SCOTCH COLLEGE

Stage 2 Physics Test 1 – 2013

30 marks

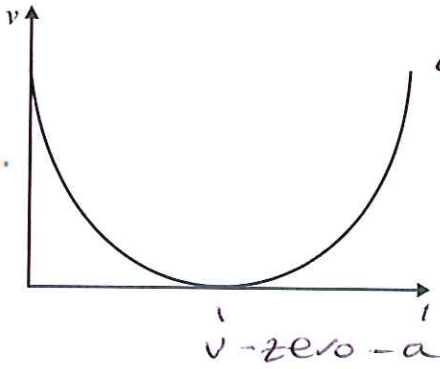
Name: Soln's

Please write your answers to the multiple choice questions in the space provided below:

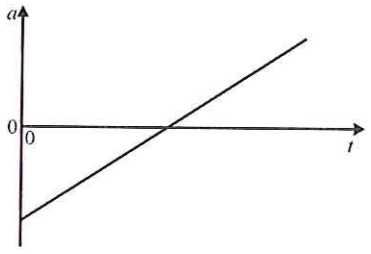
1	2	3	4	5	6	7	8	9	10
A	C	B	D	A	B	B	D	B	B

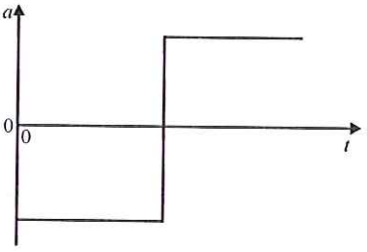
1. The graph shows the variation with time *t* of the velocity *v* of an object.

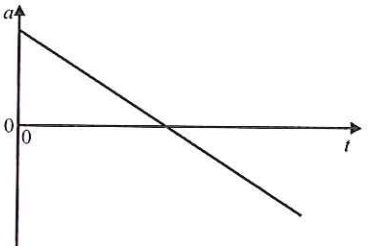
- slope ≈ acceleration

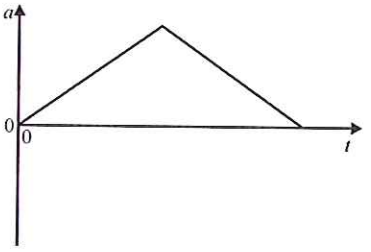


Which **one** of the following graphs best represents the variation with time *t* of the acceleration *a* of the object?

A.


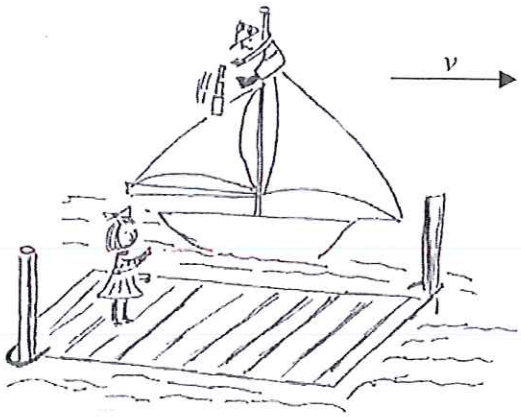
B.


C.


D.


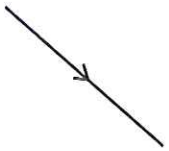
(1)

2. A sailing boat is moving with constant velocity v to the right parallel to the dock.



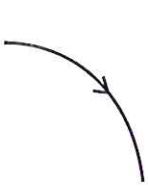
Sailor Hulot, up on the mast, drops his telescope at the moment he is opposite Lucie who is standing on the dock. Which **one** of the following best shows the path of the falling telescope as seen by Lucie?

A.



B.

C.



D.

(1)

3. A ball is released from rest near the surface of the Moon. Which **one** of the following quantities increases at a constant rate?

A. Only distance fallen $(s \propto t^2)$

B. Only speed $v \propto a$; $v \propto t$

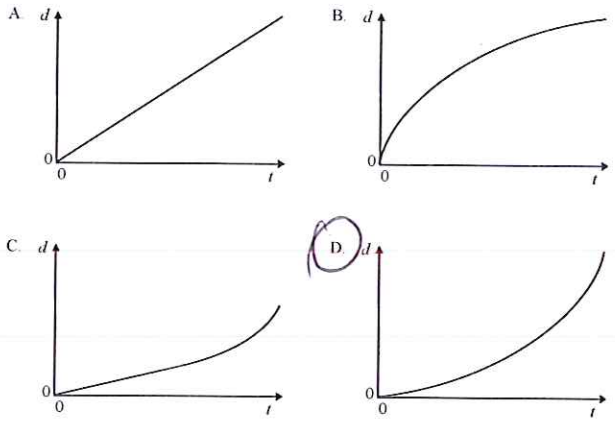
C. Only speed and distance fallen

D. Only speed and acceleration

↳ constant.

(1)

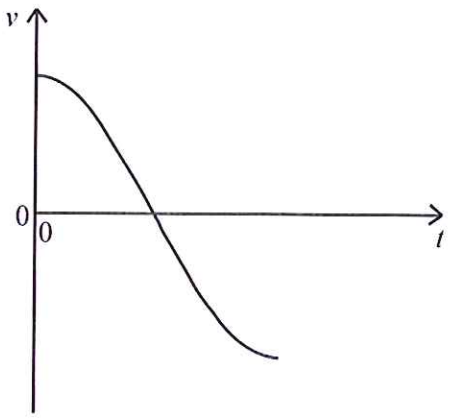
4. A ball is held at rest in air. The ball is then released. Which **one** of the following graphs best shows the variation with time t of the distance d fallen by the ball?



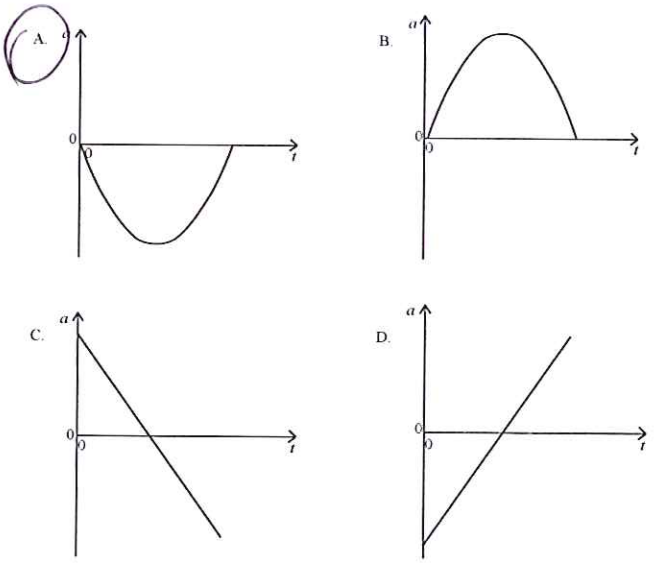
$s \propto t^2$

(1)

5. The graph shows the variation with time t of the velocity v of an object moving along a straight line.

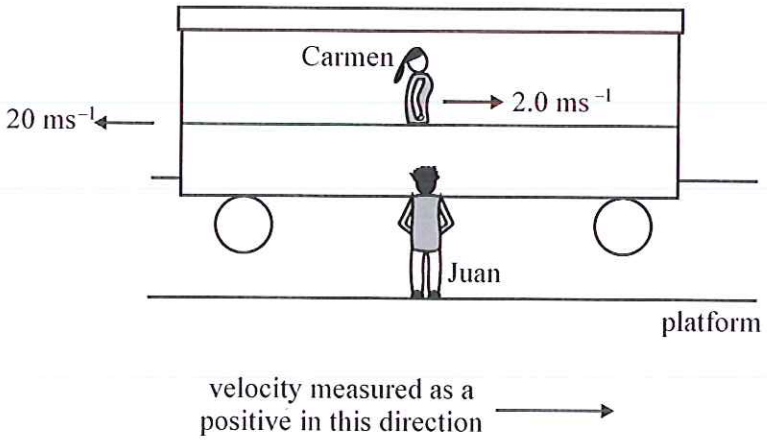


Which graph shows the variation with time t of the acceleration a of the object?



(1)

6. Juan is standing on the platform at a railway station. A train passes through the station with speed 20 m s^{-1} in the direction shown measured relative to the platform. Carmen is walking along one of the carriages of the train with a speed of 2.0 m s^{-1} measured relative to the carriage in the direction shown. Velocity is measured as positive in the direction shown on the diagram.



The velocity of Carmen relative to Juan is

A. –22 m s^{-1}.

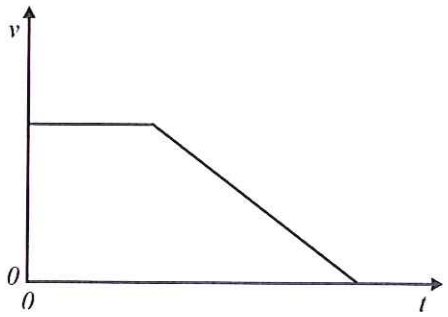
B. –18 m s^{-1}.

C. +18 m s^{-1}.

D. +22 m s^{-1}.

(1)

7. The diagram below shows the variation with time t of the velocity v of an object.



The area between the line of the graph and the time-axis represents

A. the average velocity of the object.

B. the displacement of the object.

C. the impulse acting on the object.

D. the work done on the object.

(1)

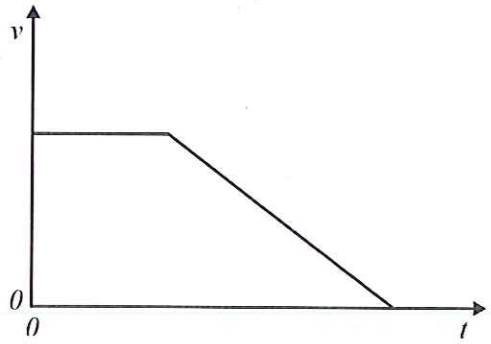
Area = $U \times t$

$= \frac{m}{s} \times s$

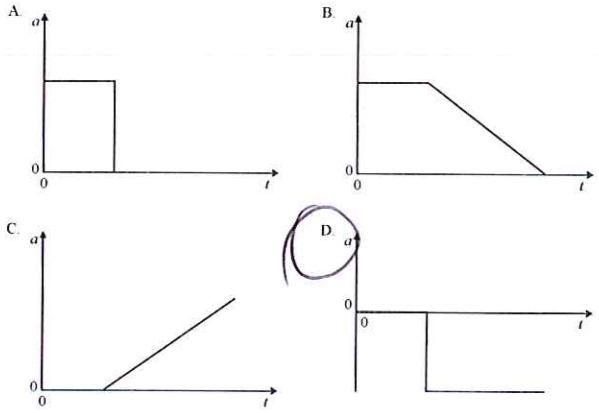
$= m$

$\Rightarrow$ Displacement.

8. The diagram below shows the variation with time t of the velocity v of an object.

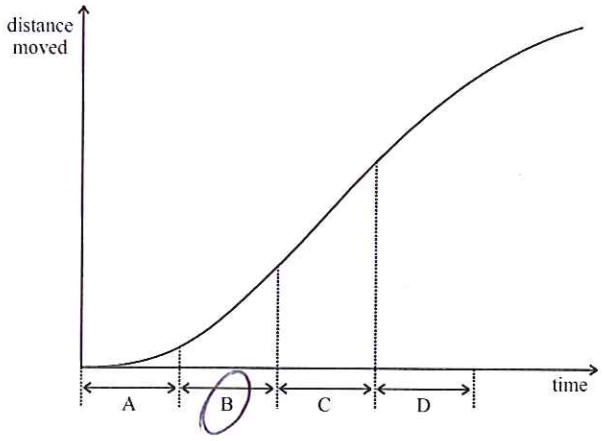


Which **one** of the following graphs shows the variation with time t of the acceleration a of the object?



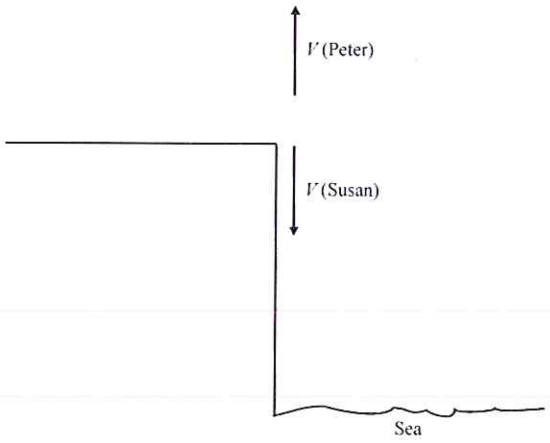
(1)

9. The graph below shows the variation with time of the distance moved by a car along a straight road. During which time interval does the car have its greatest acceleration?



(1)

10. Peter and Susan both stand on the edge of a vertical cliff.



Susan throws a stone vertically downwards and, at the same time, Peter throws a stone vertically upwards. The speed V with which both stones are thrown is the same. Neglecting air resistance, which **one** of the following statements is true?

A. The stone thrown by Susan will hit the sea with a greater speed than the stone thrown by Peter.

B. Both stones will hit the sea with the same speed no matter what the height of the cliff.

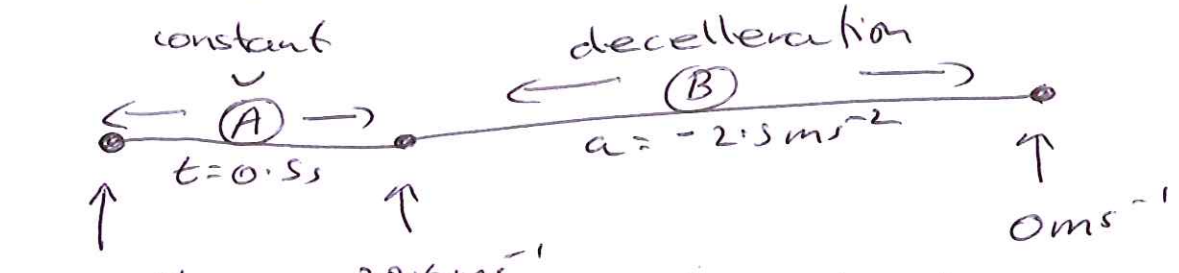
C. In order to determine which stone hits the sea first, the height of the cliff must be known.

D. In order to determine which stone hits the sea first both the height of the cliff and the mass of each stone must be known.

(1)

11. A car is travelling at 110 kmh^{-1} when the driver sees a kangaroo ahead and he hits the brakes. If the reaction time for the driver is 0.5 second and the average deceleration during braking is 2.5 ms^{-2}, find the total stopping distance of the car.

$110\ kmh^{-1} = 30.6\ ms^{-1}$



$S_A = u \times t$

$= 0.5 \times 30.6$

$= 15.3\ m$

$v^2 = u^2 + 2as_B$

$\Rightarrow 0 = (30.6)^2 + (2)(-2.5)s$

$\Rightarrow S_B s = 936$

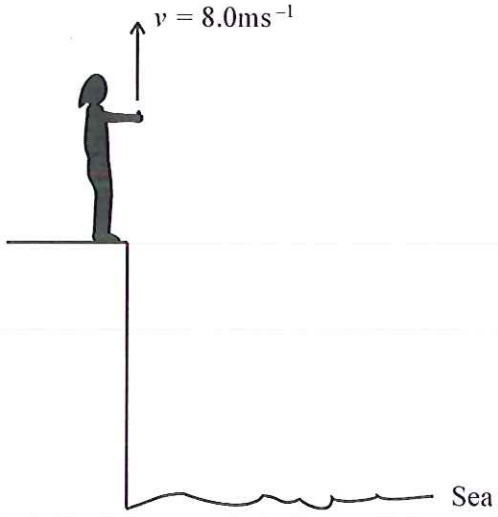
$\Rightarrow s = 187.3\ m$

(Total 4 marks)

$\Rightarrow S_t = S_A + S_B \Rightarrow S_t = 203\ m$

12. Antonia stands at the edge of a vertical cliff and throws a stone vertically upwards.

+ve ↓



The stone leaves Antonia's hand with a speed $v = 8.0\text{ms}^{-1}$.

All distance measurements are taken from the point where the stone leaves Antonia's hand.

(a) Ignoring air resistance calculate

(i) the maximum height reached by the stone.

$v^2 = u^2 + 2as$

$\Rightarrow 0 = (-8)^2 + 2 \times 9.8 \times s$

$\Rightarrow s = 3.27\text{ m}$ — ✗ **(2)**

(ii) the time taken by the stone to reach its maximum height.

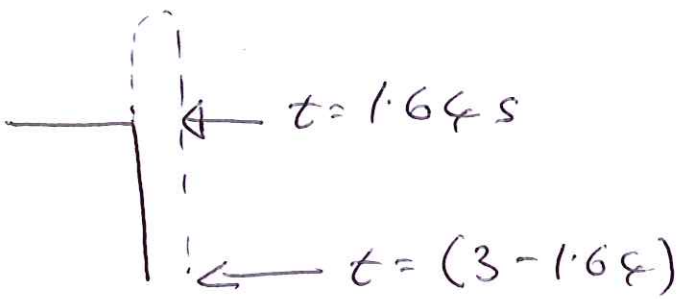
$v = u + at$

$\Rightarrow 0 = -8 + (9.8)t$

$\Rightarrow t = 0.82\text{ s}$ — ✗ **(2)**

The time between the stone leaving Antonia's hand and hitting the sea is 3.0 s.

(b) Determine the height of the cliff.



$s = ut + \frac{1}{2}at^2$

$= 8 \times 1.36 + \frac{1}{2} 9.8 (1.36)^2$

$= 10.88 + 9.06$

$= 19.9\text{ m}$ — ✗ **(3)**

(Total 7 marks)

13. A police car P is stationary by the side of a road. A car S, exceeding the speed limit, passes the police car P at a constant speed of 18 m s^{-1}. The police car P sets off to catch car S just as car S passes the police car P. Car P accelerates at 4.5 m s^{-2} for a time of 6.0 s and then continues at constant speed. Car P takes a time *t* seconds to draw level with car S.

(a) (i) State an expression, in terms of *t*, for the distance car S travels in *t* seconds.

$v_s = \frac{ds}{t_s} \Rightarrow ds = v_s \times t_s$

$= 18t$

(1)

(ii) Calculate the distance travelled by the police car P during the first 6.0 seconds of its motion.

$a_p = 4.5 ms^{-2}$

$t_p = 6s$

$\Rightarrow s = 0 + \frac{1}{2}(4.5)(6)^2$

$= 81m$

(2)

(iii) Calculate the speed of the police car P after it has completed its acceleration.

$v = u + at$

$\Rightarrow v = 0 + 4.5 \times 6$

$= 27 ms^{-1}$

(2)

(iv) State an expression, in terms of t, for the distance travelled by the police car P during the time that it is travelling at constant speed.

$27(t-6)$

(1)

(b) Using your answers to (a), determine the total time *t* taken for the police car P to draw level with car S.

Draws level when

$s_p = s_s$

$\Rightarrow 18t = 27(t-6)$

$\Rightarrow 18t = 27t - 27 \times 6$

$\Rightarrow 9t = 27 \times 6$

$\Rightarrow t = \frac{27 \times 6}{9}$

$= 18s$

(3)

(Total 9 marks)

End of Test ☺