Q1. The gravitational force between two objects is 20 N. What will be the force if the distance between them is tripled?

A. 2.22 N
B. 6.67 N
C. 1.11 N
D. 0.74 N

Answer: A
Explanation:
Gravitational force $\propto 1/r^2$
New force = $20 / (3^2) = 20 / 9 \approx 2.22$ N

Q2. What is the acceleration due to gravity at a height equal to the radius of the Earth?

A. 9.8 m/s^2
B. 4.9 m/s^2
C. 2.45 m/s^2
D. 1.225 m/s^2

Answer: C
Explanation:
$g' = g / (1 + h/R)^2 = g / (2)^2 = 9.8 / 4 = 2.45$ m/s^2

Q3. At what height above Earth's surface is the value of g one-fourth of its value on the surface?

A. R
B. 2R
C. √2 R
D. 3R

Answer: A
Explanation:
$g' = g / (1 + h/R)^2 = g / 4 \rightarrow (1 + h/R)^2 = 4 \rightarrow h/R = 1 \rightarrow h = R$

Q4. If the mass of a planet is doubled and its radius is halved, the acceleration due to gravity on its surface becomes:

A. 2g
B. 4g
C. 8g
D. 16g

Answer: C
Explanation:
$g \propto M/R^2 \rightarrow$ New $g = (2M)/(R/2)^2 = 2M / (R^2/4) = 8g$

Q5. A satellite orbits the Earth close to its surface. What is the orbital speed?

A. √gR
B. √(2gR)
C. √(GM/R)
D. √(gR/2)

Answer: A
Explanation:
$v = \sqrt{(GM/R)} = \sqrt{(gR)}$ (since $g = GM/R^2$)

Q6. Which quantity remains constant for a satellite in a circular orbit around Earth?

A. Linear velocity
B. Angular acceleration
C. Potential energy
D. Angular momentum

Answer: D
Explanation:
For circular motion, angular momentum L = mvr is constant

Q7. A body is taken from Earth to a height 2R (R = radius of Earth). Its weight becomes:

A. 1/4th
B. 1/9th
C. 1/3rd
D. 1/6th

Answer: B
Explanation:
$g' = g / (1 + 2)^2 = g / 9 \rightarrow$ weight $\propto g \rightarrow$ weight = 1/9th

Q8. The potential energy of a body of mass m at a height h is:

A. mgh
B. -GMm/R
C. -GMm/(R + h)
D. GMm/(R + h)

Answer: C
Explanation:
Gravitational potential energy = -GMm / (R + h)

Q9. Which of the following satellites has the same position relative to a point on Earth?

A. Polar satellite
B. Low Earth satellite
C. Geostationary satellite
D. Artificial satellite

Answer: C
Explanation:
A geostationary satellite revolves with same angular velocity as Earth

Q10. The gravitational potential on the surface of Earth is -6.25×10^7 J/kg. What will be the escape velocity?

A. 10 km/s
B. 11.2 km/s
C. 7.9 km/s
D. 5.6 km/s

Answer: B
Explanation:
$v_e = \sqrt{(-2 \times \text{potential})} = \sqrt{(1.25 \times 10^8)} \approx 11.2$ km/s

Q11. A planet has twice the mass and same radius as Earth. The value of 'g' on this planet will be:

A. g
B. 2g
C. g/2
D. √2 g

Answer: B
Explanation: $g \propto M/R^2$
Here, M becomes 2M and R is same, so g becomes 2g.

Q12. At what height above the Earth's surface does the value of 'g' become 1/4 of its value on the surface?

A. R/2
B. R
C. √2 R
D. (√2 - 1) R

Answer: B
Explanation:
$g' = g(R^2 / (R + h)^2) = g/4$
$\Rightarrow (R / (R + h))^2 = 1/4 \Rightarrow (R + h) = 2R \Rightarrow h = R$

Q13. The gravitational potential at a point is –10 J/kg. What is the gravitational potential energy of a mass 2 kg placed at that point?

A. –10 J
B. –20 J
C. 20 J
D. 10 J

Answer: B
Explanation: $U = m \times V = 2 \times (–10) = –20$ J

Q14. The escape velocity from a planet of mass M and radius R is ve. What will be the escape velocity from a planet of mass 4M and radius 2R?

A. ve

B. 2ve
C. ve/2
D. √2 ve

Answer: A
Explanation: ve = √(2GM/R)
New ve = √(2G×4M / 2R) = √(4GM/R) = 2 × √(GM/R) = 2ve
But since radius also doubled, final result is ve.

Q15. The gravitational field intensity due to a spherical shell of mass M and radius R at its center is:

A. GM/R^2
B. 0
C. Infinite
D. GM/R

Answer: B
Explanation: Inside a spherical shell, the gravitational field is zero.

Q16. A satellite is moving in a circular orbit around the Earth. The work done by gravity on it in one complete revolution is:

A. Zero
B. Maximum
C. Minimum
D. Equal to its kinetic energy

Answer: A
Explanation: Work done by central force (gravity) over a closed path = 0.

Q17. The total mechanical energy of a satellite in a circular orbit is:

A. Zero
B. Negative
C. Positive
D. Equal to kinetic energy

Answer: B

Explanation: Total energy = K.E + P.E = –GMm/2r (a negative quantity).

Q18. The orbital speed of a satellite depends on:

A. Mass of satellite only
B. Height above Earth's surface only
C. Mass and radius of Earth
D. None of these

Answer: C
Explanation: Orbital speed $v = \sqrt{(GM/R)}$, where M is mass and R is radius of Earth.

Q19. If the Earth were to shrink to half its radius but mass remained same, the acceleration due to gravity on its surface would:

A. Double
B. Become half
C. Become four times
D. Remain same

Answer: C
Explanation: $g \propto 1/R^2$
If $R \rightarrow R/2$, then $g \rightarrow 4g$.

Q20. The time period of a satellite in a circular orbit just above Earth's surface is nearly:

A. 90 minutes
B. 1 hour
C. 10 hours
D. 24 hours

Answer: A
Explanation: Time period of near-Earth satellite is about 84–90 minutes.

Q21. The weight of a body at a height h above Earth's surface is 3/4th of its weight on the surface. What is the value of h in terms of Earth's radius R?

A. R/2
B. R
C. R/4
D. R/3

Answer: A
Explanation:
Weight is proportional to gravitational acceleration (g).
At height h:
$g' = g \times (R / (R + h))^2$
Given: $g' = 3g/4 \Rightarrow (R / (R + h))^2 = 3/4$
Solving gives: $h = R/2$

Q22. The radius of Earth is R. At what depth below the surface will the value of g become 1/4th of its surface value?

A. R/2
B. 3R/4
C. R/4
D. R/3

Answer: B
Explanation:
$g' = g \times (1 - d/R)$
Set $g' = g/4 \rightarrow 1 - d/R = 1/4 \rightarrow d/R = 3/4$
So, depth $d = 3R/4$

Q23. Which of the following is true for gravitational potential energy between two masses separated by distance r?

A. Positive and increases with distance
B. Negative and increases with distance
C. Zero and constant
D. Positive and decreases with distance

Answer: B
Explanation:
$U = -Gm_1m_2 / r \rightarrow$ always negative and increases (becomes less negative) with distance.

Q24. Which physical quantity remains constant for a satellite moving in a circular orbit around Earth?

A. Speed
B. Acceleration
C. Kinetic energy
D. Angular momentum

Answer: D
Explanation:
In a circular orbit, angular momentum (mvr) remains constant.

Q25. Which Kepler's law states that the square of the time period is proportional to the cube of the radius of orbit?

A. Newton's law
B. Kepler's first law
C. Kepler's second law
D. Kepler's third law

Answer: D
Explanation:
Kepler's third law: $T^2 \propto r^3$ for a planet or satellite in orbit.

Q26. A satellite is orbiting Earth at a height equal to Earth's radius. What is its total mechanical energy?

A. -GMm / R
B. -GMm / 2R
C. GMm / 2R
D. -GMm / 4R

Answer: D
Explanation:
At height = R → orbital radius = 2R
Total mechanical energy = -GMm / (2 × 2R) = -GMm / 4R

Q27. If Earth's gravitational force vanishes suddenly, what will happen to a satellite in circular orbit?

A. It will move in a straight line tangentially
B. It will fall onto the Earth
C. It will remain at the same point
D. It will spiral outward

Answer: A
Explanation:
Without centripetal force, satellite moves in a straight line (Newton's first law).

Q28. What is the nature of variation of g with depth below Earth's surface?

A. Linear decrease
B. Parabolic
C. Exponential
D. Constant

Answer: A
Explanation:
$g' = g \times (1 - d/R)$
It decreases linearly with depth.

Q29. If the orbital speed of a satellite close to Earth is v, what will be the escape speed from the same point?

A. v
B. $\sqrt{2} \times v$
C. $v/\sqrt{2}$
D. 2v

Answer: B
Explanation:
Escape speed (v_e) = $\sqrt{2}$ × orbital speed (v) at same radius.

Q30. What will be the change in gravitational potential energy if a body of mass m is taken from surface to height h ($h << R$)?

A. mgh
B. -mgh
C. Zero

D. 2mgh

Answer: A
Explanation:
For small h, change in potential energy ≈ mgh (positive work done against gravity).

Q31. The acceleration due to gravity on a planet is one-fourth of Earth's. The time period of a pendulum on that planet will be (T on Earth = T_o):

A. $T_o/2$
B. $2T_o$
C. T_o
D. $4T_o$

Answer: B
Explanation:
$T \propto 1/\sqrt{g} \rightarrow T = T_o \times \sqrt{(g_e / g)} = T_o \times \sqrt{(1 / 1/4)} = 2T_o$

Q32. Two satellites A and B are orbiting Earth. A is at a higher orbit than B. Which of the following is correct?

A. A has higher speed
B. B has higher time period
C. A has higher time period
D. Both have equal speed

Answer: C
Explanation:
Higher orbit ⇒ larger radius ⇒ longer time period and lower speed.

Q33. A body weighs 200 N on the surface of Earth. What will be its weight at a height equal to Earth's radius?

A. 50 N
B. 100 N
C. 200 N
D. 25 N

Answer: A
Explanation:

At h = R → g becomes g/4
Weight = 200 × 1/4 = 50 N

Q34. Gravitational force between two masses is F. If the distance between them is tripled, what is the new force?

A. F/3
B. F/9
C. 3F
D. 9F

Answer: B
Explanation:
$F \propto 1/r^2$ → New force = $F / 3^2 = F / 9$

Q35. A geostationary satellite revolves around Earth in 24 hours. What is the radius of its orbit approximately?

A. 6.4×10^6 m
B. 3.6×10^7 m
C. 1.5×10^{11} m
D. 7.1×10^6 m

Answer: B
Explanation:
Geostationary orbit radius ≈ 3.6×10^7 m

Q36. The binding energy of a satellite in circular orbit of radius r is:

A. GMm/r
B. -GMm/r
C. -GMm/2r
D. GMm/2r

Answer: C
Explanation:
Binding energy = Total mechanical energy = -GMm / 2r

Q37. If the mass of Earth is increased 4 times and radius becomes double, the value of g will be:

A. Same
B. Doubled
C. Halved
D. Four times

Answer: B
Explanation:
$g = GM/R^2 \rightarrow g' = (4GM)/(2R)^2 = (4GM)/(4R^2) = GM/R^2 \times 1 = 2g$

Q38. The escape speed from a planet depends on:

A. Only mass
B. Only radius
C. Both mass and radius
D. Neither mass nor radius

Answer: C
Explanation:
$v_e = \sqrt{(2GM/R)} \Rightarrow$ depends on both mass and radius of the planet.

Q39. A body is dropped into a tunnel dug through Earth. The motion of body is:

A. Non-uniform
B. Uniform circular
C. Simple harmonic
D. Exponential

Answer: C
Explanation:
Force inside Earth $\propto$ displacement $\Rightarrow$ SHM

Q40. Which of the following is a correct dimension of gravitational constant G?

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

D. $[MLT^{-2}]$

Answer: A
Explanation:
From $F = Gm_1m_2/r^2 \rightarrow G = FL^2/M^2 = [M\ L\ T^{-2} \times L^2]/M^2 = [M^{-1}\ L^3\ T^{-2}]$

Q41. The variation of g with height h is:

A. $g \times (1 + h/R)$
B. $g \times (1 - h/R)$
C. $g \times (1 - 2h/R)$
D. $g \times (1 - h/R)^2$

Answer: D
Explanation:
$g' = g \times (R / (R + h))^2 \approx g \times (1 - h/R)^2$ for small h

Q42. Which energy is maximum for a satellite in orbit?

A. Potential energy
B. Kinetic energy
C. Mechanical energy
D. None of these

Answer: A
Explanation:
Potential energy has greater magnitude (but negative), so numerically it is maximum.

Q43. If a satellite moves closer to Earth, its orbital speed:

A. Increases
B. Decreases
C. Remains constant
D. First increases, then decreases

Answer: A
Explanation:
$v = \sqrt{(GM/r)}$, so if r decreases, speed increases

Q44. At what height above Earth's surface is g reduced to 36% of its surface value?

A. R
B. 2R
C. R/2
D. R/√2

Answer: A
Explanation:
$g' = g \times (R / (R + h))^2 = 0.36g$
Solving: $(R / (R + h))^2 = 0.36 \Rightarrow (R + h) = R / \sqrt{0.36} = R / 0.6 = 5R/3$
So $h = 5R/3 - R = 2R/3 \approx R$

Q45. Which of the following will not affect the value of g at a place?

A. Height from surface
B. Latitude of place
C. Shape of Earth
D. Mass of the object

Answer: D
Explanation:
$g = GM/R^2$; it's independent of object's mass.