Power

U84-P1 The graph in Fig.U84-P1 shows the speed v of an electric train of mass 5.0×10^4 kg as it makes a journey between two stations A and B on a straight horizontal track.

(a) Find the distance between A and B.

(b) Using suitable scales, draw accurate graphs to show how the following quantities vary during the journey;

(i) acceleration (and retardation) of the train;

(ii) force of acceleration (and force of retardation) of the train.

(c) During the time of constant speed, the power output of the electric motor of the train is 3×10^5W. Find the force of traction applied to the wheels of the train.

[1650 m; 1.0×10^4 N]

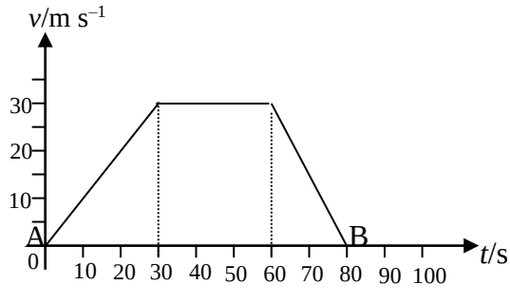

Fig.U84-P1

U92-P2a Why is tiring to hold a heavy weight even though no work is done?

(b) A locomotive, working at its full power of 1.5×10^6 W, is able to accelerate 10 coaches attached to it from an initial speed of 10 m s^{-1} to 20 m s^{-1} in 5 minutes.

(i) Neglecting frictional forces, calculate the mass of the 10 coaches.

(ii) Find the speed of the train in terms of the time t (unit of t being second).

(iii) Find the force accelerating the train in terms of the time t (unit of t being second).

(iv) Show that the distance moved by the train during this interval is equal to $4\frac{2}{3}$ km. [Hint : $s=\int_{t_1}^{t_2} v\,dt$] [3.0×10^6 kg; $\sqrt{t+100}$ ms^{-1}; $\frac{1.5\times10^6}{\sqrt{t+100}}$ N]

U99-P3a What is the relationship between the speed of motion of a car and the dynamic force of the car when the car is moving on a horizontal floor with a constant power?

(b) A car has a mass of 500 kg. It moves with a uniform speed of 30 m s^{-1} on a horizontal floor when its instant power is 12 kW.

(i) What is the resistance of the floor?

(ii) What is the coefficient of sliding friction between the car and the floor?

(c) If the power remains unchanged, what is the retardation of the car when it starts to move up a slope inclined with an angle $\theta = \sin^{-1}(3/5)$?

(d) On the same slope, if the car is going to maintain a constant speed of 10 m s^{-1}, what is the driving force needed? What is the power to be maintained?

[400 N, 0.08; - 5.84 m s^{-2}; 33200 W]

U2k09-8 In Fig.U2k09-8, a man carries an object of weight 25 N from A to B and then to the top of slope at C in 5 seconds. What is the average power of the man on the object during this journey?

A. 250 W B. 200 W C. 100 W D. 50 W

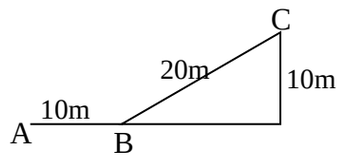

Fig.U2k09-8

U2k12-P2 A car of mass 4×10^3 kg, is moving on a road with a constant output power of 50 kW. The coefficient of the friction between the car and the road surface is 0.1. [Takes g = 10 m s^{-2}]

(a) Determine the frictional force acting by the road surface on the car.

(b) If the car starts from rest, and is moving on a horizontal road,

(i) find the work done by the car after 1 s.

(ii) what is the velocity of the car when the acceleration is 1.5 m s^{-2}?

(c) If the car starts from rest and is moving up a ramp inclined at $\theta = \sin^{-1}\frac{1}{50}$ to the horizontal, what is the maximum velocity it can achieve? [4×10^3 N; 5×10^4 J, 5 m s^{-1}; 10.42 m s^{-1}]

U2k18-06 An object of mass m slides down a smooth inclined plane with an angle of inclination θ from rest. What is the instantaneous power of gravitational force after the object has travelled a distance l?

A. $mg\sqrt{2gl\sin\theta}$ B. $mg\sin\theta\sqrt{2gl}$ C. $mg\sqrt{2gl\sin^3\theta}$ D. $mg\sqrt{\frac{gl\sin^3\theta}{2}}$