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Assessment : Gravitation
Subject : PHYSICS
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1 Variation of g with distance r from the centre of earth with (r > Re) is best given as **1**

(i) $g \propto \frac{1}{r}$

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

(iii) $g \propto r$

(iv) $g \propto r^2$

Ans : (b)

2 There is no atmosphere on moon as **1**

(i) it is closer to the earth.

(ii) it revolves round the earth.

(iii) it gets light from the SUN.

(iv)

the gases have less requirement of velocity or energy to escape from its surface.

Ans : (d)

3 Four planets A, B, C and D made up of same material have radius of $\frac{r}{2}$, r, 2r and 4r respectively. The order of the planets in increasing order of the acceleration due to gravity (on their surface) is **1**

(i) A, B, C, D

(ii) B, C, D, A

(iii) A, C, B, D

(iv) D, C, B, A

Ans : (d) as $g \propto \frac{1}{R^2}$

4 Acceleration due to gravity is **1**

(i) dependent on mass of the planet for points outside the planet.

(ii)
dependent directly on the radius of the planets under comparison are made of same material.

(iii)
inversely proportional to square of radius for all points on the surface of the planet.

(iv) All of these.

Ans : (a)

5 The wrong option among the following is **1**

(i) gravitational force acts on the line joining the masses.

(ii) independent of the other masses.

(iii) always attractive by nature.

(iv) does not form action-reaction pair.

Ans : (d)

6 An apple and a stone dropped from certain height accelerates **1**

(i) equally

(ii) differently

(iii) depending on density

(iv) depends on the position of the SUN

Ans : (a)

7 A 60 kg man weighs W kg on the moon. W is **1**

(i) 60 kg

(ii) 10 kg

(iii) 5 kg

(iv) 70 kg

Ans : (a)

8 Weight of 1 kg is **1**

(i) 9.8 newton

(ii) 1 kg-wt

(iii) both (a) and (b)

(iv) either (a) or (b)

Ans : (a)

9 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 different **1**

(i) mass

(ii) density

(iii) radius

(iv) All of these

Ans : (d)

10 A body at rest having uniform acceleration is **1**

(i) non-existing

(ii) can be realised only on the moon

(iii) any body thrown vertically up against gravity

(iv) possible only near the SUN

Ans : (c)

11 Acceleration due to gravity on the surface of the earth is the greatest **1**

(i) at poles

(ii) at equator

(iii) at 23.6 ° latitude

(iv) uniform at all places

Ans : (a)

12 Acceleration due to gravity varies with **1**

(i) height

(ii) depth

(iii) shape of the planet

(iv) All of these

Ans : (d)

13 The value of quantity G in the law of gravitation **1**

(i) depends on mass of the earth only

(ii) depends on radius of the earth only

(iii) depends on both mass and radius of the earth

(iv) is independent of mass and radius of the earth.

Ans : (d)

14 Two particles are placed at some distance. If the mass of each of the two particles is doubled, keeping the distance between them unchanged, the value of gravitational force between them will be **1**

(i) $\frac{1}{4}$ **times**

(ii) 4 times

(iii) $\frac{1}{2}$ **times**

(iv) unchanged.

Ans : (b)

15 The atmosphere is held to the earth by **1**

(i) gravity

(ii) wind

(iii) clouds

(iv)

earth's magnetic field.

Ans : (a)

16 The force of attraction between two unit point masses separated by a unit distance is called **1**

(i) gravitational potential

(ii) acceleration due to gravity

(iii) gravitational field

(iv) universal gravitational constant.

Ans : (d)

17 The weight of an object at the centre of the earth of radius R is **1**

(i) zero

(ii) infinite

(iii) R times the weight at the surface of the earth

(iv) $1/R^2$ times the weight at surface of the earth.

Ans : (a)

18 An apple falls from a tree because of gravitational attraction between the earth and apple. If F_1 is the magnitude of force exerted by the earth on the apple and F_2 is the magnitude of force exerted by apple on earth, then **1**

(i) F_1 is very much greater than F_2

(ii) F_2 is very much greater than F_1

(iii) F_1 is only a little greater than F_2

(iv) F_1 and F_2 are equal.

Ans : (d)

19 Match the Column I with Column II **1**

Column I	Column II
1. Weight of 1 kg 2. Wobbling 3. Value of G 4. Value of 'g' on earth 5. Law of Gravitation	(A) 6.6×10^{-11} Nm^2/kg^2 (B) 9.8 Newton (C) 9.8 m/s^2 (D) Tides in ocean (E) Pressure of numerous invisible celestial objects

Ans : 1. (B), 2. (E), 3. (A), 4. (C), 5. (D)

20 Freely falling objects weight _____. **1**

Ans : zero

21 The ratio of weight to mass of body on earth is _____. **1**

Ans : 9.8 m/s^2

22 Centripetal force due to earth on moon is _____ to square of distance between them. **1**

Ans : inversely proportional

23 Gravitational force can be attractive or repulsive. [True/False] **1**

Ans : False

24 When both masses and separation between them is tripled, the force of attraction remains the same. [True/False] **1**

Ans : True

25 Two equal masses separated by a distance experience a force F. On placing equal mass at the midpoint, the force becomes half. [True/False] **1**

Ans : False

26 Weight of a falling body of mass m is mg. [True/False] **1**

Ans : False

27 Briefly explain why Newton pondered over the existence of gravitation? **1**

Ans :
It is said an apple fell on Newton's head when he was sitting under a tree. He thought if earth attracts an apple, can it also attract the moon? Is the force same in both cases? This led to the study on gravitation.

28 What is the difference between gravity and gravitation? **1**

Ans : Gravitational pull of earth is called gravity.
Gravitation is the attractive force between any two objects in the universe.

29 State the significance of universal law of gravitation. **1**

Ans :
Planetary motion around the sun, occurrence of tides etc. are phenomena which are possible due to law of gravitation.

30 If gravitational force acts between all objects, why don't they move towards each other? **1**

Ans :
The gravitational force is very weak, hence objects kept on a surface don't move towards each other.

31 Give reasons for the following observations: **1**
an object dropped from a height falls towards the earth; all planets go round

the sun.

Ans :

When dropped from height, object falls towards the earth due to gravitational force of earth acting on object, while all planets go round the sun due to gravitational force of sun acting on them.

32 Write the direction of acceleration due to gravity. **1**

Ans :

Acceleration due to gravity is always directed towards the centre of the planet or celestial body on which it is measured.

33 Define the universal gravitational constant (G). **1**

Ans :

The gravitational force between two objects of unit mass each, separated by a unit distance, is equal to universal gravitational constant, i.e. when $m_1 = m_2 = 1$ kg and $r = 1$ m, then $F = G$.

34 State Newton's law of gravitation. **1**

Ans :

It states that the gravitational force exerted between any two objects of mass m_1 and m_2, whose centres are 'r' units apart, is

• directly proportional to product of masses, i.e. $F \propto m_1 m_2$

• inversely proportional to square of distance between their centres, i.e. $F \propto \frac{1}{r^2}$

i.e. $F = \frac{Gm_1m_2}{r^2}$

35 What is the force of gravity between the earth and mass of 1 kg placed on its surface? **1**

Ans : Gravitational force, $F = \frac{Gm_1m_2}{r^2}$

Mass of earth, $m_1 = 6 \times 10^{24}$ kg,

Mass of object, $m_2 = 1$ kg

Distance between them, $r = 6 \times 10^6$ m

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

$\therefore F = \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6 \times 10^6)^2} = 9.8$ N.

36 State the value of G. Who obtained it for the first time? **1**

Ans :

G = 6.673 × 10^{-11} Nm^2/kg^2. It was obtained by Henry Cavendish (1731-1810) with the help of a sensitive balance.

37 The value of gravitational constant *G* on earth is 6.67 × 10^{-11} Nm^2/kg^2. What is its value on the surface of moon? **1**

Ans :'*G*' on moon = 6.67 × 10^{-11} Nm^2/kg^2 as it is a constant.

38 Which force is responsible for motion of moon around the earth? What would happen of there was no such force? **1**

Ans :

Motion of moon around the earth is due to centripetal force of earth. If there was no such force, the moon would pursue a uniform straight line motion.

39 State the name and type of force which is responsible for the formation of tides in the sea. **1**

Ans : Tides in the sea are caused due to gravitational pull of moon.

40 Why is law of gravitation called a universal law? **1**

Ans :

It is called a universal law as it is applicable to all bodies, whether big or small, whether celestial or terrestrial.

41 If gravitational force exists between every two objects in the universe, why don't you and your friend sitting together experience it? **1**

Ans :

Gravitational force is a weak force. It exists between all objects, but it is too weak to be experienced by small masses such as human beings.

42 Why does moon exert lesser force of attraction on objects than earth? **1**

Ans :

Weight of an object on moon is the force with which moon attracts it. Mass of moon is less than that of earth. Thus, it exerts lesser force of attraction on object than earth.

43 How will the gravitational force of attraction between two objects change if their masses are doubled? **1**

Ans : If masses are doubled, force becomes four times as $F \propto m_1 m_2$.

44 Distance between two objects is halved. How does the gravitational force between them change? **1**

Ans : When distance is halved, F becomes four times as $F \propto \frac{1}{r^2}$.

45 What do you mean by free fall? **1**

Ans :
When a body falls towards the centre of a celestial body under the influence of its gravity alone, then it is said to be in free fall.

46 What is acceleration due to gravity? **1**

Ans :
The acceleration experienced by an object during the course of its free fall is called acceleration due to gravity.

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

Ans :
Both objects will reach the ground simultaneously because acceleration due to gravity is independent of mass of falling object.

48 What does it mean to state that an object experiences equal acceleration during free fall? **1**

Ans :
It means that acceleration experienced by an object during free fall is independent of its mass. It does not depend on size or mass of object.

49 State the SI unit of (i) G (ii) g. **1**

Ans : (i) $Nm^2 kg^{-2}$
(ii) ms^{-2}

50 How does the value of 'g' vary with mass of the object? **1**

Ans :
The value of g is independent of mass of the object instead it depends on the mass of earth/celestial body.

51 How is Newton's second law of motion related to universal law of gravitation? **1**

Ans : By Newton's second law of motion, $F = mg \quad \therefore \quad (a = g)$

By law of gravitation, $F = \frac{GMm}{R^2}$

or $mg = \frac{GMm}{R^2}$ or $g = \frac{Gm}{R^2}$

52 Does velocity of a body during free fall remain constant? Why/why not? **1**

Ans :

The velocity of a body increases at every point of its motion during free fall as acceleration due to gravity acts on it.

53 Write the equations of free fall. **1**

Ans : $v = u + gt$
$h = ut + \frac{1}{2}gt^2$
$v^2 = u^2 + 2gh$
} where symbols have usual meanings

54 The value of g on the surface of the earth is 9.8 m/s^2. What will be its value on the surface of the moon? **1**

Ans : It will be 1/6th of 9.8 m/s^2 = $\frac{1}{6} \times 9.8 = 1.63$ m/s^2

55 A ball is dropped from a tower of height 5 m. With what velocity does it strike the ground? [g = 10 m/s^2] **1**

Ans : $h = 5$ m, $u = 0$, $g = 10$ m/s^2.
$v^2 = u^2 + 2gh = 0 + 2 \times 10 \times 5 \Rightarrow v = 10$ m/s.

56 A stone dropped from a tree takes 2 s to reach the ground. Find its velocity on striking the ground. **1**

Ans : $t = 2$ s, $u = 0$, $g = 9.8$ m/s^2
$v = u + gt = 0 + 9.8 \times 2 = 19.6$ m/s.

57 Identify vector and scalar quantities: Weight, acceleration due to gravity, mass, gravitational constant. **1**

Ans :

Vector: weight and acceleration due to gravity

Scalar: mass

Gravitational constant is neither a vector nor a scalar quantity. It is a constant.