PHYSICS

BOOKS - PRADEEP PHYSICS (HINGLISH)

GRAVITATION

Problems

1. The gravitational force between two object is F. How will this force change when

(i)distance between them is reduced to half?

(ii) the mass of each object is quadrupled?

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2. A sphere of mass $40kg$ is attracted by a second sphere of mass $15kg$, when their centres are $20cm$ apart, with a force of 0.1 miligram weight. Caculate the value of gravitational constant.

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3. A body of mass 1 kg is placed at a distance of 2m from another body of mass 10kg. At what distance from the body of 1kg, another body of mass 5kg be placed so that the net force of gravitation acting on the body of mass 1kg is zero?

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4. A geostationary satellite is orbiting the earth at a height 5 R above the surface of earth, where R is radius of earth. Find the time

period of another of another satellite at a height of 2 R from the surface of earth.

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5. Calculate the force of gravity acting on your friend of mass 60kg.Given mass of earth = 6×10^{24} kg and radius of Earth=$6.4 \times 10^{6} m$.

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6. The Earth's gravitational force causes an acceleration of $5m/s^2$ in a 1 kg mass somewhere in space. How much will The same place?

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7. A particle is thrown up verticaly with a velocity with a velocity of $50m/s$. what will be its velocity at the highest point of the journey ? How high would the particle rise ? What time

would it take it take to reach the highest point ? Take $g = 10m/s^2$.

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8. A stone is dropped from the edge of a roof. (a) How long does it take to fall 4.9m? (b) How fast does it move at the end of that fall? (c) How fast does it move at the end of 7.9m? (d) What is its acceleration after 1s and after 2 s?

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9. If a planet existed whose mass was twice that of Earth and whose radius 3 time greater, how much will a 1 kg mass weigh on the planet?

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10. The weight of a man on the surface of Earth is 588 N. Find his mass, taking $g = 9.8m/s^2$. If the man were taking to Moon, his weight would be 98 N. What is his mass on Moon?

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Ncert Question

1. State the universal law of gravitation.

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2. Write the formula to find the magnitude of the gravitational force between the Earth and an object on the surface of the Earth.

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3. What do you mean by free fall?

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4. What do you mean by acceleration due to gravity?

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5. What is the ratio pf weight of an object on moon to its weight on earth?

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6. You find your mass to be 42 kg on a weighing machine. Is your mass more or less than 42 Kg?

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7. The gravitational force between two object is F.How will this force change when

(i)distance between them is reduced to half?

(ii) the mass of each object is quadrupled?

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8. Gravitational force acts on all objects in properties to their masses. Why then, a heavy object does not fall faster than a light object?

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9. What is the magnitude of the gravitational force between the Earth and a 1kg object on its surface ? (Mass of the earth is 6×10^{24} kg and radius of the Earth is $6.4 \times 10^{6} m\big)$.

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10. The Earth and the moon are attracted to each other by each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as

the force with which the moon attracts the earth ? Why?

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11. If the moon attracts the earth, why does the earth not move towards the moon?

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12. What happens to the force between two object, if

(i) the mass of one object is doubled ? (ii) the distance between the object is doubled and tripled?

(iii) the masses of both object are doubled?

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13. What is the imprtance of universal law of gravitation?

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14. What is the acceleration of free fall?

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15. What do we call the gravitational force between the earth and an object ?

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16. Amit buys few grams of gold at the poles as per the instruction of one of his friends. He

hands over the same when he meets him at the equator. Will the friend agree with the weight of gold bought ? If not, why ? [Hint. The value of g is greater at the poles than at the equater.]

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17. Why will a sheet of paper fall slower than one that is crumpled into a ball?

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18. Gravitational force on the surface of the moon is only $1/6$ as gravitational force on the earth. What is the weight in newtons of a 10kg object on the moon and on the earth?

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19. A ball is thrown vertically upwards with a velocity of $49m/s$. Calulate

(i) The maximum height to which it rises,

(ii) the total time it takes to return to the surface of the earth.

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20. A stone is released from the top of a tower of height 19.6m. Calculate its final velocity just before touching the ground.

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21. A stone is thrown verticaly upward with an initial velocity of $40m/s$. 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?

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22. Calculate the force of gravitation between the earth the sun, given that the mass of the earth $= 6 \times 10^{24}$kg and mass of the sun $= 2 \times 10^{30}$kg. The average distance between the two is $1.5 \times 10^{11} m$.

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

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24. A ball thrown up vertically returns to the thrower after 6s. Find

(a) the velocity with which it was thrown up.

(b) the maximum height it reaches, and (c) its position after 4s.

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Short Answer

1. What is the source of centripetal force that a planet requires to revolve around the sun ? On what factors does that force depend?

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2. On the earth, a stone is thrown from a height in a direction parallel to the earth's surfaces while another stone is simultaneously dropped from the same height. Which stone whould reach the ground first and why ?

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3. Suppose gravity of earth suddenly become zero, then in which direction will the moon begin to move if no other celestial body affects it?

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4. Identical packets are dropped from two areoplanes, one above the equator and the other above the north poole, both at height h. Assuming all condition are identical, will those packets take same time to reach the surface of earth. Justify your answer.

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5. The weight of any person on the moon is about $1/6$ times that on the earth. He can lift a mass of 15 kg on the earth. What will be the maximum mass, which can be lifted by the same force applied by the person on the moon?

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6. Calculate the average density of earth in terms of g, G and R.

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7. The Earth is acted upon by the gravitational force of attraction due to the sun. They why does the Earth not fall towards sun?

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8. What is inverse square rule ?

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9. Name two application of Newton's law of gravitation.

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10. Why don't two object move towards each other due to gravitational pull between them ?

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11. Which of kepler's laws led N ewt on to inverse square rule for gravitational force ?

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12. In free fall, will heavier objects have more acceleration due to gravity than light ones ?

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13. Can a body have mass but no weight ?

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14. Can a body have weight but no mass?

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15. On what factors does the weight of a body depend ?

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16. How are gravitation and gravity realated?

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17. What is the relation between g and G ?

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18. Can you calculate mass of earth from Newton's law of gravitational?

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19. Can you calculate density of earth from Newton's law of gravitation?

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20. A body weighs 10 kg on the surface of earth. What would be its mass and weight at the centre of earth ?

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21. A body weighs more at poles than at the equator of earth. Why ?

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22. Distinguish between gravitational and gravity.

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23. State and explain universal law of gravitation. What is its importance ?

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24. State keper's laws of planetary motion.

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25. Compare gravitational force between lighrt objects and heavy objects.

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26. Write down the equation of motion of objects under the infulence of gravitatonal force of Earth. Explain the meaning of the symbol used.

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27. Distinguish between mass and weight.

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28. What is meant by 'free fall' hence define acceleration due to gravity.

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Long Answer

1. How does the weight of an object vary with respect to 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?

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2. How does the force of attraction between the two bodies depend upon their masses and distance between them ? A student thought that two bricks tied together would fall faster than a single one under the action of gravity.

Do you agree with his hypothesis or not ? comment.

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3. Two objects of masses m_1 and m_2 having the same size are dropped simultaneously from heights h_1 and h_2 respectively. Find out the ratio of time they would take in reaching the ground. Will this ratio remain the same if (i) one of the objects is hollow and the other one is solid and (ii) both of them are hollow,

size remaining the same in each case. give reason.

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4. State the universal law of gravitation.

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5. State kepler's laws of planetary motion. How did newton guess inverse square law?

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6. Define 'g' and 'G'. Establish relation between the two. How do you use this relation to calculate mass of earth ?

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7. Comment on application of newton's third law of motion to gravitation. Illustrate by explain by example.

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Very Short Answer

1. On Earth value of $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

What is its value on Moon, where g is nearly one-sixth than that of Earth?

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2. Which force revolves moon around earth?

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3. The distance between two objects is doubled. What happens to gravitational force between them ?

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4. Which force accelerates a body in free fall ?

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5. Which force is responsible for tides in the ocean at night ?

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6. Does gravitational force between two object depend on medium between them?\

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7. Which force is responsible for holding the solar system together ?

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8. Who gave three laws of planetary motion ?

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9. Who explain the motion of planets around the sun?

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10. What is the usual shape of orbits of planets around the sun ?

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11. Does Newton's third law of motion apply to gravitational force?

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12. A stone falling towords earths also attractst the earth with the same force, Is it true ?

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13. Then why is the Earth not seen moving towards the stone ?

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14. What is value of 'g' vary from place to place on earth ?

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15. Where is 'g' greater, at poles or at equator ?

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16. Where is 'g' maximum, on the surface of earth, above the surfce or below the surface of

Earth ?

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17. What is the value of 'g' at the centre of Earth ?

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18. A body is projected upwards. What is its initial velocity at maximum height?

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19. A body is just dropped from a height. What is its initial velocity?

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20. What is the SI unit of mass ?

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21. What is the SI unit of weight ?

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22. What is the weight of a body of mass 1 kg on the surface pf earth?

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Higher Order Thinking Skills

1. One earth, value of $G = 6.67 \times 10^{11} Nm^2 kg^2$. What is its value on

moon, where g is nearly $\frac{1}{6}$th that of earth ?

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2. Suppose gravitational pull varies inversely as nth power of the distance. Show that the time period of a planet in circular orbit of radius R around the sun will be proportinal to $R^{(n+1)/2}$

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3. Two identical copper spheres of radius R are in contact with each other. If the gravitational attraction between them is F, find the relation berween F and R.

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4. Two particles of equal mass (m) move in a circle of radius (r) under the action of their mutual gravitational attraction. Find the speed of each particle.

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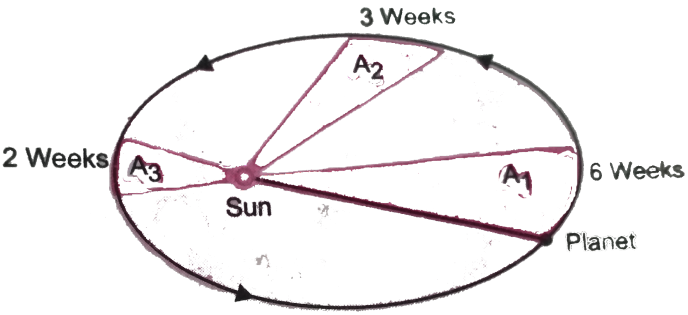
5. In Fig. the line that join a planet to the sun sweep out areas A_1, A_2, A_3 in time intervals 6 weeks, 3 weeks and 2 weeks respectively. How are A_1, A_2, A_3 ?realted



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Value Based Questions

1. Earth attracts everybody towards its centre. Therefore, every object, object when free, falls towards the earth due to gravitational force of earth on it.This is the phenomenon of free fall. The acceleration due to gravity (g). On the surface of earth, $g = 9.8m/s^2$. This value does not depend on mass of the body or nature of the body.

Read the avobe passage and answer the following quetion:

(i) convert the value of g in $k\frac{m}{h}r^2$.

(ii) Is the value of g on moon the same as on earth?

(iii) What vslues of life do you learn from this concept?

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2. Whenever a body is thrown up with a certain velocity, the upward motion is opposed by gravitational pull of earth and also by the resistance of air.

Therefore, velocity of the body goes on decreasing.When this velocity becomes zero, the body cannot rise further. It has attained, what is called 'maximum height'. from this height, the body begins to fall downloads under the action of gravity.

Read the above passage and answer the following question:

(i)At the highest point, what are the velocity and acceleration of the body?

(ii)What is the maximum height attained by a body thrown upwards with a velocity of $19.6m/s$? Take $g = 9.8m/s^2$.

(iii) What value in life do you learn from this concept ?

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3. Take a piece of thread. Tie a small piece of stone to one end of the thread. Hold the other end of the thread in hand and whirl it round. Note the motion of the stone. If the thread breakes suddenly, the stone files off along tangent to the circle at the instant.

Read the above passage and answer the

following question:

(i) which force is whirling the stone ? who is providing this force ?

(ii) why does the stone fly off along the tangnet to the circle at that instant?

(iii) what value of life do you learn from this?

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4. A physics teacher explains to his students in class, the subject of motion under gravity. When a body is project upwards from the

ground with a certain velicity u, the velocity goes on decreasing at a constant rate due to gravitational pill of earth. At a certain height, this velocity becomes zero. the body cannot rise futher. from this maximum height, the body begins to fall and its velocity goes on increasing at the same constant rate due to gravitational pull of earth. the body would strike the ground with exactly the same velocity $(v = u)$, with which it was thrown initially. this is on the assumption that resistance due to air is zero,either way.

Read the above passage and answer the

following quetion:

(i) why is velocity of body on striking the ground the same as intial velocity of projection of the body?

(ii) Does the body take same time to fall to ground as the time it takes to reach the maximum height?

(iii) What value of life of life do you learn from this breif study ?

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Problem For Practice

1. Calculate the force of gravitation between two objects of masses 80 kg and 1200 kg kept at a distance of 10m from each other Given, $G = 6.7 \times 10^{11} Nm^2/kg^2$.

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2. The gravitational force between two object is 100N. How should the distance between these object be changed so that force between them becomes 50N.

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3. Two electrones each of mass 9.1×10^{31} kg are at a distance of 10 A. calculate the gravitational force of attraction between them. Given $1A = 10^{-10}m$.

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4. The mass of sun is 2×10^{30} kg and mass of earth is 6×10^{24} kg. if the distance between

the centers of sun and earth is 1.5×10^8 km, calculate the force of gravitation between them.

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5. Two bodies A and B having masses 2 kg and 4 kg respectively are separated by 2 m. Where should a body of mass 1 kg be placed so that the gravitational force on this body due to bodies A and B is zero?

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6. If the distance between two masses is increased by a factor of 4, by what factor would the mass of one of them have to be altered to maintain the same gravitational force?

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7. The mass of the earth is 6×10^{24} kg and that of the moon is7.4×10^{22} kg. If the distance between the earth and the moon is

3.84×10^5 km, calculate the force exerted by the earth on the moon. (Take G $= 6.7 \times 10^{-11} Nm^2 kg^{-2}$)

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8. Two satelites of a planet have period 32 days and 256 days. If the radius of orbit of former is R, find the orbital radius of the latter.

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9. If the distance of earth form the sun were half the present value, how many days will make one year?

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10. The distance of planet Jupiter from the Sun is 5.2 times that of the earth. Find the period of revolution of Jupiter around the Sun.

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11. What is the gravitational acceleration of a spaceship at a distance equal to two earth's radius from the centre of the earth?

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12. 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 second stone?

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13. A stone drops from the edge of the roof. It passes a window 2 m high in $0 \cdot 1s$. How far is the roof above the top of the window?

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14. A particle is dropped from a tower 180 m high. How long does it take to reach the ground ? What is the velocity when it touches the ground ? Take $g = 10m / s^2$.

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15. To estimate the height of a bridge over a river, a stone is dropped freely on the river from the bridge. The stone takes 2 s to touch the water surface in the river. Calculate the height of the bridge from the water level. Take $g = 9.8m / s^2$

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16. How much would a 70 kg man weigh on moon ?what will be his mass on earth and moon ? Given g on moon $= 1.7m/s^2$.

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17. A body weighs 10 kg on the surface of earth. What would be its mass and weight at the centre of earth ?

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18. A force of 2 kg wt. act on a body of mass 4.9 kg calculate its acceleration.

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19. A force of 20 N acts upon a body whose weight is 9.8 N. what is the mass of the body and how much is its acceleration ?

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20. A man weigh 600 N on the earth. What is its mass ? Take $g = 10m/s^2$. If he were taken on moon, his weight would be 100 N. What is his mass on moon ? What is acceleration due to gravity on moon ?

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21. A car falls off a ledge and drops to the ground in $0.5s$. let$g = 10m/s^2$ (for simplifyng the calculation).

(i) what is its speed on striking the ground ?

what is its average speed during 0.5s?

(iii) How high is the ledge from the ground ?

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22. An object is thrown vertically upwards and rises to a height of 10 m. Calculate

(i) the velocity with which the object was thrown upwards and (ii) the time taken by the object to reach the highest point.

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23. Mass of an object is 10 kg. what is its weight on earth ?

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24. An object weigh 10 N when measured on the surface of the earth. What would be its weight when measure on the surface of moon ?

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25. Calculate the value of acceleration due to gravity on moon. Given mass of moon $= 7.4 \times 10^{22}$ kg, radius of moon $= 1740$ km.

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26. Suppose a planet exists whose mass and radius both, are half those of earth. Calculate the acceleration due to gravity on the surface of this planet.

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27. A ball is thrown up with a speed of $15m/s$.

how high will it go before it begins to fall ?

Take $g = 9.8m/s^2$.

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Oral Testing

1. What is meant by gravitation?

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2. (a) What holds the atmosphere around earth? (b) How do you account for flow of water in rivers?

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3. Is force of gravitation ever repulsive?

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4. What is the value of universal gravitational constant?

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5. Does gravitational force between two object depend on medium between them?\

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6. The areal velocity of a planet around the earth is constant. Which law is this?

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7. When does the gravitational force of attraction become really large?

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8. How does the period of revolution of a planet around the sun vary with its distance from the sun?

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9. What is meant by gravity ?

Watch Video Solution

10. What is the value of acceleration due to gravity on the surface of earth ?

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11. Does the value of 'g' depend upon mass of the body?

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12. All bodies lose their weight at the centre of earth.why?

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13. What is the ratio pf weight of an object on moon to its weight on earth?

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14. Can mass of a body ever be zero?

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15. What is the weight of a body of mass 1 kg on the surface pf earth?

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16. Out of mass and weight of a body, which is scaler and which is vector ?

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Quiz Testing

1. (a)Gravitational is the phenomenon of attraction between two terrestrial object only.

In it true ? (b) gravitational is the phenomenon of attraction between two terrestrial objects only. Is it true?

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2. (a) Value of gravitational constant depends neither on mass of two objects nor on distance between them. Is it true?

(b) Magnitude of gravitational force does not depend upon medium separating the two object. Do you agree?

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3. (a) The gravitational force between two objects depends only on their masses and distance of separation. The objects may be rest or rotating. Is this statement correct? (b)Force ecerted by earth on an apple is same as forced exerted by the apple on earth. is it true ?

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4. (a) What are the SI units of G? (b) on what factors does the value of G depend ?

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5. (a) What are the units of areal velocity?

(b) if distance of earth from the sun were to increase, what will happen to number of days in an year?

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6. (a) value of 'g' maximum , at poles or at equater?

(b) where is value of 'g' minimum , at poles or at equater ?

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7. (a) Which balance is used for measuring mass of a body ?

(b) which balance is used for measuring mass of a body ?

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8. (a) A person weighs 70kg on earth, where $g = 10m/s^2$. What is this mass?

(b) the mass of a child is 20 kg. if $g = 9.8m/s^2$. What is his mass ?

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9. (a) a person weighs 60 kg on earth. Will his weight increase as he moves to the top of a hill ?

(b) will the weight of person increase at the bottom of a mine ?

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10. (a) If ratio are made to fall of two bodies is $1:2,$ what is the ratio of their heights of fall ?

(b) Two bodies are made to fall from two different height in the ratio $9:4$. What will be the ratio of their times of fall ?

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Worksheet 1

1. Newton's universal law of gravitation is expressed mathematically as

$$F = \frac{Gm_1m_2}{d^2}$$

Answer the following the question based on this law:

(i) what is represented by m_1, m_2 and d?

(ii) what is G called?

(iii) what is the meaning of the world 'universal' in this law?

(iv) Gravitational force between any two

ordinary objects is really weak. why?

(v) why you or your friend sitting near you do not move towards each other due to gravitation force of attraction?

(vi) Though gravitational force is the weakest force in nature, yet it is responsible for holding our solar system.why?

(vii) will gravitational force of attraction between two bodies change when they are placed same distance apart (i) on earth (ii) on moon?

(viii) how will gravitational force change between two bodies when distance between

them is halved?

(ix) masses of each of two bodies are doubled. how should the distance between them be changed to keep the gravitational force constant?

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2. How much will a body of mass once kg weigh on moon ? Given mass of moon is $\frac{1}{100}$ mass of earth and diameter of moon is $\frac{1}{4}$ the diameter of earth.

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3. A ball is thrown vertically upwards with a velocity of $98m/s$. Calculate

(i) The maximum height to which it rises.

(ii) Total time it takes to return to earth.

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4. A stone is dropped from the top of a tower 200 m high. At the same time, another stone is projected vertically upwards from the ground

with a velocity of $40m/s$. Calcuate when and where the two stones will mest.

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5. Suppose a planet exist whose mass and diameter both are twice of earth. Calculate acceleration due to gravity on this planet. On earth, take $g = 9.8m/s$.

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Worksheet 2

1. Calculate the force of attraction between the earth and the sun, given that mass of earth is 6×10^{24}kg abd mass of sun $= 2 \times 10^{30}$kg. the average distance between the two is $1.5 \times 10^{11} m$.

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2. Take a sheet of paper and piece of stone. Drop the two together from the second floor

of a building. Check if both of them reach the ground simultaneously. Explain why if the answer is 'yes' and why not if the answer is 'no'.

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3. Now, perform the same experiment again in glass jar from which air has been sucked out. Check again if both the paper and stone reach the bottom of glass har simultaenously.

explain why , if the answer is 'yes' and why not

, if the answer is 'no'.

what conclusion do you draw from this activity

?

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Worksheet

1. A sphere of mass 25 kg attracts another sphere of mass 24kg with a force of 0.1 milligram weight. if distance between the

centres of two sphere is 20 cm, what is the value of G ?

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2. If distance between two masses is quadrupled, what will be the new force of attraction between them? given the initial gravitational pull is 9.8N.

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3. An electron of mass 9.1×10^{-31} kg is at a distance of $10A^{\circ}$ from a. porton of mass 1.67×10^{-27} kg. calculate the gravitational force of attraction between them.

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4. Then ratio of orbital radii of two satellites of a planet is $1:2$. what is the ratio of their time period?

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Paper Pen Test

1. The SI unit of gravitational constant is

A. N

B. J

C. m / s^2

D. Nm^2kg^{-2}

Answer: D

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2. The gravitational force of attraction between any two objects does not depend upon

A. masses of objects

B. distance between objects

C. size and shape of objects

D. all the three above

Answer: C

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3. According to kepler's third law, with usual notation:

A. T^2 / R^2=constant

B. R^2 / T^3

C. T^2 / R^3=constant

D. all the three above

Answer: C

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4. Newton's law of gravitation

A. can be verified in the laboratory

B. can not be verified, but is true

C. is valid only on earth

D. is valid only in our solar system

Answer: A

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5. Two spherical balls of mass 10 kg each are placed 10 cm apart. Find the gravitational force of attraction between them.

A. $6.67 \times 10^{5} N$

B. $6.67 \times 10^{-5} N$

C. $6.67 \times 10^{9} N$

D. $6.67 \times 10^{-9} N$

Answer: B

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6. The mass of a body of a body is increased 4 fold and mass of other body is increased 16 fold and mass of other body is increase 16 fold. How should the distance between then be change to keep the same gravitational force between them ?

A. 4 times

B. $\frac{1}{4}$ times

C. 8 times

D. $\frac{1}{8}$ times

Answer: C

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7. If the moon attracts the earth, why does the earth not move towards the moon?

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8. Gravitational force acts on all objects in properties to their masses. Why then, a heavy object does not fall faster than a light object?

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9. Calculate the gravitational force on a body of mass 1 kg lying on the aurface of earth. Given mass of earth. Given mass of earth is 6×10^{24} kg and radius of earth is 6400 km.

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10. (a) What holds the atmosphere around earth? (b) How do you account for flow of

water in rivers?

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11. Does newton's third law apply to force of gravitation ? Give one example.

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12. The speed of planet is greater when it is closer to the sun than when it is farther away from the sun. explain why?

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13. Two bodies A and B having masses 20kg and 40kg are separated by 10 m. at what distance from body a should another body C of mass 15 kg be placed so that net gravitational force on C is zero?

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14. Define universal gravitational constant. Given its value with SI units.

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15. The earth attracts a body of mass 2 kg on its surface with a force of

A. $9.8N$

B. $19.6N$

C. $6.67 \times 10^{-11}N$

D. $2 \times 6.67 \times 10^{-11} N$

Answer: B

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16. A stone dropped from a building takes 4 s to reach the ground. The height of the building is

A. $19.6m$

B. $80.4m$

C. $78.4m$

D. $156.8m$

Answer: C

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17. In the above quation, velocity with which the sone hits the ground is

A. $39.2m/s$

B. $19.6m/s$

C. zero

D. $78.4m / s$

Answer: A

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18. If g_e is acceleration due to gravity on earth and g_m is acceleration due to gravity on moon, then

A. $g_e = g_m$

B. $g_e < g_m$

C. $g_e = \frac{1}{6} g_e$

D. $g_m = \frac{1}{6} g_e$

Answer: D

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19. Given, acceleration due to gravity on surface of earth is g. if g' is acceleration due to gravity at a height h above the surface of earth, then

A. $g' = g$

B. $g' < g$

C. $g' > g$

D. $g' = 0$

Answer: B

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20. The mass of a body on the surface of earth is $12kg$. if acceleration due to gravity on moon

is $\frac{1}{6}$ of acceleration due to gravity on earth, then its mass on moon will be

A. $2kg$

B. $72kg$

C. $12kg$

D. $0kg$

Answer: C

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21. When a stone is thrown up, it reaches a certain height and then stars falling down. Why ?

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22. A body weighs 10 kg on earth, where $g = 9.8m/s^2$. What would be its mass and weight on moon, where $g = 1.6m/s^2$?

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23. A stone is released from the top of a tower of height 1960 m. calculate the time taken by the stone to hit the ground.

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24. The value of 'g' does not depend upon mass of the body, but gravitational pull of earth depends on mass of the body, comment.

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25. The value of acceleration due to gravity is maximum at poles and minimum at equator.why ?

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26. (i) mass of a body is always constant. Why ?

(ii) mass of a body can never be zero. Why ?

(iii) At the center of earth, weight of a body is zero. Why ?

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27. A ball thrown up vertically returns to the thrower after 8 second. Calculate

(i) velocity with which it was thrown

(ii) maximum height it acquired.

(iii) velocity with which it hit the ground. Given $g = 9.8m/s^2$.

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28. Explain why weight of an object on moon is only $\frac{1}{6}th$ of the weight of the object on earth.

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29. Define 'g' and 'G'. Establish relation between the two. How do you use this relation to calculate mass of earth ?

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Multiple Choice Questions

1. Two object of different masses falling freely near the surface of moon would

A. have same velocity at any instant

B. have different acceleration

C. experience forces of same magnitude

D. undergo a change in their inertia

Answer: A

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2. The value of acceleration due to gravity

A. is same on equator and poles

B. is least on poles

C. is least on equator

D. increase from pole to equator

Answer: C

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3. The gravitational force between two object is F. It masses of both object are halved without changing distance between them, then the gravitation force would become

A. $F/4$

B. $F/2$

C. F

D. $2F$

Answer: A

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4. A boy is whirling a stone tied with a string in a horizontal circular path. When the string breacks, the stone

A. Will continue to move in the circular path

B. will move alonge a straight line towards the circular path

C. will move along a straight line tangential to the circular path

D. will move along a straight line perpendicular to the circular path away from the boy

Answer: C

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5. In the relation $F = GMm/d^2$, the quantity G

A. depends on the value of g at the place of observation

B. is used only when the earth is one of the two masses

C. is greatest at the surface of the earth

D. is universal constant of nature

Answer: D

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6. Law of gravitation gives the gravitational force between

A. the earth and a point mass only

B. the earth and sun only

C. any two bodies having some mass

D. two charged bodies only

Answer: C

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7. The value of quantity of G in the law of gravitation

A. depends on mass of earth only

B. depends on radius of earth only

C. depends on both mass and radius of earth

D. is independent of mass and radius of the earth

Answer: D

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8. 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

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

B. 4 times

C. $\frac{1}{2}$times

D. unchanged

Answer: B

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9. The atmosphere is held to the earth by:

A. gravity

B. wind

C. clouds

D. earth's magnetic fields

Answer: A

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10. The force of attraction between two unit point masses separted by a unit distance is called

A. gravitational potential

B. accelerationa due to gravity

C. gravitational field

D. universal gravitational constant

Answer: D

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11. The weight of an object at the centre of the earth of radius R is

A. zero

B. infinite

C. R times the weight at the surface of the earth

D. $1/R^2$ times the weight at surface of the earth

Answer: A

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12. An apple falls from a tree because of gravitational 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

A. F_1 is very much greater than F_2

B. F_2 is very much greater than F_1

C. F_1 is only a little greater than F_2

D. F_1 and F_2 are equal

Answer: D

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Mock Test 3

1. What is represented by G ? What is its value on moon ?

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2. Two bodies, one of mass 1 gram and other of mass 1 kiliogram are dropped are dropped from the same height.which one will hit the ground first ?

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3. A body weighs 1 kg on the surface of earth. What is its mass on moon ?

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4. Which force is responsible for the rainfall and snowfall on the earth? Is this force ever repulsive?

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5. Distinguish between gravitational and gravity.

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6. What is meant by 'free fall' hence define acceleration due to gravity.

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7. What is centripetal force ? What is its function ? Illustrate with one example.

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8. Calculate mass of earth taking it to ne a sphere of radius 6400 km. given $g = 9.8m/s^2$

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

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9. What do you understand by areal velocity of a planet ? State kepler's second law of planetary motion.what does it imply ?

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10. Distance between two bodies is double. What happens to gravitational force of

attraction between them ?this force is to be kept unchanged, how should mass of one of the bodies be changed?

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11. If earth is taken as a sphere of radius 6400 km and mass 6×10^{24} kg, what would be the value of g on the surface of earth ?

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12. State the three equations of motion of a body under the influence of gravitational force of earth. When is g positive and when is it negative? What is maximum height?

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13. (i) what is the mass of body of weight 1 kg ?

(ii) what is the weight of a body of mass 1 kg ?

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14. (i) what is the mass of body of weight 1 kg ?

(ii) what is the weight of a body of mass 1 kg ?

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15. The velocity with which a body stricks the ground is always equal to the velocity with which it was projected upwards.' is the statement true ? On what principle is ist based ?

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16. Prove that time taken by a body to rise to highest point is always equal to the time taken by it to fall through he same height.

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17. The weight of a body on the surface of earth is 392N. What is its mass, when $g = 9.8m/s^2$. If the body is taken to moon, it weighs 64 N. what is mass of body on moon ? Calculate acceleration due to gravity on moon.

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18. Using Newton's law of gravitation, calculate density of earth.

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19. Newton's law of gravitation has been verified experimentally. But there is enough indirect evidence of its truth. For example, gravitational force of attraction of earth is responsible for binding all terrestrial object

on earth. The same force is responsible for holding the atmosphere around earth, for rainfall and snowfall on earth. the gravitational force alone is responsible for holding our solar system in place, and so on.

Read the above passage and answer the following questions:

(i) name any two prediction made on the basis of this law.

(ii) what values do you learn from this law ?

View Text Solution

20. What happens to garavitational force between two bodies, when mass of each is made three times and distance between them is reduced to $\frac{1}{3}$rd ? Is the value of G affected ?

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21. State and explain breifly keplar's laws of planetary motion.

Watch Video Solution

22. A ball trown up vertically returns to the thrower after 10 second. Calculate

(i) the velocity with which it was thrown up.

(ii) the maximum height it reachesand

(iii) its poisition after 7 second.

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23. If mass of earth is roughly 80 times the mass of moon and diameter of earth is roughly 3.6 times the diameter of moon, show

that weight of an object on moon will be roughly $\frac{1}{6}$th of the weight of the object on earth.

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24. A geostationary satellite is orbiting the earth at a height 5 R above the surface of earth, where R is radius of earth. Find the time period of another of another satellite at a height of 2 R from the surface of earth.

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25. (a) Calculate average density of earth in terms of g. G and R.

(b) If gravity of earth becomes zero sudddelny, what will happen to moon ?

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Model Test Paper 1

1. An object has moved through some distance. Can its displacement be zero ?

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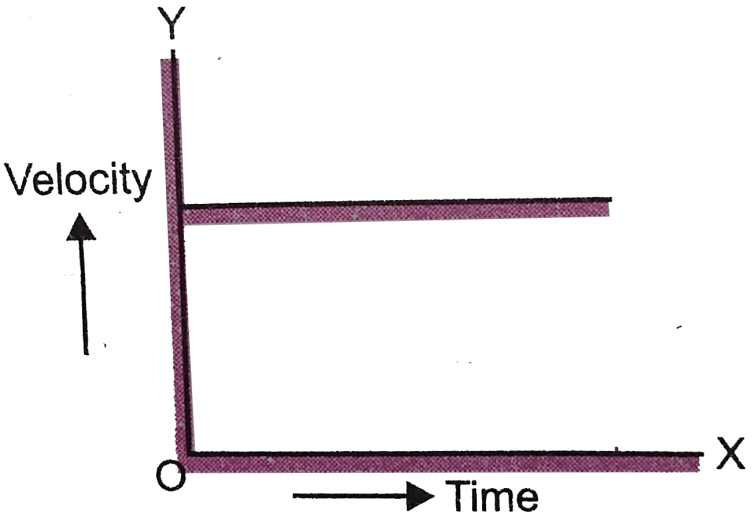
2. The velocity time graph of a body is as showh in



what would be the acceleration of the body ?

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3. Uniform motion along a circle is a an acceleration motion. Comment.

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4. What does the path of an object look like when it is in uniform motion ?

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5. A train starting from a railway station and moving with uniform acceleration attains a speed of $40 km/h$ in 5 min. find its acceleration.

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6. What is the nature of the distance-time graphs for uniform and non-uniform motion of an object ?

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7. Seat belts in cars are called safety belts. Why?

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8. A body covers half the distance with a speeed of 20 m/s and the other half with a sopeed of 30 m/s. What is the average speed of the whole journey ?

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9. A bullet of mass 20 gram is fired horizinatally with a speed of $150 m / s$ from a pistol of mass 2.5kg. What is the recoil velocity of the pistol ?

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10. A truck starts from rest and rolls down a hill with a constant acceleration. It travels a distance of $400 m$ in $20 s$. Find its acceleration.

Find the force acting on it if its mass is 7 metric tonnes (Hint.1 metric tonne=1000kg)

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11. If diameter of earth becomes half of its present value and its mass becomes four times its present value, how would the weight of any object on the surface of earth be affected ?

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12. An athlete complete one round of a circular track of diameter 200m in 40s. What will be the distance covered and the displacement at the end of 2 minutes ?

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13. Draw distance time graph of a body (i) at rest

(ii) in uniform motion and

(iii) in non uniform motion.

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14. Derive graphically the relation $v = u + at$,where the symbols have their usual meaning.

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15. A balloon is rising up with an acceleration of $10 m/s^2$. A body is dropped from the balloon when its velocity is 200 m/s. The body strickes the ground in half a minute.

With that velocity did the body hit the ground ? Take $g = 9.8m/s^2$.

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16. To catch a fast cricket ball, a player pulls his hands backwards. Why ?

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17. The car A of mass 1000 kg travelling at $25m/s$ collides with another car B of mass

1500 kg moving with a speed of 20 m/s in the same direction, the velocity of car A becomes 15 m/s, what would be the velocity of car B ?

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18. A 60 kg tiger springs at hunter with a velocity of $10m/s$ the hunter possesses a machine gun that can fire 50 g bullets with a velocity of $150m/s$. the hunter can save himself from the tiger by firing suitable number of bullets/sec into the tiger.read the

above passage and answer the following questions:

(i) What principal is involved here?

(ii) How many bullets/sec. must the hunter fire into the tiger?

(iii) What lessons do you learn from this?

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19. Two bodies each of mass 10 kg attract each other with a force of 0.1 milligram weight. What is the distance between them ?

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20. Using second law of motion, derive the relation between force and acceleration.

Watch Video Solution

21. Draw velocity time graph of a body

(i) at rest (ii) in uniform motion

(iii) in uniform acceleration (iv) in non uniform acceleration.

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22. State the law of conservation of linear momentium. How do you obtain this law from newton's third law ?

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23. Define G and g. how are they telated to eachother ? Use this relation to calculate mass of earth.

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24. Use velocity time graph to derive the relation : $v^2 - u^2 = 2$ as, where the symbols have their usual meaning.

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25. Which of the following is called the real law of motion ?

A. Newton's first law

B. Newton's 2nd law

C. Newton's third law

D. none of these

Answer: B

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26. When we hold a suitcase steady at some height

A. weight of suitcase stops acting

B. suitcase alone applies force

C. suitcase is under the action of balanced forced

D. none of the above

Answer: C

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27. A body A of mass 20 kg collides with another body B of mass 1 kg. then

A. force exerted by A on B is more than that exerted by B on A

B. force exerted by B on A is more than that exerted by A on B

C. forces exerted by B and A are equel and opposite

D. cannot predict.

Answer: C

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28. A moving body cannot stop on its own. This is due to

A. inertia of rest

B. inertia of motion

C. inertia of direction

D. all of theese.

Answer: B

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29. A block is placed on a horizontal table. Identify the force of action

A. weight of block

B. support of table on the block

C. either (a) or (b)

D. neither (a) nor (b).

Answer: A

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30. In walking, identify the force of reaction:

A. push of our foot on the ground

B. push of ground on our foot

C. either (a) or (b)

D. neither (a) nor (b).

Answer: B

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31. The condition for validity of the principle of conservation of linear momentum is :

A. external force should be acting on any one body

B. external force should be aacting on both the bodies

C. no external unbalanced force should act on the system

D. none of these

Answer: C

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32. The force of action and reaction can occur only when two bodies collide against one another. The statement is

A. true

B. false

C. sometimes true and sometimes false

D. cannot predict.

Answer: B

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33. The forces of action and reaction appear only when the bodies are at rest. The statement is

A. true

B. false

C. sometimes true and sometimes false

D. can not predict.

Answer: B

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34. A proton moving with a velocity of $10^6 m/s$ collides with a neutron at rest. If collision is prefectliy elastic, then after collsion, what are the velocities of porton and neutron?

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35. A 10 gram bullet is shot from a 2 kg gun with a velocity of 400 m/s. What is the speed of recoil of the gun ?

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36. A man weighing 50 kg runs along a railway track with a velocity of 18 km/h and jumps onto a stationary car of 2 quintal standing on the rails. What would be the velocity acquered by the car ?

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