M.Prakash Academy **Science Weekly Workout**

Set VIII 3 June - 9 June

Dear Students,

This is the last set of your vacation homework. These are some problems from your physics portion. The problems are mixed, some are easy, some are very easy and some are moderate. As usual, we have not given any 'difficult' problems.

As we move towards the end of the vacation, let us remind you that you need to **bring a completed file of all solutions at the time of your first science class**, whether Chemistry or Physics. Very soon, you will have class tests in your respective classes. So here we go...

Q1. On a two lane road, car A is traveling at 10 m/s while cars B and C approach A in opposite directions with speed 15 m/s each. At the instant when $AB = AC = 1\ km, B$ decides to overtake A before C does. What minimum acceleration of car B is required to avoid an accident?

Q2. A body moving with an initial velocity of $1m/s$ accelerates uniformly at $\frac{1}{2}\ m/s^2$. Find its displacement and velocity at the end of 10 s. What is its velocity when it has a displacement of 48 m?

Q3. The initial velocity of a car 10 m/s. It accelerates uniformly at 2 m/s^2 for $20s$ and thereafter retards uniformly at 4 m/s^2. Find the total distance covered by the car before it comes to rest. For how much time the car is in motion?

Q4. A body starting from rest accelerates uniformly at 0.1 m/s^2 and retards uniformly at 0.2 m/s^2. What is the least time in which it can complete a journey of 5 km if it attains a maximum velocity of 72 km/hr? Express your answer in second.

Q5. A body moves in a straight line with uniform acceleration and at time $t = 0, 1, 2, 3, 4\ s$ it has displacements of $12, 21, 38, 63$ and 96 m respectively from a fixed point O. Find its acceleration.

Q6. A body moving with uniform acceleration covers 15 m in the third second of its motion and 19.4 m in the fifth second. If its acceleration is uniform, find the acceleration and initial velocity.

Q7. A body moving with uniform acceleration has velocities of 20 m/s and 30 m/s when passing points P and Q respectively in its path. Find its velocity at the point midway between P and Q.

Q8. A train moving with uniform acceleration has its front end passing a given fixed point P with a speed u and the tail end passing the same point P with a speed v. What is the speed of the mid-point of the train when passing that point?

Q9. Two trains A and B, each of length 500 m are moving on two parallel tracks with a uniform speed of 90 km/hr in the same direction A being ahead of B. The driver of B accelerates at 1 m/s^2 to overtake A. After 40 s the end if train B or its guard van just passes by the front cabin or driver cabin of the train A. Find the original distance between A and B.

Q10. Starting from rest, a body P travels with a uniform acceleration of 4 m/s^2 and 4 s later a body Q travels with a uniform acceleration of 16 m/s^2 in the same direction as P. Note that Q also starts from rest. Find when and where will they meet.

Q11. The initial velocity of a car is 5 m/s. It accelerates uniformly at $\frac{1}{2}$ m/s^2 for 30 s and then retards uniformly at 2 m/s^2. Find the distance covered by the car before it comes to rest. For how much time is the car in motion?

Q12. A body moving with uniform acceleration covers 65 cm in the 5^{th} second and 105 cm in the 9^{th} second. What distance does it travel in 15 s?

Q13. A car travelling at 72 km/h has its velocity reduced to 36 km/h in 5 s. If the retardation is uniform, find how much distance it has covered during this time. How much farther would it travel before coming to rest assuming same uniform retardation?

Q14. Starting from rest, a car P travels with a uniform acceleration of 2 m/s^2. Starting from rest from the same point 4 s later, a car Q travels with an acceleration of 8 m/s^2 in the same direction as P. Find the time required by Q to overtake P. What is the distance travelled by each car?

Q15. A body moves along a straight line with uniform acceleration and at instants $t = 0, 1, 2, 3$ s it is at distance of $30, 52.5, 80$ and 112.5 m from a fixed point. Find its acceleration, velocity at $t = 0$.

Q16. An objects is thrown vertically upwards using a machine with a velocity of 80 m/s.Find the maximum height attained by the object and the time required for it to return to the point from which it was thrown.

Q17. From the top of a cliff 104 m high, a body is thrown vertically upward with velocity 20 m/s. Neglecting air resistance, compute:
(i) Maximum height attained by the object from the ground.
(ii)Time required to attain maximum height.
(iii) Time required to reach the point from which it was thrown.
(iv) Velocity with which the object passes the point of throw.
(v)Total time for which the object is in air.
(vi) Velocity with which it strikes the ground.

Q18. An object is released from height of 300 m. At the same time, another object is thrown from the ground in vertically upward direction with $30m/s$. Find where and when will they meet.

Q19. A stone released from top of a tower covers a distance of 25 m in the last second of its motion. Find the height of the tower.

Q20. A body at rest, with mass 160 kg, is subjected to a constant force of 800 N. With is the distance travelled in 10 s? Neglect friction.

Q21. A constant force acts for 5 s on a body of mass 10 kg and then stops acting. The body is initially at rest. If the body covers a distance of 100 m in next 5 s, calculate the force applied. Neglect friction.

Q22. An engine of mass 50 ton is moving with velocity of 36 km/hr. What force can stop if within a distance of 100 m after its application? How much force is needed if the engine is to be stopped in 10 s after the application of the force?

Q23. Two blocks of masses 50 kg and 150 kg are connected by a light, massless string and are lying on a smooth, horizontal surface with the lighter block on the right side of the heavier block. How much force should be applied to pull the lighter block so that the system of blocks accelerates with 5 m/s^2? (We call this force as F.) How much tension will be developed in the string? Call this tension as T_1. Let T_2 be the tension developed in the string when force F is applied on the heavier block. Compute $T_1 - T_2$.

Q24. In a graph, distance is plotted against time. What does the graph tell us if:
(i) The curve is a straight line parallel to the time axis?
(ii) The curve coincides with the time axis?
(iii) The curve makes an angle of 30^0 with the time axis and passes through the origin?
(iv) At time $t = 0$ the curve has some positive value on the distance axis and makes an angle of 150^0 with the time axis. How much is that positive value at time $t = 0$?

Q25. In a graph, velocity is plotted against time. What does the graph tell us if we have curves exactly same as those mentioned in the above problem?

Q26. A jet plane traveling with a speed $600km/hr$ ejects its products of combination at a speed of $1800km/hr$ relative to the plane. What is the speed of these gases with respect to the observer on the ground?

Q27. A body moving along a straight line has its displacement in metres given by $s = 3 + 2t + 4t^2$. Find its velocity after $2s$ and the acceleration.

Q28. A particle moves along a straight line such that its displacement s at any time t is given by $s = t^3 - 6t^2 + 5t + 4$ metre. Find its velocity when the acceleration is zero.

Q30. An alien space traveller uses units of glong to measure distance and tock to measure time. She observes that her gun, dropped from a high cliff, fell a distance of 1 [glong] in a time of 1 [tock]. How far will it fall in 2 [tocks]? (Ignore air resistance.)

Q31. A rock is dropped out of the window of a moving car. At the same time a ball is dropped from rest from the same height. (Neglect air resistance.) Which of them will reach the ground first? Justify your answer.

Q32. A Father (80 Kg) and son (40kg) have put on roller-skating shoes. They take a rope to play tug-of-war. Father wishes his son to win, hence doesn't exert much force. Finally who will win and why? If they push each other with hands, who will travel faster?

Q33. A tow-truck exerts a 18300-N force upon a 1210 Kg car to drag it out of a mud puddle onto the shoulder of a road. A 17900 N force opposes the car's motion. The plane of motion of the car is horizontal. Determine the time required to drag the car a distance of 6.90 meters from its rest position.

Q34. A train has a mass of $6.5x10^4$ kg and is moving with a speed of 90 km/hr. The driver applies the brakes which results in a net backward force of $2.6x10^5$ N on the train. The brakes are held for 4 second. How far (in meters) does the train travel during this time?

Q35. A car goes up a hill with gradient of 45 degrees with horizontal without changing its speed. Is the car accelerating? Explain your answer.

Documentary for this week:

Some of your have already spent some time learning about electricity and some would be doing that soon. We suggest that all of you watch the following documentry film based on life and work of Nikola Tesla. It goes without saying that this is one version of his story. **Parental guidance required.**

Here is the link.

https://www.youtube.com/watch?v=eoY$_7mbm5ng$

——— Enjoy !! See you soon !!! ———