## AS-2007 Q3

3. A stone, thrown vertically into the air from ground level, returns to the ground in 4 seconds due to the constant gravitational force acting upon it (ignore air resistance). If the stone is thrown up at twice the initial speed, the time taken to return to the ground will now be

A. 6s B. 8s C. 12s D. 16s

## AS-2007 Q6

6. A small mass, $M$, is given an initial velocity $v_0$, and it slides from A to B via two possible paths; either down the shallow dip X or over the hump Y, both of which are the same shape but inverted. Friction is to be ignored. Along which path does the mass take the shortest time to slide from A to B?

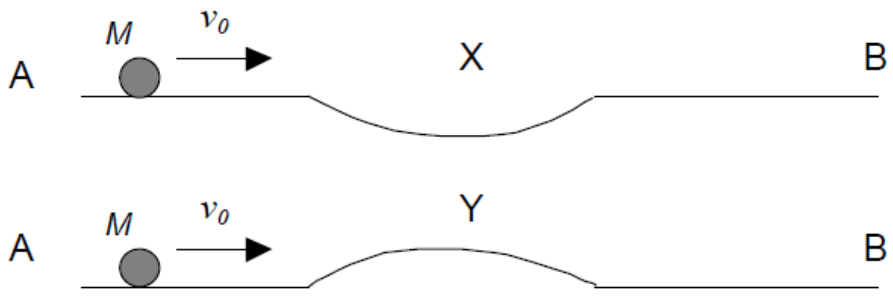
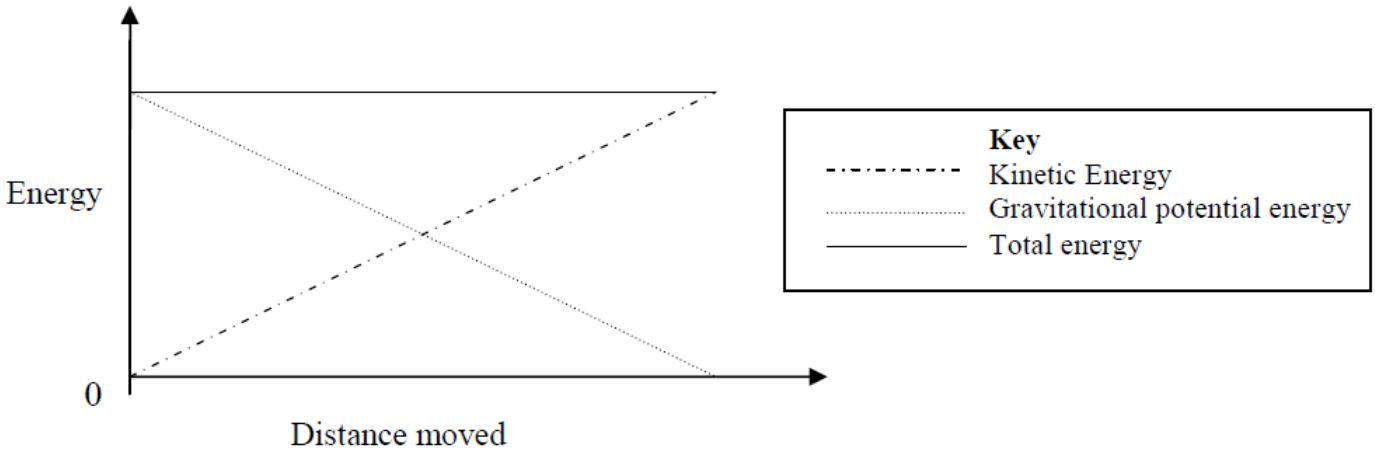



fig. 4

A. Via X B. Via Y C. You cannot say D. Same time taken

AS-2008 Q6

6. The graph below represents the kinetic energy, gravitational potential energy, and total energy of a moving block




Which best describes the motion of the block?

A Sliding down an incline with constant friction

B Falling at a constant velocity

C Accelerating on a flat horizontal surface

D Falling freely under gravity

## AS-2010 Q2

A small object is dropped from the top of a building and falls to the ground. As it falls, accelerating due to gravity, it passes a window. If it has speed $v_1$ at the top of the window, and speed $v_2$ at the bottom of the window, at what point does it have a speed $(v_1 + v_2)/2$ ? Neglect the effect of air resistance.

**A.** It depends on the height of the window or its distance from the top of the building

**B.** Above the centre point of the window

**C.** Below the centre point of the window

**D.** At the centre point of the window

## AS-2009 Q3

A 750 kg car is moving at a speed of 20.0 $ms^{-1}$ when at a height of 5.0 m above the bottom of a hill when it runs out of fuel. The car coasts down the hill and then continues up the other side until it comes to rest. Ignoring frictional forces and air resistance, what is the value of $h$, the highest position the car reaches above the bottom of the hill?

A. 6 m

B. 15 m

C. 25 m

D. 45 m

## AS-2012 Q1

1. A stone is dropped to the ground from a height $h$ and takes time $t$ to reach the ground. When this experiment is carried out in a lift rising at a constant speed, the time taken for the stone to fall the same height $h$ in the lift is

A. Dependent upon the speed of the lift

B. Greater than $t$

C. Equal to $t$

D. Less than $t$

## AS-2012 Q6

6. Jack and Jill decide to throw pennies out of a window. They lean out and Jill throws hers straight down to the ground with an initial speed of 4 m/s whilst Jack throws his straight upwards with an initial speed of 4 m/s. How do the speeds and kinetic energies of the pennies compare when they each hit the ground?
You should ignore air resistance.

A. Jack's penny has a greater speed and greater KE

B. Jack's penny has the same speed but greater KE

C. Jill's penny has the same speed but greater KE

D. Jill's penny has the same speed and the same KE

AS-2009 Q11

A plane accelerates from rest to take off from a runway. There is a point of no return where the pilot will not be able to stop the plane before the end of the runway if he fails to take off. The runaway is 2 km long and the plane can accelerate at 3 $ms^{-2}$ and can decelerate at 2 $ms^{-2}$. We can calculate the length of time available from the start of the take off to the point of no return.

a) Sketch a graph of the speed of the plane against time for the situation where the plane fails to take off but the whole length of the runway is used. (no values are required)

[2]

b) If $t_1$ is the time taken for the plane to reach its maximum speed $v$, and $t_2$ is the time taken for it to decelerate before it goes beyond the end of the runway, express $v$ in terms of $t_1$ and $t_2$, and the respective accelerations.

[2]

c) Calculate the distance $s_1$ travelled by the plane whilst accelerating, in terms of $t_1$, and the distance $s_2$ travelled by the plane whilst decelerating, in terms of $t_2$.

[2]

d) From your answers to (b) and (c), calculate the value of $t_1$, the time taken to reach the point of no return, given that the runaway is 2 km long.

[2]

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AS-2011 Q12

A solid sphere of mass $m$ rolls down a slope. The sphere gains kinetic energy in two forms: *rotational kinetic energy* and *translational kinetic energy* in which the centre of mass moves along at speed $v$. For the solid sphere, a fixed fraction, $\frac{2}{7}$, of the gravitational potential energy lost as it rolls down the slope appears as *rotational kinetic energy*.
If the sphere now rolls along a flat surface, moving at a speed of 4.0 $ms^{-1}$ and then encounters a rising slope at 30° to the horizontal, we can calculate how far up the slope the sphere will rise. We can take the mass of the sphere as 1 kg.

a) Calculate the translational KE of the sphere and hence the total energy of the rolling sphere.

[3]

b) Describe the energy changes that take place as the sphere rolls up the slope.

[3]

c) What is the vertical height reached by the sphere?

[2]

d) How far up along the slope does this take the sphere?

[2]

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