on the mountains?

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23. If Earth be at one fourth its present distance from the Sun, how many days will there be in a year?

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24. Why is Newton's law of gravitation called a universal law?

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25. Why does the gravitational potential energy U(r) is always negative?

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30. If the Earth stops rotating about its axis, then by what value will the acceleration due to gravity change at the equator?

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31. A hippopotamus and a frog are to be projected out of Earth into space. Do we need different velocities to do so?

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32. Tides arise in the ocean. Give reason.

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33. How does an astronaut float in a space shuttle ?

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34. Where does the weight of a body become zero?

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