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Class 9 science ncert solutions chapter 10

State the Universal Law of Gravity The Universal Law of Gravity states that every object in the universe attracts any other object with a force called gravitational force. The force acting between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. For two objects of the masses m_1 and m_2 and the distance between them r , the force (F) of the attraction that acts between them is given by the universal law of gravity such as: Where is G the universal gravitational constant, given by: NCERT solution for Class 9 science - gravity 134 , Question 1 Write the formula to find the size of the gravitational force between the earth and an object on the surface of the Earth. Let ME be the mass of the earth and m be the mass of an object on its surface. If R is the radius of the earth, then according to the universal law of gravity, the gravitational force (F) acting between the earth and the object is given by the relationship: NCERT solution for the science of class 9 - gravity 134 , question 2 page no. 136: What do you mean by free fall? The gravity of the earth pulls each object towards its center. When an object is released from a height, it falls under the influence of gravitational force on the Earth's surface. The movement of the object should have free fall. NCERT Solution for Class 9 Science - Gravity 136 , Question 1 Page No. 136: What do you mean by acceleration due to gravity? When an object falls to the ground from a height, its speed changes during the fall. This changing speed creates acceleration in the object. This acceleration is called acceleration due to gravity (g). Its value is given as 9.8 m/s². NCERT Solution for Class 9 Science - Gravity 136 , Question 2 Page No. 138: What are the differences between the mass of an object and its weight? S. No. Mass Weight I. Mass is the amount of matter contained in the body. Weight is the force of gravity that acts on the body. II. It is the measure of the inertia of the body. It is the measure of gravity. III. Mass is a constant amount. Weight is not a constant quantity. It's different in different places. IV. It has only size. It has size and direction. V. His SI unit is kilogram (kg). Its SI unit is the same as the SI force unit, i.e. Newton (N). NCERT Solution for Class 9 Science - Gravity 138 , Question 1 Page No. 138: Why is the weight of an object on the moon its weight on Earth? Let ME be the mass of the earth and m be an object on the surface of the earth. Let RE be the radius of the earth. According to the universal law of gravity, the weight OF the object on the earth's surface is determined by. Let and be the masse radius of the moon. Then, according to the universal law of gravity, weight WM of the object on the surface of the moon is given by: Therefore, the weight of an object on the moon is of its weight on the NCERT Solution for Class 9 Science - Gravity 138 , Question 2 Page No. 141: Why is it difficult to hold a school bag with a strap made of a thin and strong cord? It is difficult to hold a school bag with a thin strap, as the pressure on the shoulders is quite large. This is because the pressure is inversely proportional to the surface on which the force acts. The smaller the area, the greater the pressure on the surface. With a thin belt, the contact surface is very small. Therefore, the pressure on the shoulder is very high. NCERT Solution for Class 9 Science - Gravity 141 , Question 1 Page No. 141: What do you mean by buoyancy? The upward force exerts a liquid on an object immersed in it is called buoyancy. When you try to immerse an object in water, you can exert an upward force on the object, which increases as you push the object deeper into the water. NCERT Solution for Class 9 Science - Gravity 141 , Question 2 Page No. 141: Why does an object float or sink when placed on the water surface? If the density of an object is greater than the density of the liquid, then it sinks in the liquid. This is because the driving force acting on the object is smaller than gravity. On the other hand, if the density of the object is less than the density of the liquid, then it floats on the surface of the liquid. This is because the driving force acting on the object is greater than gravity. NCERT Solution for The Science of Class 9 - Gravity 141 , Question 3 Page No. 142: You will find your mass 42 kg on a weighing machine. Is your mass more or less than 42 kg? When you weigh your body, an upward force affects it. This upward force is the buoyant force. This pushes the body slightly upwards, causing the weighing machine to display a value below the actual value. NCERT solution for class 9 - gravity 142 , Question 1 page 142: You have a cotton bag and an iron rod, each showing a mass of 100 kg when measured on a weighing machine. In reality, one is heavier than the other. Can you tell which is heavier and why? The cotton bag is heavier than the iron bar. This is because the surface of the cotton bag is larger than the iron rod. Therefore, more powerful force acts on the bag than on an iron rod. This makes the cotton bag heavier than its actual value. For this reason, the iron rod and the bag of cotton show the same mass on the weighing machine, but actually the mass of the cotton bag is more than that of the iron rod. Actual Weight = Measured Weight + Buoyancy Force NCERT Solution for Class 9 Gravity 142 , Question 2 Page No. 143: How the gravitational force between two objects when the distance between them is reduced to half? According to the universal law of gravity, the gravitational force (F) acting between two objects is inversely proportional to the square of the distance (r) between i.e. If distance r becomes $\frac{1}{2}$, then the gravitational force becomes proportional to four times the previous value. NCERT Solution for The Science of Class 9 - Gravitation 143 , Question 1 Page No. 143: Gravitational Force Affects All Objects in Relation to Their Masses. Why doesn't a heavy object fall faster than a light object? All objects fall to the ground with constant acceleration, called acceleration due to gravity (in the absence of air resistance). It is constant and does not depend on the mass of an object. Therefore, heavy objects do not fall faster than light objects. NCERT Solution for Class 9 Science - Gravity 143 , Question 2 Page No. 143: How big is the gravitational force between the Earth and a 1 kg object on its surface? (The mass of the earth is 6×10^{24} kg and the radius of the earth is 6.4×10^6 m). According to the universal law of gravity, the gravitational force exerted on an object of mass m is given by: Where, mass of the earth, $M = 6 \times 10^{24}$ kg mass of the object, $m = 1$ kg Universal gravitational constant, $G = 6.7 \times 10^{-11}$ Nm² kg², since the object is on the earth's surface, $r =$ radius of the earth (R) $r = R = 6.4 \times 10^6$ m gravitational force, NCERT solution for natural gravity of class 9 - gravity 143 , question 3 page 143: The earth and the moon are attracted by gravitational force. Does the Earth attract the moon with a force greater or less or equal to the force with which the moon attracts the earth? Why? According to the Universal Law of Gravity, two objects attract with the same force, but in opposite directions. The Earth attracts the moon with the same force with which the moon attracts the Earth. NCERT Solution for Class 9 Science - Gravity 143 , Question 4 Page No. 143: When the Moon Attracts the Earth, why doesn't the Earth Move to the Moon? The Earth and the Moon experience the same gravitational forces of each other. However, the mass of the earth is much larger than the mass of the moon. Therefore, it accelerates towards Earth at a speed lower than the moon's acceleration rate. For this reason, the Earth does not move towards the moon. NCERT Solution for Class 9 Science - Gravity 143 , Question 5 Page No. 144: What happens to the force between two objects when (i) the mass of an object is doubled? (ii) the distance between the objects is doubled and tripled? (iii) the masses of both objects are doubled? (i) Doubles (ii) One quarter and one-ninth (iii) four times According to the Universal Law of Gravity, the gravitational force is given between two objects by: (i) F is directly proportional to the masses of the objects, the Doubled. (ii) F is inversely proportional to the square of the distances between the objects. When the distance is doubled, the gravitational force becomes gravitational force of its original value. When the distance is tripled, the gravitational force also becomes one-ninth of its original value. (iii) F is directly proportional to the product of the masses of objects. When the masses of both objects are doubled, the gravitational force becomes four times as high as the original value. NCERT Solution for Class 9 Science - Gravity 144 , Question 6 Page No. 144: What is the meaning of the universal right of gravity? The universal law of gravity proves that every object in the universe attracts every other object. NCERT Solution for Class 9 Science - Gravity 144 , Question 7 Page No. 144: How high is the acceleration of free fall? If objects fall on the Earth alone under the influence of gravitational force, then they should be in free fall. The acceleration of free fall is 9.8 m/s², which is constant for all objects (regardless of their masses). NCERT Solution for Class 9 Science - Gravity 144 , Question 8 Page No. 144: What do we call the gravitational force between the Earth and an object? Gravitational force between the Earth and an object is called the weight of the object. NCERT Solution for Class 9 Science - Gravity 144 , Question 9 Page No. 144: Amit buys a few grams of gold from the Poles at the direction of one of his friends. He hands over the same thing when he meets him at the equator. Does the friend match the weight of the gold purchased? If not, why? [Note: The value of g is greater at the poles than at the equator]. The weight of a body on earth is given by: $W = mg$ Where, $m =$ mass of the body $g =$ Acceleration due to gravity The value of g is greater at the poles than at the equator. Therefore, gold weighs less at the equator than on the poles. Therefore, Amit's friend will not agree with the weight of the purchased gold. NCERT Solution for Class 9 Science - Gravity 144 , Question 10 Page No. 144: Why will a sheet of paper fall more slowly than a sheet crumpled into a sphere? When a piece of paper crumbles into a sphere, its density increases. Therefore, the resistance to its movement decreases through the air and it falls faster than the sheet of paper. NCERT Solution for The Science of Class 9 - Gravity 144 , Question 11 Page No. 144: The gravitational force on the lunar surface is only as strong as the gravitational force on Earth. What is the weight in Newton of a 10 kg object on the moon and on Earth? Weight of an object on the moon Weight of an object on Earth Also weight = mass \times acceleration Acceleration due to gravity, $g = 9.8$ m/s² Therefore the weight of a 10 kg object on Earth = $10 \times 9.8 = 98$ N And, weight of the same object on the moon NCERT Solution for Class 9 Science - Gravity 144 , Question 12 Page No. 144: A sphere is vertically up with a 49 m/s. Calculate (i) the maximum height to which it rises. (ii) the total time it takes to return to the earth's surface. (i) 122.5 m (ii) 10 s According to the equation of motion under gravity, $v^2 - u^2 = 2$ Where, $u =$ initial velocity of the ball $v =$ final velocity of the ball $g =$ acceleration due to gravity At maximum height, the final velocity of the ball is zero, i.e. $v = 0$ $u = 49$ m/s During the upward movement, $g = -9.8$ m/s² Let h be the maximum height that the ball reaches. Therefore, let's take the time to which are taken from the ball to reach the height 122.5 m, then according to the equation of movement: $v = u + gt$ We get, But, time of ascent = time of descent. Therefore, the total time of the ball is taken to return = $5 + 5 = 10$ s NCERT solution for class 9 science - gravity 144 , question 13 page no. 144: A stone is released from the top of a tower of height 19.6 m. Calculate the last speed just before touching the ground. According to the equation of motion under gravity, $v^2 - u^2 = 2$ $u =$ initial speed of the stone $v =$ final velocity of the stone $s =$ height of the stone = 19.6 m $g =$ acceleration due to gravity = 9.8 m/s². $v^2 - 0^2 = 2 \times 9.8 \times 19.6$ $v^2 = 2 \times 9.8 \times 19.6 = (19.6)^2$ $v = 19.6$ m/s the speed of the stone just before touching the ground is 19.6 m/s. NCERT Solution for Class 9 Science - Gravity 144 , Question 14 Page No. 144: A stone is thrown vertically upwards at an initial speed of 40 m/s. Under $g = 10$ m/s² you will find the maximum height reached by the stone. What is the net shift and the total distance the stone covered? According to the equation of motion under gravity: $v^2 - u^2 = 2$ g Where, $u =$ initial speed of the stone = 40 m/s $v =$ final velocity of the stone = 0 $s =$ height of the stone $g =$ acceleration due to gravity = 10 m/s² Let h be the maximum height achieved by the stone. Therefore, the total distance that the stone covered during its up and down journey = $80 + 80 = 160$ m net displacement of the stone during its ascent and down is = $80 + (80) = 0$ NCERT solution for the science of class 9 - gravity 144 , question 15 page No. 144: Calculate the gravitational force between earth and sun, since the mass of the earth = 6×10^{24} kg and the sun = 2×10^{30} kg. The average distance between the two is 1.5×10^{11} m. According to the universal law of gravity, the power of attraction between the earth and the sun is given by: Where, $M_{Sun} =$ Mass of the Sun = 2×10^{30} kg $M_{Earth} =$ Earth Mass = 6×10^{24} kg $R =$ Average distance between Earth and Sun = 1.5×10^{11} m $G =$ Universal gravitational constant = 6.7×10^{-11} Nm² kg⁻² NCERT solution for class 9 science - gravity 144 , question 16 page No. 144: A stone may fall from the top of a 100 m high tower and at the same time another stone is projected vertically from the ground upwards at a speed of 25 m/s. Calculate when where the two stones meet. Let the two stones meet t after a time. (i) For the stone dropped from the tower: initial velocity, $u = 0$ Let the shift of the stone in time t be from the top of the tower s . Acceleration due to gravity, $g = m/s^2$ From the equation of motion, (ii) For the stone thrown upwards: initial velocity, $u = 25$ m/s Let the movement of the stone from the ground be in time t s . Acceleration by gravity, $g = 9.8$ m/s² Equation of motion, The combined displacement of the two stones at the meeting point is equal to the height of the tower 100 m. In 4 s the ball reaches has covered a distance specified by equation (1), since the stones after 4 s at a height (100 \times 80) = 20 m from the ground NCERT solution for class 9 science - gravity 144 , question 17 page no. 144: A vertically raised ball returns to the thrower after 6 s. Find (a) the speed at which it was thrown up, (b) the maximum altitude it reaches, and (c) its position after 4 s. (a) 29.4 m/s (b) 44.1 m (c) 39.2 m above the ground (a) the time of ascent corresponds to the time of descent. The ball takes a total of 6 s for its up and down drive. Therefore, it took 3 s to reach the maximum height. Final speed of the ball at maximum height, $v = 0$ Acceleration due to gravity, $g = 9.8$ m/s² Equation of motion, $v = u + gt$ results. $0 = u + (9.8 \times 3)$ $u = 9.8 \times 3 = 29.4$ m/s 1 Therefore the ball was thrown upwards at a speed of 29.4 m. b) Let the maximum height the ball reaches be h . Initial velocity during the upward journey, $u = 29.4$ m/s-1 final speed, $v = 0$ Acceleration due to gravity, $g = 9.8$ m/s $s = 2$ From the equation of motion (c) Ball reaches the maximum height after 3 s. After this height is reached, it begins to fall downwards. In this case, the initial velocity, $u = 0$ position of the ball after 4 s of the throw is indicated by the distance travelled by it during its downward journey in 4 s $s = 3 \times 3 = 1$ s. Equation of movement, will give total height = 44.1 m This means that the ball is 39.2 m (44.1 m \times 4.9 m) above the ground after 4 seconds. NCERT Solution for The Science of Class 9 - Gravity 144 , Question 18 Page No. 145: In which direction does the buoyancy act on an object immersed in a liquid air? An object that is immersed in a liquid experiences strong force in the upward direction. NCERT Solution for Class 9 Science - Gravity 145 , Question 19 Page No. 145: Why does a plastic block released underwater come to the water surface? Two forces act on an object submerged in water. One is the gravitational force that pulls the object down, and the other is the buoyant force that pushes the object upwards. If the rising buoyancy force is greater than the downward gravitational force, then the object comes to the surface of the water as soon as it is released into the water. For this reason, a plastic block released under water comes to the water surface. NCERT Solution for Class 9 - Gravity 145 , Question 20 page No. 145: The volume of 50 g of a substance is 20 cm³. If the density of the water is 1 g/cm³, will the substance swim or decrease? If the density of an object is greater than the density of a liquid, liquid, the liquid. On the other hand, if the density of an object is less than the density of a liquid, then it floats on the surface of the liquid. Here is the density of the substance = The density of the substance is greater than the density of the water (1 g/cm³). Therefore, the substance in the water will sink. NCERT Solution for Class 9 Science - Gravity 145 , Question 21 Page No. 145: The volume of a 500 g sealed package is 350 cm³. Does the package swim or sink in the water when the water density is 1 g/cm³? What will be the mass of water displaced by this package? Density of the 500 g sealed pack The density of the substance is greater than the density of the water (1). Therefore, it will sink in the water. The water mass displaced by the package corresponds to the volume of the package, i.e. 350 g. NCERT solution for Class 9 Science - Gravitation 145 , Question 22 22

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