CBSE

GRAVITATION WS 2

Class 09 - Science

Section A

1. At a place, value of g is less by 1% than its value on the surface of the Earth (Radius of Earth = 6400 km). The place is **[1]**

   a) 64 km below the surface of the Earth
   b) 32 km below the surface of the Earth
   c) 64 km above the surface of the Earth
   d) 30 km above the surface of the Earth

2. Acceleration due to gravity is **[1]**

   a) All of these
   b) Inversely proportional to square of radius for all points on the surface of the planet.
   c) Dependent directly on the radius of the planets under comparison are made of same material.
   d) Dependent on mass of the planet for points outside the planet.

3. Which of the following is not correct? **[1]**

   i. If we drop a 10 lb iron ball and 1 lb aluminium ball from the top of a high platform inside a mine, then both will reach the floor at the same time.
   ii. The gravitational force of attraction between the two bodies increases when their masses are increased and distance is reduced.
   iii. We do not observe small objects moving towards each other because frictional force balances the gravitational pull.
   iv. When a body is thrown up, the acceleration due to gravity at the topmost point is zero because velocity of the body is zero.

   a) Statement (iv) is correct.
   b) Statement (iii) is correct.
   c) Statement (ii) is correct.
   d) Statement (i) is correct.

4. A stone dropped from a certain height takes 4 second to reach the ground. The height is **[1]**

   a) 19.6 m
   b) 39.2 m
   c) 78.4 m
   d) 156.8 m

5. The height at which the acceleration due to gravity becomes $\frac{g}{9}$ in terms of R, where g is the acceleration due to gravity on the surface of the Earth is (R is the radius of the Earth) **[1]**

   a) $\frac{R}{2}$
   b) $\frac{R}{\sqrt{2}}$
   c) 2R
   d) $\sqrt{\frac{2}{R}}$

6. A ball is thrown up and attains a maximum height of 100 m. It is thrown upwards with a speed of **[1]**

   a) $9.8\ ms^{-1}$
   b) $19.69\ ms^{-1}$

c) 98 ms^{-1}

d) 44.2 ms^{-1}

7. A ball is thrown vertically upward, acceleration due to gravity is **[1]**

a) In the direction same as the direction motion.

b) In the direction opposite to the direction of motion.

c) Increases as it comes down.

d) Becomes zero at the highest point.

8. If the earth stops rotating the value of 'g' at the equator will **[1]**

a) Fall

b) remain same

c) decrease

d) increase

9. Acceleration due to gravity on the surface of the earth is the greatest **[1]**

a) uniform at all places

b) at equator

c) at poles

d) at 23.6^o latitude

10. Two bodies, one held 1 m vertically above the other, are released simultaneously and fall freely under gravity. After 2 second, the relative separation of the bodies will be **[1]**

a) 4.9 m

b) 19.6 m

c) 9.8 m

d) 1 m

11. A ball is released from the top of a tower of height h metres. It takes T seconds to reach the ground. What is the position of ball above the ground in $\frac{T}{5}$ seconds? **[1]**

a) $\frac{24}{25}h$ m

b) $\frac{h}{25}$ m

c) 25 hm

d) 24 hm

12. Variation of acceleration due to gravity g with distance r from the centre of earth with ($r > R_e$) is best given as **[1]**

a) $g \propto r^2$

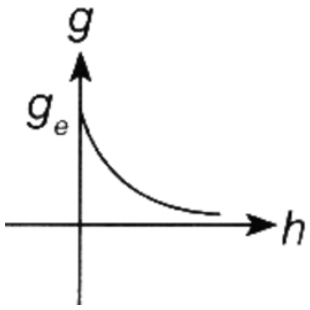
b) $g \propto r$

c) $g \propto \frac{1}{r}$

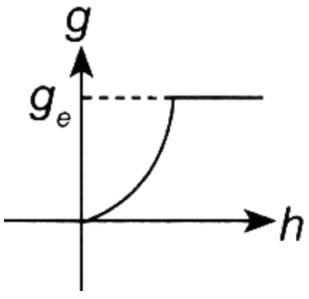
d) $g \propto \frac{1}{r^2}$

13. Which of the following graphs shows an approximate variation of g with height h above the Earth's surface? **[1]**

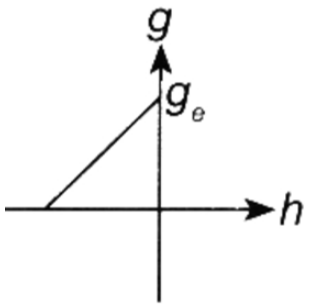
a)



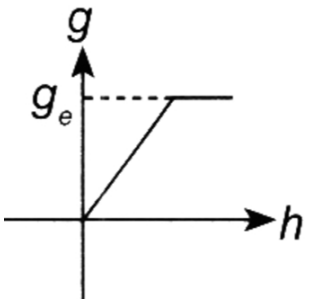
b)



c)



d)



14. Acceleration due to gravity on the surface of the moon is $\frac{1}{6}$th of its value on the surface of the earth as they have **[1]**

different

a) radius
b) All of these
c) density
d) mass

15. A stone is dropped from the top of the tower. Its speed after it has fallen 20 m is (Take g = $10ms^{-1}$) **[1]**

a) $30\ ms^{-1}$
b) $20\ ms^{-1}$
c) $-\ 10\ ms^{-1}$
d) $10\ ms^{-1}$

16. A body at rest having uniform acceleration is **[1]**

a) possible only near the sun.
b) any body thrown vertically up against gravity.
c) can be released only on the moon.
d) non-existing

17. In vacuum all freely falling objects **[1]**

a) have the same acceleration
b) have the same velocity
c) have the same speed
d) have the same force

18. The value of acceleration due to gravity **[1]**

a) increases from pole to equator
b) is least on equator
c) is same on equator and poles
d) is least on poles

19. Acceleration due to gravity (due to the shell) at any point inside the shell is **[1]**

a) zero as long as no other mass is outside the shell.
b) cannot be found
c) zero always
d) zero as long as no other mass is inside.

20. Acceleration due to gravity varies with **[1]**

a) shape of the planet
b) All of these
c) height
d) depth

21. When a spaceship is two earth radii distant from the centre of the earth, its gravitational acceleration is **[1]**

a) $4.9\ ms^{-2}$
b) $19.6\ ms^{-2}$
c) $2.45\ ms^{-2}$
d) $9.8\ ms^{-2}$

22. An apple and a stone dropped from certain height accelerates **[1]**

a) depending on density
b) depends on the position of the SUN
c) equally
d) differently

23. **Assertion (A):** The value of acceleration due to gravity changes with the height, depth and shape of the earth. **[1]**
Reason (R): Acceleration due to gravity is zero at the centre of the earth.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

24. **Assertion (A):** A sheet of paper falls slower, than one that is crumpled into a ball. **[1]**

Reason (R): Sheet of paper has lesser weight than that is crumpled into a ball.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

25. **Assertion (A):** The acceleration experienced by an object during free fall is dependent on its mass. **[1]**
Reason (R): All objects hollow or solid, big or small, should fall at the same rate.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

26. **Assertion (A):** The falling of a body from a height towards the earth under its gravitational force is called free fall. **[1]**
Reason (R): Whenever objects fall towards the earth under gravitational force, we say that the objects are in free fall.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

27. **Assertion (A):** The value of the acceleration due to gravity g on earth depends upon the average density of the earth. **[1]**
Reason (R): It is the radius of the earth which determines the value of the g.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

28. **Assertion (A):** At the centre of earth, a body has a centre of mass but no centre of gravity. **[1]**
Reason (R): Acceleration due to gravity at the centre of the earth is zero.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

29. **Assertion (A):** If we drop a stone and a sheet of paper from a balcony of first floor, then stone will reach the ground first. **[1]**
Reason (R): The resistance due to air depends on velocity only.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

30. What do you mean by free fall? **[1]**

31. What is weightlessness? **[1]**

32. Two objects of masses m_1 and m_2 are dropped in vacuum from a height above the surface of the earth (m_1 is greater than m_2). Which one will reach the ground first and why? **[1]**

33. What is the acceleration of free fall? **[1]**

Section B

34. A stone dropped from the roof of a building takes 4s to reach the ground. Calculate the height of the building. **[2]**

35. A boy on a cliff 49 m high drops a stone. One second later, he throws a second stone after the first. They both hit the ground at the same time. With what speed did he throw the second stone? **[2]**

36. On the earth, a stone is thrown from a height in a direction parallel to the earth's surface while another stone is simultaneously dropped from the same height. Which stone would reach the ground first and why? **[2]**

37. A ball is dropped from the top of a tower 40 m high. What is its velocity when it has covered a distance of 20 m? We would be its velocity when it hits the ground? (Take g = 10 ms^{-2}) **[2]**

38. Calculate the value of acceleration due to gravity g using the relation between g and G. **[2]**

39. A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate **[2]**
    (i) the maximum height to which it rises,
    (ii) the total time it takes to return to the surface of the earth.

40. A ball is thrown up with a speed of 0.5 m/s. **[2]**
    i. How high will it go before it begins to fall?
    ii. How long will it take to reach that height?

41. A stone is dropped from the edge of a roof. It passes a window 2 metre high in 0.1 second. How far is the roof above the top of the window? **[2]**

42. Two objects A and B begin a free fall from rest from the same height 1.00 s apart. How long after A was dropped will A and B be 10 m apart? **[2]**

43. A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 m/s. Calculate when and where the two stones will meet. **[2]**

44. A stone is thrown vertically upward with an initial velocity of 40 m/s. Taking $g = 10m/s^2$, find the maximum height reached by the stone. What is the net displacement and the total distance covered by the stone? **[2]**

45. An object is thrown vertically upwards and rises to a height of 10 m. Calculate **[2]**
    i. the velocity with which the object was thrown upwards and
    ii. the time taken by the object to reach the highest point.

46. A firecracker is fired and it rises to a height of 1000 m. Find the **[2]**
    i. velocity by which it was released.
    ii. time taken by it to reach the highest point. (Take, g = 9.8 m/s^2)

47. How does the weight of an object vary with respect to the mass and radius of the earth? In a hypothetical case, if the diameter of the earth becomes half of its present value and its mass becomes four times of its present value, then how would the weight of any object on the surface of the earth be affected? **[2]**

48. On the moon's surface, the acceleration due to gravity is 1.67 ms^{-2}. If the radius of the moon is 1.74×10^6 m, calculate the mass of the moon. **[2]**

49. Prove that if a body is thrown vertically upwards then the time of ascent is equal to the time of descent. **[2]**

50. Calculate the average density of the earth in terms of g, G and R. **[2]**

51. An object is thrown vertically upwards and rises to a height of 13.07 m. Calculate **[2]**
    i. the velocity with which the object was thrown upwards.
    ii. the time taken by the object to reach the highest point.

52. A ball is thrown vertically upwards with a velocity 'u'. Calculate the velocity with which it falls to the earth **[2]**

again.

53. A ball is thrown vertically upwards with a velocity of 49 ms^{-1}. Calculate:i) the maximum height to which it rises.ii) the total time it takes to return to the surface of the earth. **[2]**

54. Two bodies of masses 3 kg and 12 kg are placed at a distance 12 m. A third body of mass 0.5 kg is to be placed at such a point that the force acting on this body is zero. Find the position of that point. **[2]**

55. Why will a sheet of paper fall slower than one that is crumpled into a ball? **[2]**

56. What do you mean by acceleration due to gravity? **[2]**

Section C

57. **State True or False:** **[3]**
    (a) During free fall, there is no change in the direction of motion of the object, but the magnitude of the velocity of the falling object changes. **[1]**
    (b) The falling of a body from a height towards the earth under its gravitational force is called free fall. **[1]**
    (c) The value of **g** is minimum on the surface of the earth. **[1]**

58. A coconut is hanging on a tree at a height of 15 m from the ground. A boy launches a projectile vertically upward with a velocity of 20 ms^{-1}. After what time, the projectile will pass by the coconut. Explain the two answers that you get in this problem. (Take g = 10 ms^{-2}) **[3]**

59. A boy on a cliff 49m high, drops a stone to the ground.One second later, he throws another stone vertically downwards. The two stones hit the ground at the same time. What was the velocity with which the second stone was thrown? **[3]**

60. The radius of the earth is about 6370Km. An object of mass 30Kg is taken to a height of 230Km above the surface of the earth. **[3]**
    i. What is the mass of the body?
    ii. What is the acceleration to gravity at this height?
    iii. What is the weight of the body at this height?

61. A ball is thrown vertically upwards. The speed of the ball was 10m/s when it had reached one half of its maximum height. **[3]**
    i. How high does the ball rise?Take g= 10ms^2
    ii. Find the velocity and acceleration 1s after it is thrown.

62. A stone is dropped from a height of 50m on earth. At the same time, another stone is thrown vertically upwards from the ground with a velocity up wards from the ground with a velocity of 50m/s. At what height from the ground will the two stones meet (g = -10 m/s^2) **[3]**

63. A ball is dropped from the jumping board of a swimming pool, which is at a height of 20 m. A second ball is thrown from the same board after one second with initial velocity u. If both the balls hit the water together, calculate the initial velocity of second ball. Do they hit the ground at the same time? (Take g = 10 ms^{-2}) **[3]**

64. A ball thrown up vertically returns to the tower after 6 s. Find **[3]**
    i. the velocity of the ball with which it was thrown up,
    ii. the maximum height it reaches, and
    iii. the position of the ball after 4 s.

65. A ball thrown up vertically returns to the thrower after 6s.Find **[3]**
    a. the velocity with which it was thrown up.
    b. the maximum height it reaches and

c. its position after 4s.

Section D

66. From a cliff of 49 m high, a man drops a stone. One second later, he throws another stone. They both hit the ground at the same time. Find out the speed with which he threw the second stone. **[5]**

67. A car falls off a ledge and drops to the ground in 0.5 s. Let g = 10 ms^{-2} (for simplifying the calculations). **[5]**

    i. What is its speed on striking the ground?

    ii. What is its average speed during the 0.5 s?

    iii. How high is the ledge from the ground?

68. A stone is allowed to fall from the top of a tower 100 m high and at the same time another stone is projected vertically upwards from the ground with a velocity of 25 ms^{-1}. Calculate when and where the two stones will meet. **[5]**

69. Define acceleration due to gravity. Derive an expression for acceleration due to gravity in terms of mass of the earth (M) and universal gravitational constant (G). **[5]**

70. A stone is dropped from the edge of a roof. **[5]**

    i. How long does it take to fall 4.9 m?

    ii. How fast does it move at the end of that fall?

    iii. How fast does it move at the end of 7.9 m?

    iv. What is its acceleration after 1s and after 2 s?