Q2 P1

An electric motor is required to haul a cage of mass 400 kg up a mine shaft through a vertical height of 1200 m in 2.0 minutes. What will be the electrical power required if the overall efficiency is 80%?

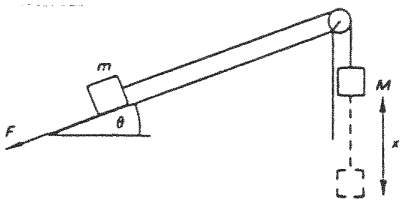
[Take g as 10 m s^{-2}]

A 3.2 kW
B 5.0 kW
C 32 kW
D 50 kW
E 3000 kW

J87/Q8

Q4 P2

A mass m moves on a rough plane inclined at an angle θ to the horizontal and, when moving, experiences a constant frictional force F. Mass M is attached to it by means of a light inelastic cord running over a smooth pulley. Mass M is allowed to fall a vertical distance x, causing m to move up the plane as shown in the diagram below.



How much heat is generated by friction in this process?

A Fx
B mgx
C $Mgx\sin\theta$
D $Mgx\sin\theta - Fx$
E $Mgx\sin\theta + Fx$

J88/Q6

Q5 P3

What is the power required to give a body of mass m a forward acceleration a when it is moving with velocity v up a frictionless track inclined at an angle θ to the horizontal?

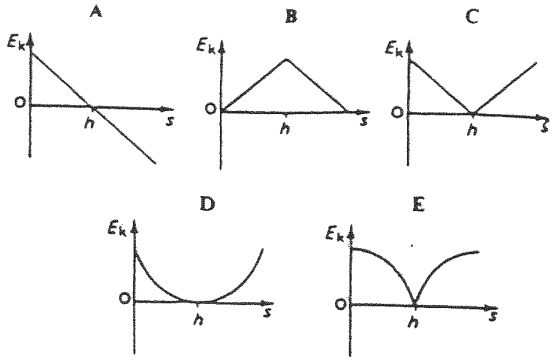
A $mavg \sin\theta$
B $mav \sin\theta + mgv$
C $mav + mgv \sin\theta$
D $(mav + mgv) \sin\theta$
E $\dfrac{mav + mgv}{\sin\theta}$

D88/Q5

Q6 P4

A stone, thrown vertically upwards from ground level, rises to a height h and then falls back to its starting point.

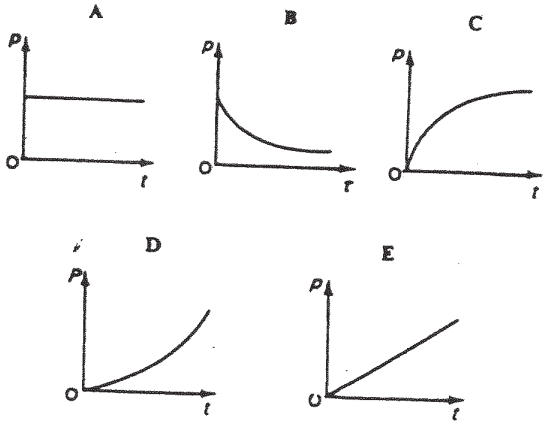
Assuming that air resistance is negligible, which of the following graphs best shows how E_k, the kinetic energy of the stone, varies with s, the distance travelled?



D89/Q2

Q7 P5

A constant force is applied to a body which is initially stationary but free to move in the direction of the force. Assuming that the effects of friction are negligible, which of the following graphs best represents the variation of P, the power supplied, with time t?

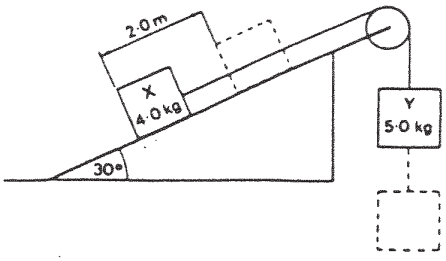


D89/Q4

W, E, P 1

Q8 p6

The diagram shows two bodies X and Y connected by a light cord passing over a light, free-running pulley. X starts from rest and moves on a smooth plane inclined at 30° to the horizontal.



What will be the total kinetic energy of the system when X has travelled 2.0 m along the plane? (g = 9.8 ms^{-2}).

A 20 J
B 59 J
C 64 J
D 132 J
E 137 J

J90 / Q7

Q9 p7

A crate is pushed 10m along a horizontal surface by a force of 80N. The frictional force opposing the motion is 60N. How much of the work done is converted into thermal energy and how much into kinetic energy of the crate?

	thermal energy/J	*kinetic energy*/J
A	200	600
B	200	800
C	600	200
D	600	800
E	600	1400

D90/Q7

Q10 p8

A raindrop of mass m is falling vertically through the air with a steady speed v. It experiences a retarding force kv due to the air, where k is a constant. The acceleration of free fall is g.

Which expression gives the kinetic energy of the raindrop?

A $\frac{mg}{k}$ B $\frac{mg^2}{2k^2}$ C $\frac{m^3g^2}{k^2}$ D $\frac{m^3g^2}{2k^2}$ E $\frac{m^3g^2k^2}{2}$

J92 / Q6

Q11 p9

A small metal sphere of mass m is moving through a viscous liquid.

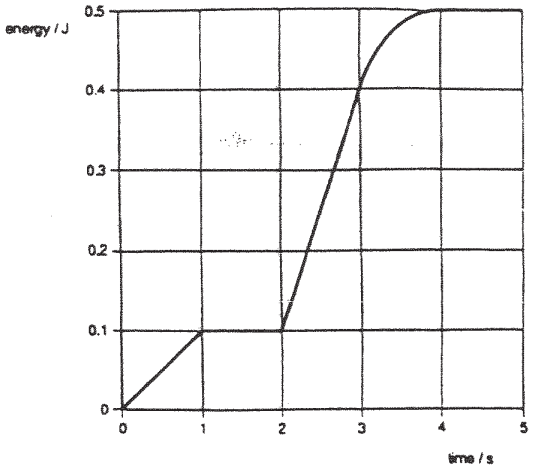
When it reaches a constant downward velocity v, which of the following describes the changes with time in the kinetic energy and gravitational potential energy of the sphere?

	kinetic energy	*gravitational potential energy*
A	constant and equal to $\frac{1}{2}mv^2$	decreases at a rate of mgv
B	constant and equal to $\frac{1}{2}mv^2$	decreases at a rate of $(mgv - \frac{1}{2}mv^3)$
C	constant and equal to $\frac{1}{2}mv^2$	decreases at a rate of $(\frac{1}{2}mv^3 - mgv)$
D	increases at a rate of mgv	decreases at a rate of mgv
E	increases at a rate of mgv	decreases at a rate of $(\frac{1}{2}mv^3 - mgv)$

U.E.P 2

Q12 P10

A bicycle dynamo is started at time zero. The total energy transformed by the dynamo during the first 5 seconds increases as shown in the graph.



What is the maximum power generated at any instant during these first 5 seconds?

A 0.10 W C 0.30 W
B 0.13 W D 0.50 W

J94 / Q6

Q13 P11

A power station has an efficiency of 40% and generates 1000 MW of electrical power. What is the input power and the wasted power?

	input power/MW	*wasted power*/MW
A	1000	400
B	1000	600
C	1400	400
D	2500	1500

D94 / Q6

Q14 P12

A space vehicle of mass m re-enters the Earth's atmosphere at an angle θ to the horizontal. Because of air resistance, the vehicle travels at a constant speed v.

The heat-shield of the vehicle dissipates heat at a rate P, so that the mean temperature of the vehicle remains constant.

Taking g as the relevant value of the acceleration of free fall, which expression is equal to P?

A mgv
B $mgv \sin\theta$
C $\frac{1}{2}mv^2$
D $\frac{1}{2}mv^2 \sin^2\theta$

D95 / Q6

Q17 P13

A force of 1000 N is needed to lift the hook of a crane at a steady velocity. The crane is then used to lift a load of mass 1000 kg at a velocity of 0.50 m s^{-1}.

How much of the power developed by the motor of the crane is used in lifting the hook and the load? [Take g as 10 m s^{-2}.]

A 5.0 kW B 5.5 kW C 20 kW D 22 kW

D97 / Q6