1. A force f = $(3\hat{\imath} + 4\hat{\jmath})$N acts on a 2 kg object that moves from an initial position d_1 = $(-3\hat{\imath} - 2\hat{\jmath})$m to final position d_2 = $(5\hat{\imath} + 4\hat{\jmath})$m in 6 s. What is the average power delivered by the force during the interval?
2. A particle moves with a velocity v = $(5\hat{\imath} - 3\hat{\jmath} + 6\hat{k})$m/s under the influence of a constant force F = $(10\hat{\imath} + 10\hat{\jmath} + 20\hat{k})$N. Find the instantaneous power delivered to the particle.
3. A block of mass m is moving with a constant acceleration a on a rough horizontal plane. The coefficient of friction between the block and plane is μ. At time t from the beginning find the power delivered by

   (a) gravity (b) normal force

   (c) friction (d) the external agent
4. A block of mass 2.0 kg is pulled up on a smooth incline of angle 30° with the horizontal. If the block moves with an acceleration of 1.0 m/s², find the power delivered by the pulling force at a time 4.0 s after the motion starts.
5. A stone is projected with velocity u at an angle θ with horizontal. Find out

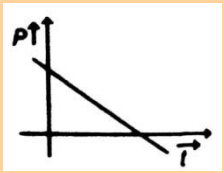
   (a) average power of the gravity during time t.

   (b) instantaneous power due to gravitational force at time t, where t is time of flight.
6. A water pump lifts water from a level 10 m below the ground. Water is pumped at a rate of 30 kg/min with negligible velocity. Calculate the minimum horsepower the engine should have to do this. (746 W = 1 HP)
7. Power applied to a particle varies with time as P = [3t² – 2t + 1] W, where is time in seconds. What is the change in kinetic energy of particle between time t = 2 s to t = 4 s?

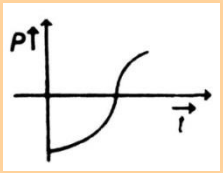
   (c) the position is given as a function of time by s = = $\left(\frac{8P}{9m}\right)^{1/2} t^{-3/2}$
8. A vehicle of mass M is accelerated on a horizontal frictionless road under a force changing its velocity from u to v in distance s. If a constant power P is given by the engine of the vehicle, then v is

(a) $\left(u^3+\frac{2Ps}{M}\right)^{1/3}$ (b) $\left(\frac{Ps}{M}+u^3\right)^{1/2}$ (c) $\left(\frac{Ps}{M}+u^2\right)^{1/3}$ (d) $\left(\frac{Ps}{M}+u^3\right)^{1/3}$

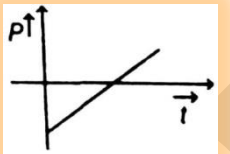
9. A particle is projected with speed u in air at an angle θ with the horizontal. The graph showing the variation of instantaneous power due to gravity P with time t will be



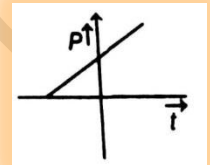
(a)



(b)



(c)

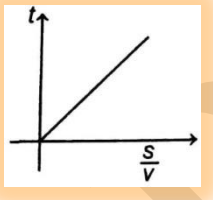


(d)

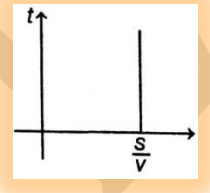
10. Water is pumped from a depth of 10 m and delivered through a pipe of cross-section 10^{-2} m^2. If it is needed to deliver a volume of 10^{-1} m^3 per second the power required will be

(a) 10kW (b) 9.8 kW (c) 15kW (d) 4.9kW

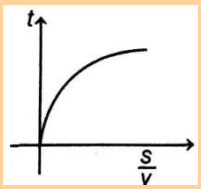
11. A body is moved from rest along a straight line by a machine delivering constant power. The ratio of displacement and velocity varies with time t as



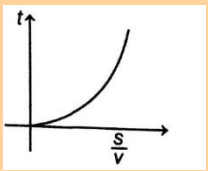
(a)



(b)



(c)



(d)

12. A body is moved along a straight line by a machine delivering constant power. The distance moved by the body in time t is proportional to (u = 0)

(a) $t^{1/2}$ (b) $t^{3/4}$ (c) $t^{3/2}$ (d) t^2

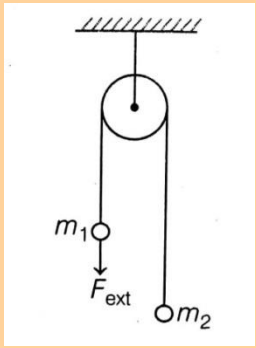
13. A truck of mass 30000 kg moves up an inclined plane of slope 1 in 100 at a speed of 30 km/h. The power of the truck is (given, g = 10 m/s^2)

(a) 25 kW (b) 10kW (c) 5kW (d) 2.5kW

14. Two bodies of mass m_1 and m_2 ($m_2 > m_1$) are connected by a light inextensible string which passes through a smooth fixed pulley. What is the

instantaneous power delivered by an external agent to pull m_1 with constant velocity v at any instant?

(a) $(m_2 - m_1)gv$ (b) $(m_2 + m_1)gv$ (c) $2(m_2 - m_1)gv$ (d) $2(m_2 + m_1)gv$



15. A machine gun is firing 60 bullets per minute with a velocity of 700 m/s. If each bullet has a mass of 50 g, the power developed by the gun is

(a) 20000 W (b) 10000 W (c) 12250 W (d) 12000 W

16. A block of mass m is pulled by a constant power P placed on a rough horizontal plane. The friction co-efficient between the block and surface is μ. Find the maximum velocity of the block.

(a) μmgP (b) $\frac{2P}{\mu mg}$ (c) $\frac{P}{2\mu mg}$ (d) $\frac{P}{\mu mg}$