

Worksheet (Equation of Motion & Variable Mass)

MCQ (Multiple Choice Questions)

- Q1. A rocket has 50 kg weight and contains 450 kg fuel. It has to be given an acceleration of 20 m/s^2 . The exhaust gas velocity must be (rate of fuel consumption is 7.45 kg/s)
(a) 2 km/s (b) 3 km/s (c) 2 m/s (d) 10 m/s
- Q2. A 40 kg rocket contains 160 kg fuel. The exhaust velocity is 2 km/s and rate of fuel consumption is 4 kg/sec . The ultimate vertical speed gained by rocket is ($g = 10\text{ m/s}$)
(a) 2 km/s (b) 2.82 km/s (c) 3 km/s (d) 3.82 km/s
- Q3. A rain drop of mass m falls through the atmosphere with a resistance to its velocity v . after a long time ($t \rightarrow \infty$), the velocity of the drops is
(a) constant (b) Still increases continuously
(c) becomes negligible (d) cannot be predicted
- Q4. A chain of length l , mass m , fall vertically on a table. The force on the chain, applied by the table, when $\frac{3}{4}$ th of the chain length is on the table is
(a) $\frac{5}{4}mg$ (upwards) (b) $\frac{mg}{4}$ (upward)
(c) $\frac{3}{2}mg$ (upward) (d) $\frac{mg}{2}$ (downward)
- Q5. A truck is moving on horizontal smooth surface with velocity 10 m/sec . It contains sand which starts leaking through it at a rate of 2 kg/sec . The thrust force acting on the truck due to this is
(a) 0 N (b) 20 N (c) 50 N (d) 2000 N
- Q6. A truck moving on a smooth horizontal road with a speed of 10 m/sec , has sand leaking through it at a rate of 2 kg/sec and simultaneously sand being poured into it at a rate of 5 kg/sec through a hopper the thrust force acting on it is
(a) 10 N (b) 30 N (c) 50 N (d) 100 N
- Q7. A truck of weight 2000 kg moves on a horizontal smooth surface road at a speed of 36 km/hr sand is poured into it through a hopper at a rate of 10 kg/sec . As a result, the speed of the truck after 5 sec is
(a) 12 m/sec (b) 20 m/sec (c) 9.75 m/sec (d) remains same

Q8. A spherical rain drop of radius R falls freely from rest. During this, it accumulates the condensed vapor proportional to its surface area. Then its velocity after it has fallen for t sec is

- (a) $\frac{g}{4k} \left[a + kt - \frac{R^2}{(R + kt)^3} \right]$ (b) $\frac{g}{k} \left[a + kt - \frac{R^4}{(R + kt)^3} \right]$
- (c) $\frac{g}{4k} \left[a + kt - \frac{R^4}{(R + kt)^3} \right]$ (d) $\frac{g}{4k} \left[a + kt - \frac{R}{(R + kt)} \right]$

Q9. A raindrop falls through a medium where the resistance to its motion is proportional to square of its velocity v , then the distance moved by the drop x when $t \rightarrow \infty$ is related to v is

- (a) $V \left(1 - e^{-2gx/v^2} \right)$ (b) $V^2 \left(1 + e^{-2gx/v^2} \right)$
- (c) $V \left(1 + e^{-2gx/v^2} \right)$ (d) $V^2 \left(1 - e^{-2gx/v^2} \right)$

Q10. A particle moving in a straight line has velocity displacement relationship as $v = 5\sqrt{1+s} \text{ m/s}$, then its initial velocity and acceleration are respectively

- (a) 5 m/s and 12.5 m/s^2 (b) 5 m/s and 15.5 m/s^2
- (c) 7 m/s and 12.5 m/s^2 (d) 7 m/s and 15.5 m/s^2

Q11. Equation of motion of a body is $\frac{dv}{dt} = -4v + 8$ (v in m/s and t in sec). Initial velocity is zero.

Initial rate of change of acceleration is

- (a) 32 m/sec^2 (b) -32 m/sec^2 (c) 48 m/sec^2 (d) -48 m/sec^2

NAT (Numerical Answer Type)

Q12. A 5000 kg rocket is fired vertically, the rate of ejection of gases is _____ kg/sec at exhaust speed of 100 m/s to provide a necessary thrust to support the weight of rocket.

Q13. A 5000 kg rocket is fired vertically, the value of fuel consumption rate for providing acceleration $2g$ to rocket is _____ m/sec

Q14. A tank contains water to a height of 10 m . It has an opening of 0.1 m^2 area at the bottom. If the tank is kept on wheels on a smooth surface, the distance it can move in 2 sec is _____ m .