A pump extracts water from a well of depth h at a constant rate of R kg s^{-1}. What is the power required to raise the water?

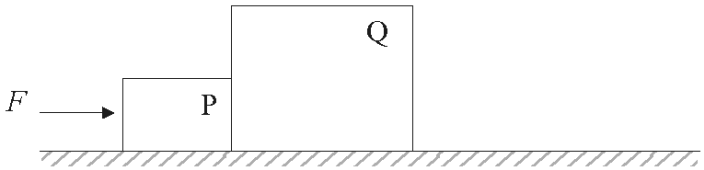
A. $\frac{R}{gh}$

B. Rgh

C. $\frac{Rg}{h}$

D. $\frac{hg}{R}$

Stephen pushes two boxes P and Q, that stay in contact, along a rough table, with a force F of 30 N. Box P has a mass of 2.0 kg and box Q has a mass of 4.0 kg. Both boxes move with constant speed.



The resultant force on box Q is

A. 0 N.

B. 5.0 N.

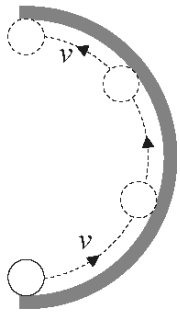
C. 15 N.

D. 30 N.

Two objects undergo an inelastic collision. Which of the following is correct in respect of both the conservation of momentum and the conservation of total energy of the system?

	Momentum	Total energy
A.	conserved	not conserved
B.	conserved	conserved
C.	not conserved	not conserved
D.	not conserved	conserved

A ball moves along the inside of a horizontal semi-circular ring as shown. The diagram is a view from above.



Which arrow represents the direction of the average force on the ball?

A.

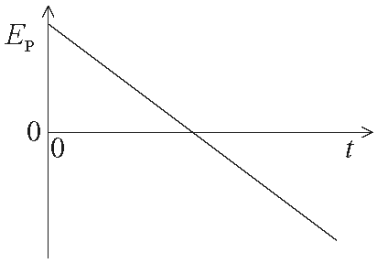
B.

C.

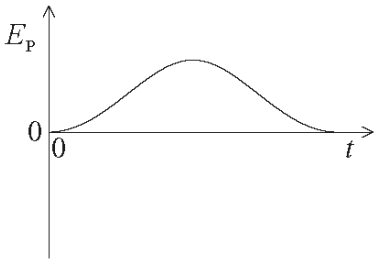
D.

A ball is thrown vertically upwards and comes down again. Air resistance is negligible. Which of the following graphs shows how the gravitational potential energy E_P varies with time t?

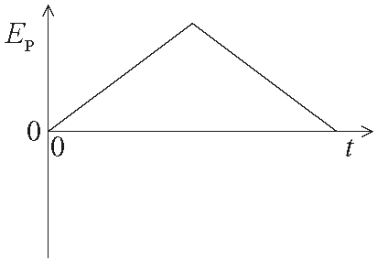
A.



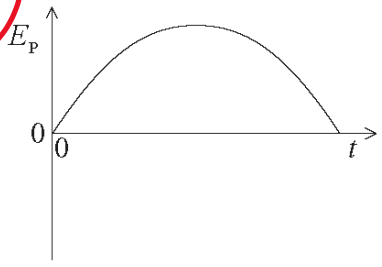
B.



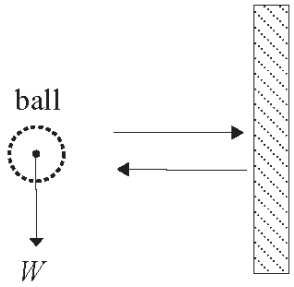
C.



D.



A ball of weight W is travelling horizontally towards a vertical wall. It strikes the wall and rebounds horizontally. The change in the magnitude of the momentum of the ball is Δp. Which of the following is the magnitude of the impulse that the ball imparts to the wall?



A. $W + \Delta p$

B. $W - \Delta p$

C. W

D. Δp

Which of the following is equivalent to the joule?

A. $\mathrm{N\,m^2}$

B. $\mathrm{N\,m^{-2}}$

C. $\mathrm{kg\,m\,s^{-2}}$

D. $\mathrm{kg\,m^2\,s^{-2}}$

A net force of magnitude 4.0 N acts on a body of mass 3.0 kg for 6.0 s. The body is initially at rest. Which of the following is the speed of the body after the 6.0 s interval?

A. $0.50\,\mathrm{m\,s^{-1}}$

B. $2.0\,\mathrm{m\,s^{-1}}$

C. $4.5\,\mathrm{m\,s^{-1}}$

D. $8.0\,\mathrm{m\,s^{-1}}$

A skydiver of mass 80 kg falls vertically with a constant speed of $50\,\text{m s}^{-1}$. The upward force acting on the skydiver is approximately

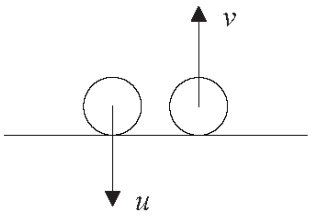
A. 0 N.

B. 80 N.

C. 800 N.

D. 4000 N.

A ball falls vertically and bounces off the ground. Immediately before impact with the ground the speed of the ball is u. Immediately after leaving the ground the speed is v.



Which of the following expressions is the ratio of $\dfrac{\text{kinetic energy lost on collision}}{\text{kinetic energy immediately before collision}}$?

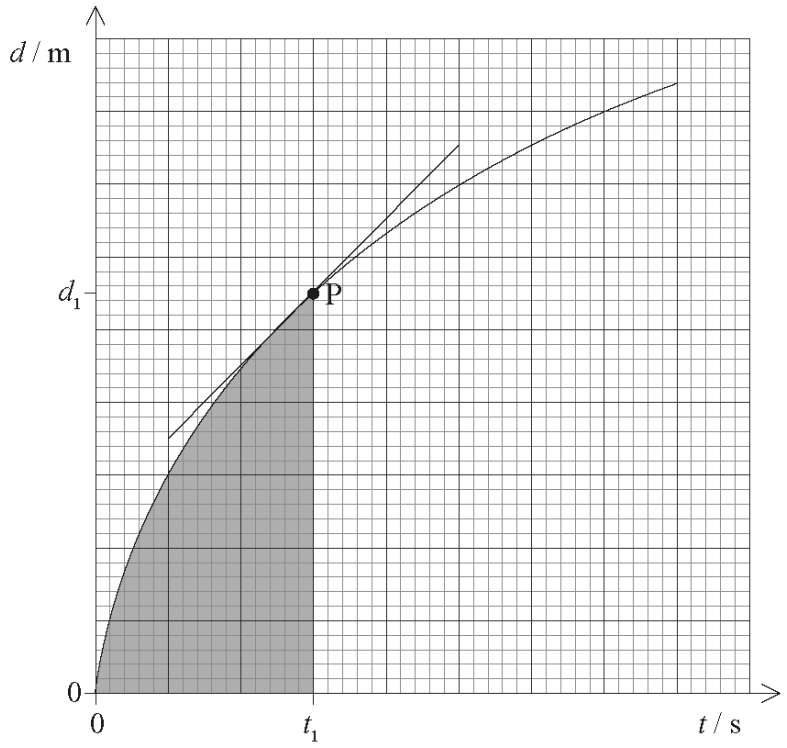
A. $\dfrac{v}{u}$

B. $1-\dfrac{v}{u}$

C. $\left(\dfrac{v}{u}\right)^2$

D. $1-\left(\dfrac{v}{u}\right)^2$

The graph shows how the displacement d of an object varies with time t. The tangent to the curve at time t_1 is also shown.



Which of the following gives the speed of the object at point P?

A. the gradient at P

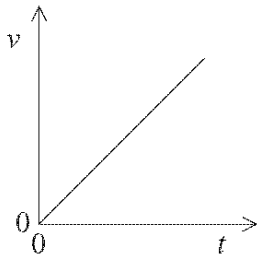
B. the shaded area

C. $\dfrac{1}{\text{gradient at P}}$

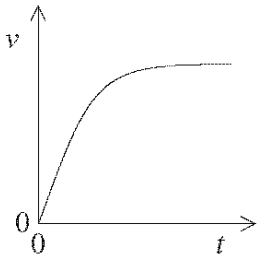
D. $\dfrac{d_1}{t_1}$

A raindrop falling from rest at time $t=0$ reaches terminal velocity. Which graph best represents how the speed v varies with time t?

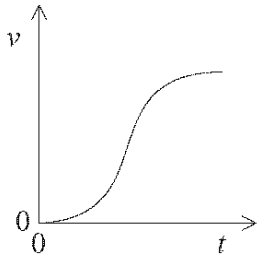
A.



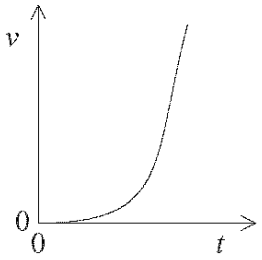
B.



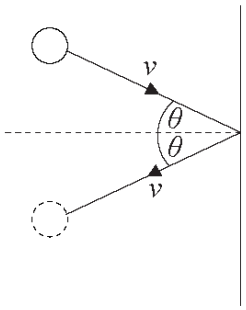
C.



D.



A gas atom strikes a wall with speed v at an angle θ to the normal to the wall. The atom rebounds at the same speed v and angle θ.



Which of the following gives the magnitude of the momentum change of the gas atom?

A. zero

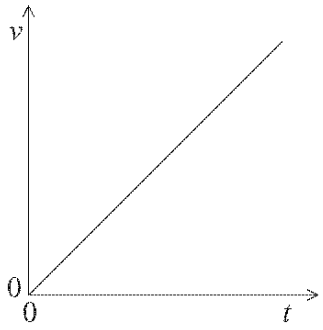
B. $2mv\sin\theta$

C. $2mv$

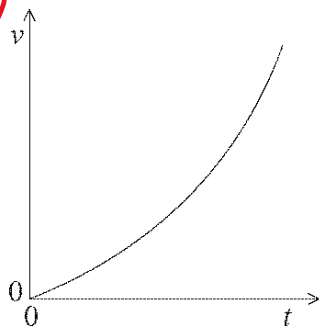
D. $2mv\cos\theta$

A car accelerates from rest. The acceleration increases with time. Which graph shows the variation with time t of the speed v of the car?

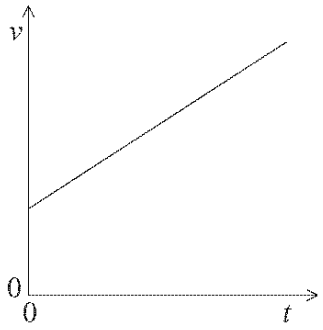
A.



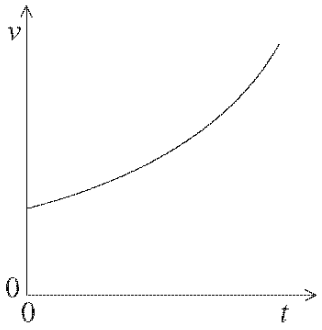
B.



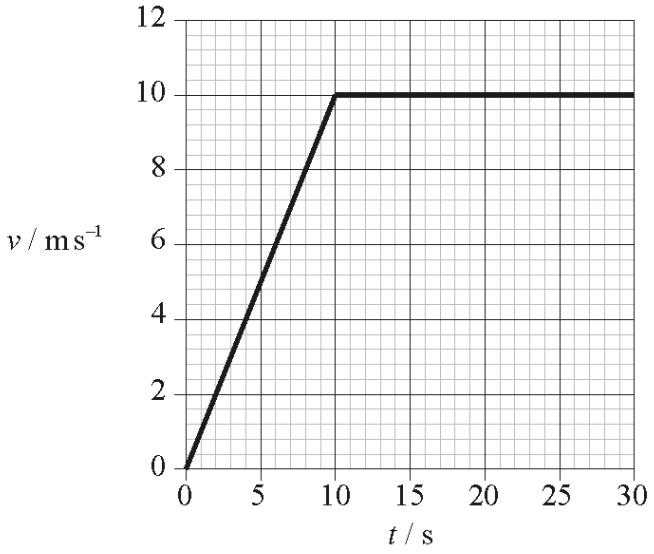
C.



D.



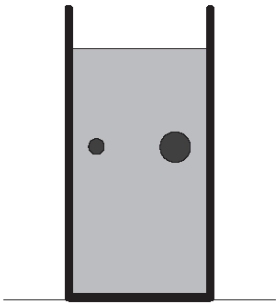
Joseph runs along a long straight track. The variation of his speed v with time t is shown below.



After 25 seconds Joseph has run 200 m. Which of the following is correct at 25 seconds?

	Instantaneous speed / $m s^{-1}$	Average speed / $m s^{-1}$
A.	$8 m s^{-1}$	$8 m s^{-1}$
B.	$8 m s^{-1}$	$10 m s^{-1}$
C	$10 m s^{-1}$	$8 m s^{-1}$
D.	$10 m s^{-1}$	$10 m s^{-1}$

Two steel balls, of mass M and $2M$, fall at constant speeds in a tube filled with oil.



Which of the following correctly compares the magnitudes of the net force and of the drag (resistance) force on the two balls?

	Net force	Drag force
A.	same	same
B.	same	different
C.	different	same
D.	different	different

A railway engine of mass m moves along a horizontal track with uniform speed v. The total resistive force acting on the engine is F.

Which of the following is the power of the engine?

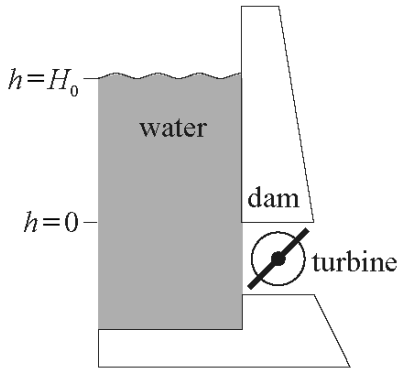
A. $\frac{F}{mv}$

B. Fv

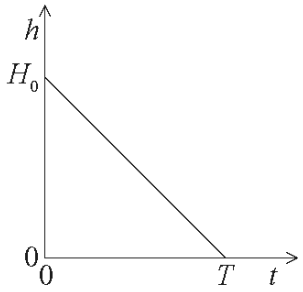
C. $\frac{mv}{F}$

D. $\frac{v}{F}$

The water in a reservoir behind a dam drops from an initial height H_0 above a turbine to produce hydroelectricity. At time $t=T$, $h=0$.



The graph shows the variation with time t of the height h of the water above the turbine.



Which of the following is a measure of the maximum theoretical electric power available?

A. H_0 and the slope of the graph

B. T and the slope of the graph

C. T and the area under the graph

D. H_0 and the area under the graph