	INDIAN SCHOOL AL WADI AL KABIR	
CLASS: XI	**DEPARTMENT: SCIENCE 2024 – 25** **SUBJECT: PHYSICS**	**DATE:03-11-2024**
WORKSHEET NO: 07 **WITH ANSWERS**	**CHAPTER / UNIT: GRAVITATION**	**NOTE:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO.:**

OBJECTIVE TYPE OF QUESTIONS (1 MARK):

1) There is no atmosphere on the moon because
   a) it is closer to the earth
   b) it revolves round the earth
   c) it gets light from the sun
   d) the escape velocity of gas molecules is less than their root mean square velocity here.

2) If the distance between two masses is doubled, the gravitational attraction between them
   a) Is doubled
   b) Becomes four times
   c) Is reduced to half
   d) Is reduced to a quarter.

3) Where will it be profitable to purchase one-kilogram sugar?
   a) at poles
   b) at equator
   c) at 45° latitude
   d) at 40° latitude

4) The masses of two planets are in the ratio 1: 2. Their radii are in the ratio 1: 2. The acceleration due to gravity on the planets are in the ratio.
   a) 1: 2
   b) 2: 1
   c) 3: 5
   d) 5: 3

5) The mass of a body is increased 4 fold and mass of other body is increased 16 fold. How should the distance between them be changed to keep the same gravitational force between them?
   a) 4 times
   b) 16 times
   c) 8 times

d) 81 times

6) A body weighs 500 N on the surface of the earth. How much would it weight half way below the surface of the earth?
   a) 1000 N
   b) 500 N
   c) 250 N
   d) 125 N

7) If a body of mass m is taken out from the surface of earth, to a height twice the radius of the earth, above the earth's surface, then work done on it will be
   a) (1/3) mgR
   b) (2/3) mgR
   c) (3/2) mgR
   d) (2) mgR

8) If the radius of the earth were to be raise by 1% its mass remaining the same, the acceleration due to gravity on the surface of the earth will
   a) increase by 1%
   b) decrease by 2%
   c) decrease by 1%
   d) increase by 2%

9) The height at which the weight of a body becomes 1/16th, its weight on the surface of the earth (radius R), is
   a) 5R
   b) 15R
   c) 3R
   d) 4R

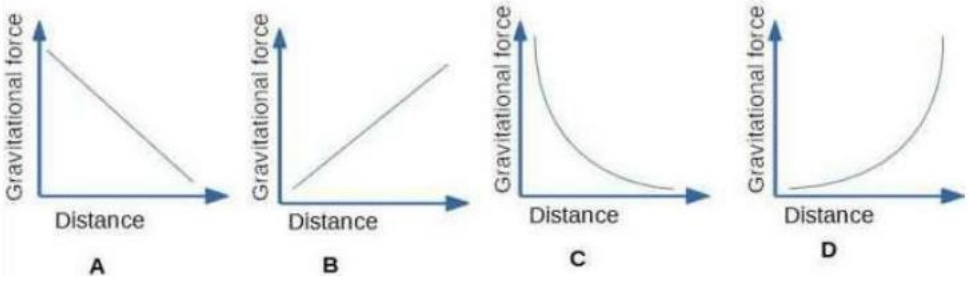
10) Two astronauts are floating in gravitational free space after having lost contact with their spaceship. The two will
   a) keep floating at the same distance between them
   b) move towards each other
   c) move away from each other
   d) will become stationary

11) The acceleration due to gravity at a height 1 km above the earth is the same as at a depth d below the surface of earth. Then
   a) d = 1/2 km
   b) d =1km
   c) d = 3/2 km
   d) d =2 km

12) The period of revolution of the planet A round the sun is 8 times that of B. The distance of A from the sun is how many times greater than that of B from the sun?
   a) 5
   b) 4
   c) 3
   d) 2

13) The radii of circular orbits of two satellites A and B of the earth are 4R and R, respectively. If the speed of satellite A is 3v, then the speed of satellite B will be
    a) 3v/4
    b) 6v
    c) 12v
    d) 3v/2

14) Observe the following figures and answer the question:



Which is the correct graph of gravitational force vs distance?
    a) Option A
    b) Option B
    c) Option C
    d) Option D

ASSERTION AND REASONING TYPE OF QUESTIONS (1 MARK):

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
c) If Assertion is true but Reason is false.
d) If both Assertion and Reason are false.

15) **Assertion:** The escape velocity from the surface of Jupiter is found to be less than that from the earth's surface
    Reason: The radius of Jupiter is smaller than that of earth.

16) **Assertion**: A planet moves faster, when it is closer to the sun in its orbit and vice versa
    Reason: Orbital velocity for an orbiting planet is constant.

17) **Assertion:** Gravitational potential of earth at every place on it is negative
    Reason: Every body on earth is bound by the attraction of earth.

18) **Assertion:** Objects appear 'weightless' inside an orbiting spacecraft.
    Reason: Objects in circular motion experience centripetal force

VERY SHORT ANSWER TYPE OF QUESTIONS: (2 MARK)

19) Why a man can jump higher on the moon than on the earth?

20) Show graphically how 'g' varies as you move from the centre of the earth to great heights above the surface.
21) A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth?
22) Why a body weighs more at poles and less at equator?
23) What will be the value of g at the bottom of sea 7 km deep? Diameter of earth is 12800 km and g on the surface of the earth is 9.8 m/s^2.
24) If the radius of earth shrinks by 1.5% (mass remains the same) then how would the value of acceleration due to gravity change?

SHORT ANSWER TYPE OF QUESTIONS (3 MARK):

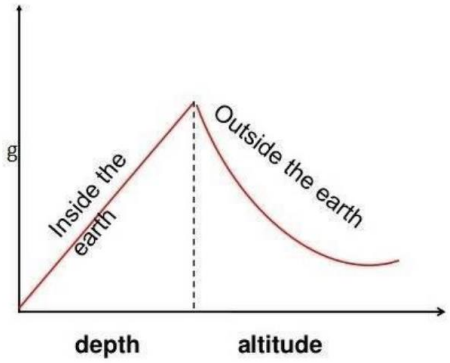
25) How far away from the surface of earth does the value of g is reduced to 4% of its value on the surface of the earth Given radius of earth = 6400km
26) Two planets of radii r_1, and r_2 are made from the same material. Calculate the ratio of the acceleration due to gravity on the surface of the planets
27) If earth has a mass 9 times and radius 4 times than that of a planet "P". Calculate the escape velocity at the planet "P" if its value on earth is 11.2 kms^{-1}.

LONG ANSWER TYPE OF QUESTIONS (5 MARK):

28) A man can jump 2.0 m high on the earth. Calculate the approximate height he might be able to jump on a planet whose density is one third that of the earth. And whose radius is one fourth of that of the earth's radius.
29) At what height from the surface of the earth will the value of "g" be reduced by 36% of its value at the surface of earth?

CASE STUDY TYPE OF QUESTIONS (4 MARK):

30) Depending on the location, an object at the surface of Earth falls with an acceleration between 9.76 m/s^2 and 9.83 m/s^2. Earth is not exactly spherical. It is similar to a "squashed" sphere, with the radius at the equator slightly larger than the radius at the poles. This has the effect of slightly increasing gravitational acceleration at the poles (since we are close to the centre of Earth and the gravitational force depends on distance) and slightly decreasing it at the equator. Also, because of centripetal acceleration, the acceleration due to gravity is slightly less at the equator than at the poles. Changes in the density of rock under the ground or the presence of mountains nearby can affect gravitational acceleration slightly. The acceleration of an object changes with altitude.
The change in gravitational acceleration with distance from the centre of Earth follows an inverse-square law. This means that gravitational acceleration is inversely proportional to the square of the distance from the centre of Earth. As the distance is doubled, the gravitational acceleration decreases by a factor of 4. As the distance is tripled, the gravitational acceleration decreases by a factor of 9, and so on.
The extent of the variation of g with height differs from that of the variation of g with depth, but it's to note that the value of g falls both with increasing height & with increasing depth, with respect to the earth's surface. This also means the value of g is maximum on the surface of the earth itself.



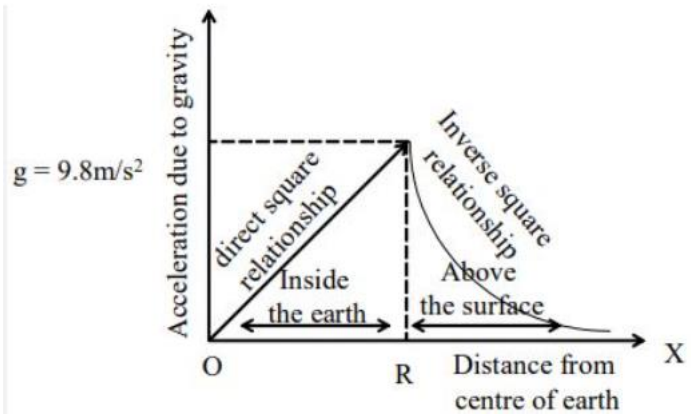
i. The value of ‘g’ is inversely proportional to the square of the Earth's
   a) diameter
   b) radius
   c) weight
   d) area

ii. If R is the radius of the earth, the height at which the weight of body becomes ¼ its weight on the surface of earth is
   a) 2R
   b) R/2
   c) R
   d) R/4

iii. A body weighs 200 N on the surface of earth. How much will it weigh half way down to the centre of earth?
   a) 100 N
   b) 150 N
   c) 200 N
   d) 250 N

iv. The weight of an object in the coal mine, sea level, at the top of the mountain are W_1, W_2 and W_3 respectively then
   a) $W_1 = W_2 > W_3$
   b) $W_1, W_3 < W_2$
   c) $W_2 = W_3, W_1$
   d) $W_1 < W_2 < W_3$

ANSWER KEY	
1	d)the escape velocity of gas molecules is less than their root mean square velocity here.
2	d) Is reduced to a quarter.
3	b)at equator
4	b)2:1
5	c)8 times
6	c)250 N
7	b)2/3 mgR
8	b)decrease by 2%
9	c)3R

10	b)move towards each other
11	d)d =2 km
12	b)4
13	b)6v
14	c)Option C
15	d)If both Assertion and Reason are false.
16	c)If Assertion is true but Reason is false.
17	a)If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
18	b)If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
19	A man can jump higher on the Moon than on Earth primarily due to the Moon's lower gravitational acceleration, resulting in less weight and reduced force opposing the jump. This allows for a higher vertical ascent during a jump.
20	
21	$= (\frac{2}{3})^2 = \frac{4}{9}$ $g' = g(\frac{R}{R+h})^2$ $g_h = \frac{4}{9}g$ $\frac{g_h}{g} = (\frac{R}{R+h})^2$ $\therefore mg_h = \frac{4}{9}mg$ $= \left(\frac{R}{R+\frac{R}{2}}\right)^2$ $= \frac{4}{9} \times 63$ $= 28\ N$
22	As the distance of the pole is less than the distance of the equator from the center of the earth, the force of attraction is higher on the body at poles than at the equator. Hence the weight of a body is greater at pole than at the equator.

23	$g^1 = g(1 - \frac{d}{R})$ $g^1 = 9.8(1 - \frac{7\times10^3}{6400\times10^2})$ $= 9.8(1 - 0.001093)$ $= 9.789 m/s^2$
24	$g = \frac{GM}{R^2}$ decreasing radius by 1.5% will increase gravity on surface $\frac{g'}{g} = \frac{R_2^2}{R_1^2} = \frac{1}{(0.985)^2} = 1.03$ Change in acceleration = $(\frac{g1}{g-1}) \times 100\% = (1.03 - 1) \times 100\% = 3\%$
25	$g\,h = g\left(\frac{R}{R+h}\right)^2$ $g\,h = 4\%$ of $g = \frac{4g}{100}$ R = 6400km $\frac{4g}{100} g\left(\frac{R}{R+h}\right)^2$ $\frac{4}{100} = \left(\frac{R}{R+h}\right)^2$ $\frac{2}{10} = \frac{R}{R+h}$ 2R+2h = 10R 2h = 8R h = 4R = 4x6400 = 25,600km.
26	Since they are made of the same material, therefore, the density of both the planets would be same. Mass of the planet = volume x density (volume = $\frac{4}{3}\pi r^3$) $g_1 = \frac{G\times\frac{4}{3}\pi r_1^3}{r_1^2}$ and $g_2 = \frac{G\times\frac{4}{3}\pi r_2^3}{r_2^2}$ On comparing both the ratio, we get, $\frac{r_1}{r_2}$

27	$v_e = \sqrt{\frac{2GM}{R_e}}$, $v_p = \frac{\sqrt{2GM_p}}{R_p}$ $M_p = \frac{M}{9}, R_p = \frac{R_e}{4}$ $\therefore\ v_p = \sqrt{2G\frac{M}{9}\times\frac{4}{R_e}}$ $= \frac{2}{3}\sqrt{\frac{2GM}{R_e}} = \frac{2}{3}\times 11.2 = \frac{22.4}{3}$ = 7.47 km/sec.
28	$P.E._p = P.E._e$ $m\, g_p h_p = m\, g_e h_e$ $h_p = \frac{g_e}{g_p} \times h_e$ ...(i) $g_e = \frac{GM_e}{R_e^2} = \frac{G}{R_e^2} \times \left(\frac{4\pi}{3} R_e^3 \rho_e\right)$ $= \frac{4\pi}{3} G\, R_e \rho_e$ ...(ii) $\therefore\ g_p = \frac{4\pi}{3} G\, R_p \rho_p$ ...(iii) From equation (ii) and (iii), we get. $\frac{g_e}{g_p} = \frac{R_e \rho_e}{R_p / \rho_p} = 4 \times 3 = 12$ From equation (i), we have, $h_p = 12 \times 2 = 24m$
29	Since the acceleration due to gravity reduces by $36\,\%$ the value of acceleration due to gravity there is $100 - 36 = 64\,\%$. It means $g' = \frac{64}{100} g$. If h is the height of location above the surface of earth then $g' = g\frac{R^2}{(R+h)^2}$ or $\frac{64}{100} g = g\frac{R^2}{(R+h^2)^2}$ $\frac{8}{10} = \frac{R}{R+h}$ or $8R + 8h = 10R$ $\Rightarrow h = \frac{2R}{8} = \frac{R}{4} = \frac{6.4 \times 10^6}{4} = 1.6 \times 10^6 m$
30	i) b)radius ii) c)R iii) a)100 N iv) b)W1 , W3< W2

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