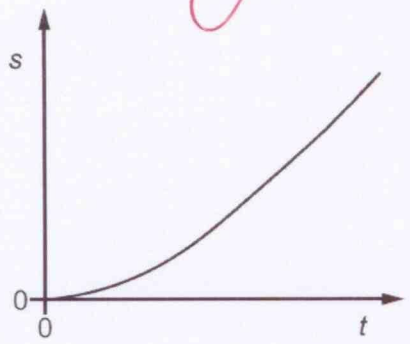
Kinematics - 2018

1. 9702/11/M/J/18/No.6

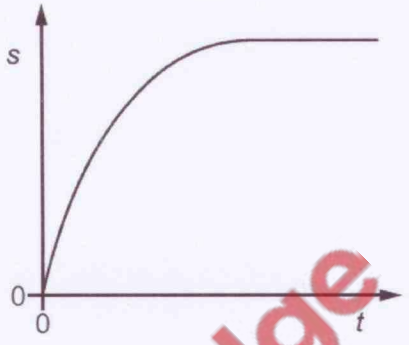
A tennis ball falls freely, in air, from the top of a tall building.

Which graph best represents the variation with time *t* of the distance *s* fallen?

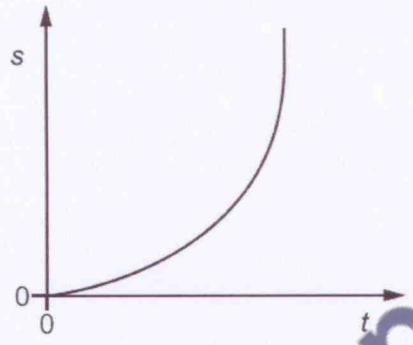
A



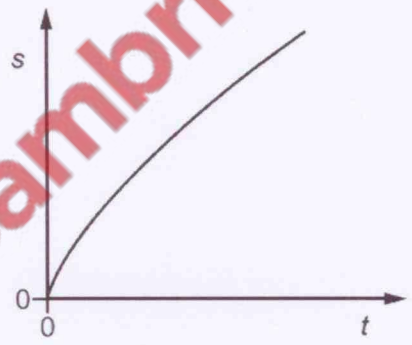
B



C

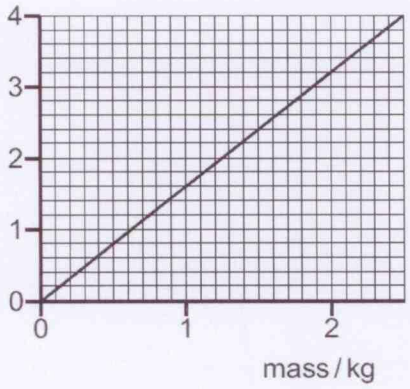


D



2. 9702/11/M/J/18/No.7

The graph shows the variation with mass of the weight of objects on a particular planet.



$W = mg$.

$g = \frac{W}{m}$ = gradient

$= \frac{4-0}{2.5-0}$

$= 1.6\ N/kg$.

$= 1.6\ ms^{-2}$

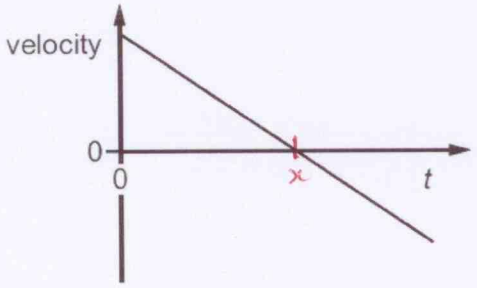
What is the value of the acceleration of free fall on the planet?

A $0.63\,ms^{-2}$ **B** $1.6\,ms^{-2}$ **C** $3.2\,ms^{-2}$ **D** $9.8\,ms^{-2}$

3. 9702/12/M/J/18/No.5

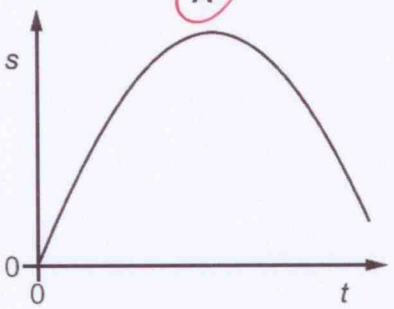
The velocity of an object changes with time t as shown.

Remember $v = \frac{\Delta s}{\Delta t}$.
at x, v = 0.

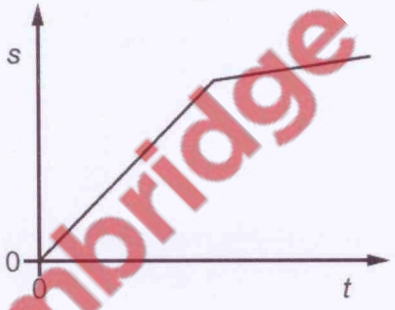


Which graph best shows the variation with time t of the displacement s of the object?

A

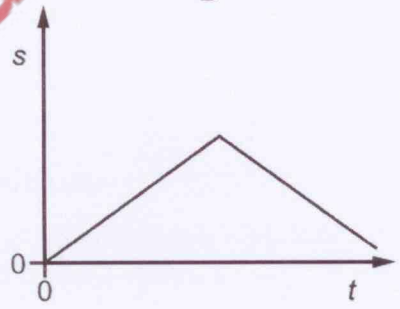


B



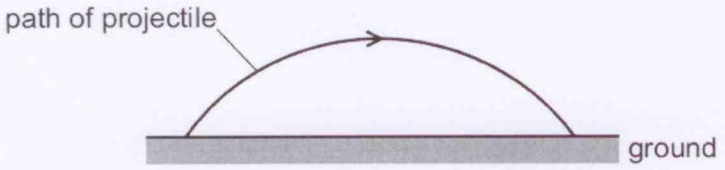
C

D



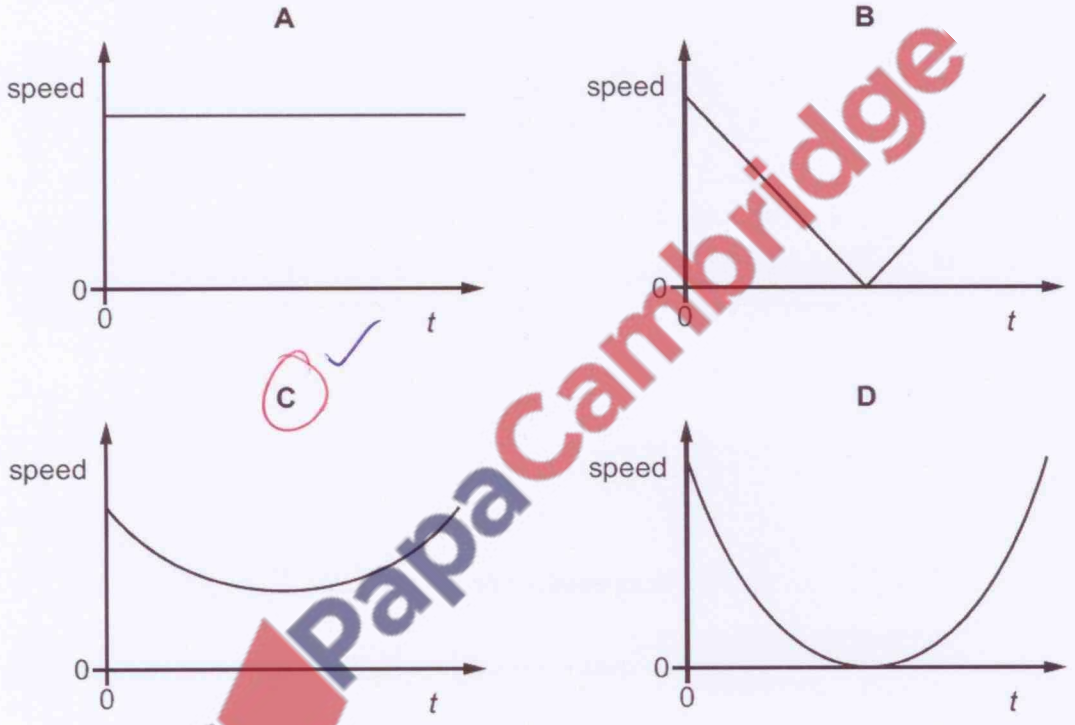
4. 9702/12/M/J/18/No.6

A projectile is launched at an angle to the horizontal at time $t = 0$. It travels over horizontal ground, as shown.



Assume that air resistance is negligible.

Which graph best shows the variation with t of the speed of the projectile from when it is launched to when it lands on the ground?



5. 9702/13/M/J/18/No.6

A rock on the surface of Mars is projected vertically upwards with an initial speed of $9.4\,m\,s^{-1}$. The rock rises to a height of 12 m above the surface.

Assume there is no atmosphere on Mars.

What is the acceleration of free fall near the surface of Mars?

A $0.39\,m\,s^{-2}$ **B** $3.7\,m\,s^{-2}$ **C** $7.4\,m\,s^{-2}$ **D** $9.8\,m\,s^{-2}$

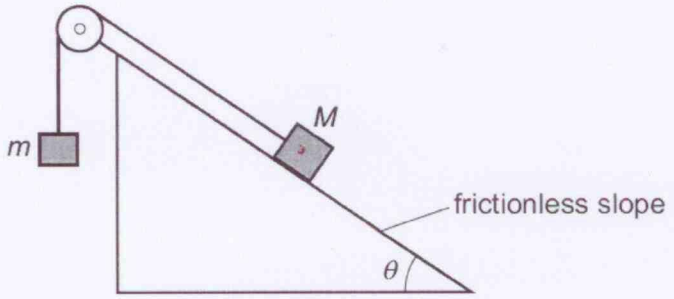
At max. height
$v = 0$
$s = 12\,m$
$u = 9.4\,ms^{-1}$
$g = ?$

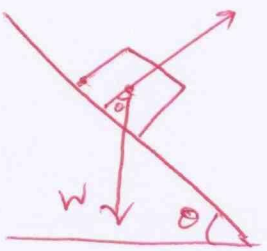
use equation
$v^2 = u^2 - 2gs$
$2gs = u^2$
$g = \frac{u^2}{2s}$

$g = \frac{9.4^2}{2 \times 12}$
$= 3.68$
$\approx 3.7\,m\,s^{-2}$

6. 9702/13/M/J/18/No.7

Two masses, M and m, are connected by an inextensible string which passes over a frictionless pulley. Mass M rests on a frictionless slope, as shown.





The slope is at an angle θ to the horizontal.

The two masses are initially held stationary and then released. Mass M moves down the slope.

Which expression **must** be correct?

A $\sin\theta < \frac{m}{M}$ **B** $\cos\theta < \frac{m}{M}$ **C** $\sin\theta > \frac{m}{M}$ **D** $\cos\theta > \frac{m}{M}$

$\sin\theta = \frac{Mg - mg}{W}$, $W = Mg$

$= \frac{Mg - mg}{Mg}$

$= \frac{M - m}{M}$

$\sin\theta = \frac{M}{M} - \frac{m}{M}$

$= 1 - \frac{m}{M}$

$\sin\theta + \frac{m}{M} = 1.$

$M > m.$

So $\frac{m}{M} < 1.$

$\therefore \sin\theta > \frac{m}{M}.$

7. 9702/12/F/M/18/No.7

A stone of mass m is dropped from a tall building. There is significant air resistance. The acceleration of free fall is g.

When the stone is falling at a constant (terminal) velocity, which information is correct?

	magnitude of the acceleration of the stone	magnitude of the force of gravity on the stone	magnitude of the force of air resistance on the stone
A	g	zero	mg
B	zero	mg	mg
C	zero	zero	mg
D	zero	mg	zero

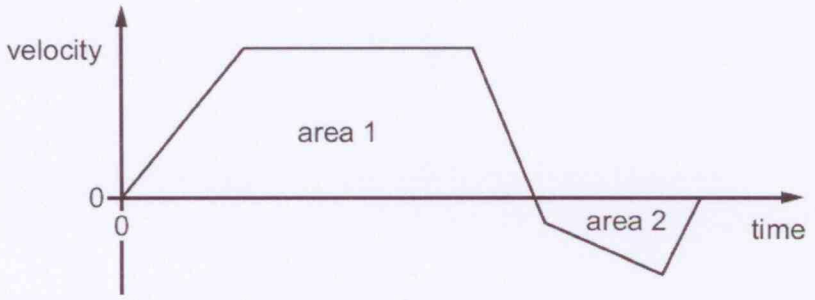
At terminal velocity:

Weight = air resistance

$W = mg$, so air resistance $= mg$

8. 9702/12/F/M/18/No.8

The velocity-time graph for an object is shown.



How can the total displacement of the object be determined?

A area 1 – area 2

B $\frac{(\text{area 1} + \text{area 2})}{2}$

C area 1 + area 2

D area 2 – area 1

Area 1 – going forward.
area 2 – object reversing.
displacement = distance from start point to finish point.

9. 9702/12/F/M/18/No.9

A girl throws a ball vertically upwards. It takes a time of 3.20 s to return to her hand.

Assume air resistance is negligible.

What is the initial speed with which the ball is thrown?

A $3.07\,m\,s^{-1}$ B $7.85\,m\,s^{-1}$ C $15.7\,m\,s^{-1}$ D $31.4\,m\,s^{-1}$

Time of flight $t = 3.2\,s$

$s = 0$ (displacement from start point).

$s = ut - \frac{1}{2}gt^2$

$0 = ut - \frac{1}{2}gt^2$

$ut = \frac{1}{2}gt^2$

$u = \frac{1}{2}gt$

$= \frac{1}{2} \times 9.81 \times 3.2$

$= 15.696$

$\approx 15.7\ m\,s^{-1}$