3.1 Equations of Motion

Question Paper

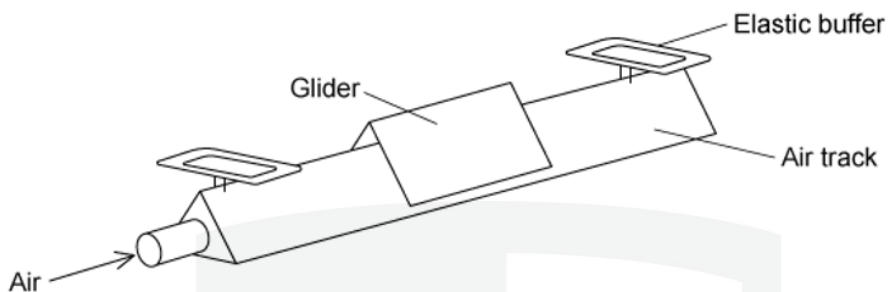|	
Course	CIE A Level Physics (9702) 2019-2021
Section	3. Kinematics
Topic	3.1 Equations of Motion
Difficulty	Hard

Time allowed: 10
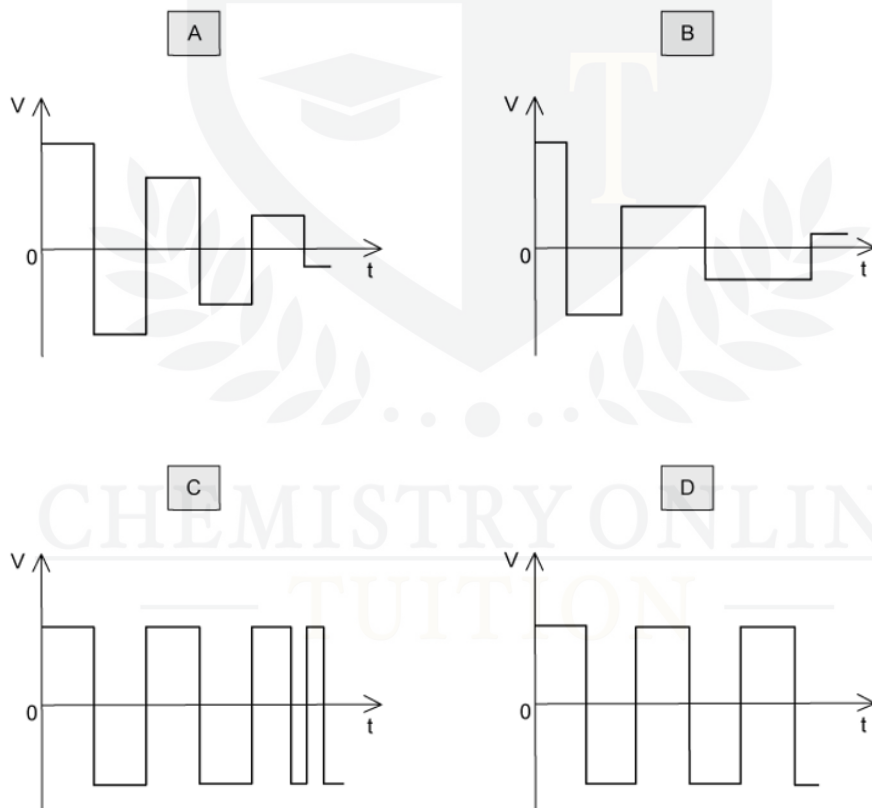
Score: /10

Percentage: /100

Question 1

A small glider moves along a friction-free horizontal air track as shown below.

At each end of the air track there is a perfectly elastic buffer.

Which graph represents the variation with time t of the velocity v of the glider as it moves between the two buffers?

[1 mark]

Question 2

An aeroplane travels at an average speed of 700 km h^{-1} on an outward flight and at 300 km h^{-1} on the return flight over the same distance.
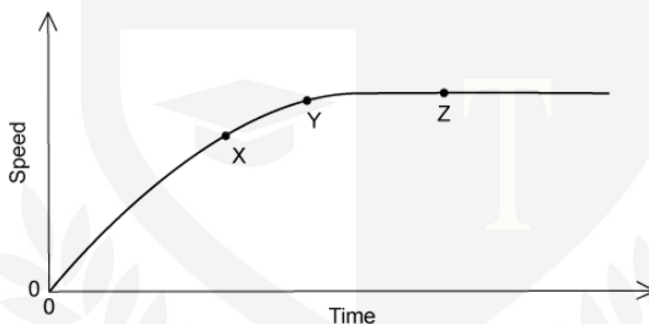
What is the average speed of the whole flight?

A 400 km h^{-1} **B** 420 km h^{-1} **C** 480 km h^{-1} **D** 500 km h^{-1}

[1 mark]

Question 3

A raindrop falls vertically from rest in air. The variation with time of the speed of the raindrop is shown in the graph.

Which statement about the raindrop is correct?

A   at point X, the raindrop has an acceleration of 9.81 m s^{-2}

B   at point Z, the force on the raindrop due to air resistance has reached its maximum value and so the acceleration of the raindrop has also reached its maximum value

C   at point Z, the force due to air resistance is equal and opposite to the weight of the raindrop and so the speed of the raindrop is zero

D   the resultant force on the raindrop at point Y is less than the resultant force on the raindrop at point X

[1 mark]

Question 4

In order that a train can stop safely, it will always pass a signal showing a yellow light before it reaches a signal showing a red light.

Drivers apply the brake at the yellow light and this results in a uniform deceleration to stop exactly at the red light. The distance between the red and yellow lights is *x*.

What must be the minimum distance between the lights if the train speed is increased by 25%, without changing the deceleration of the trains?

A   1.20*x*   B   1.25*x*   C   1.44*x*   D   1.56*x*

[1 mark]

Question 5

A sprinter runs a 200m race in a straight line. He accelerates from the starting block at a constant acceleration of 2.5 m s^{-2} to reach his maximum speed of 10 m s^{-1}. He maintains this speed until he crosses the finish line.

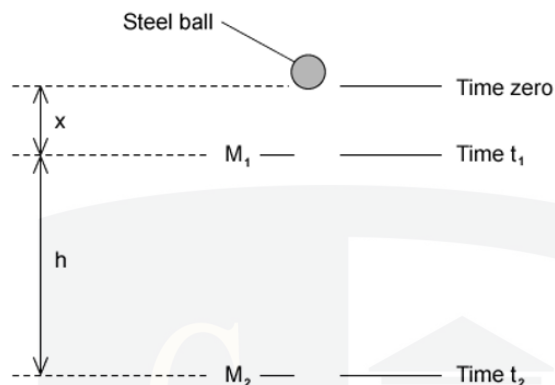Which time does it take the sprinter to run the race?

A   8 s   B   20 s   C   22 s   D   40 s

[1 mark]

Question 6

Two markers M_1 and M_2 are set up a vertical distance h apart.

A steel ball is released at time zero from a point a distance x above M_1. The ball reaches M_1 at time t_1 and reaches M_2 at time t_2. The acceleration of the ball is constant.

Which expression gives the acceleration of the ball?

A $\dfrac{2h}{t_2{}^2}$
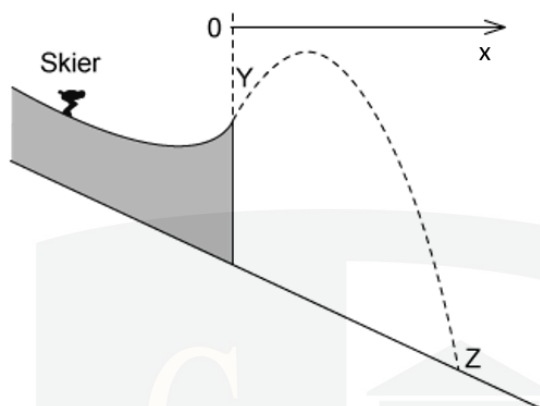
B $\dfrac{2h}{(t_1 + t_2)}$

C $\dfrac{2h}{t_2{}^2 - t_1{}^2}$
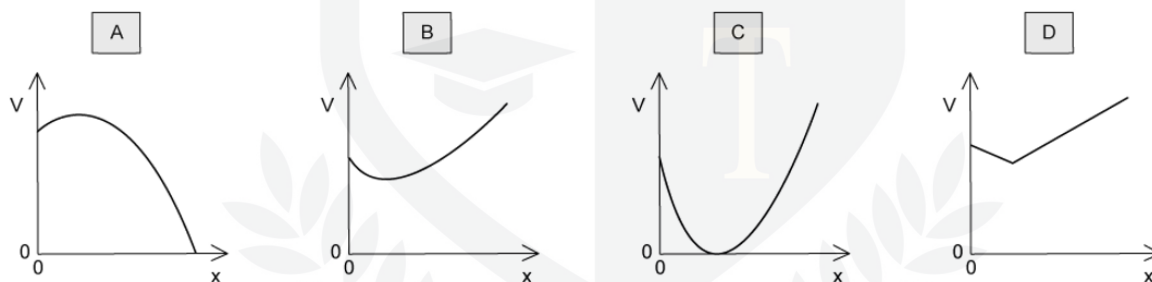
D $\dfrac{2h}{(t_2 - t_1)^2}$

[1 mark]

Question 7

The dotted line shows the path of a competitor in a ski-jumping competition.

Ignoring air resistance, which graph best represents the variation of his speed *v* with the horizontal distance *x* covered from the start of his jump at Y before landing at Z?
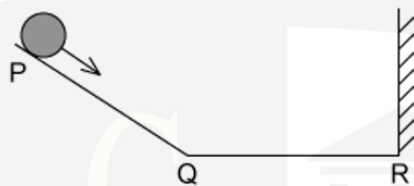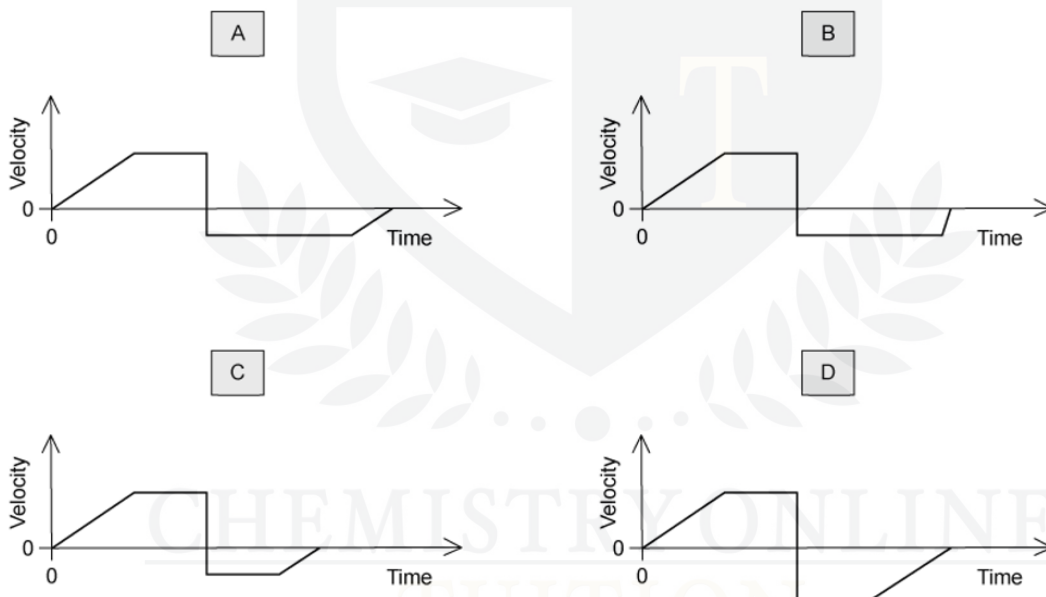

[1 mark]

Question 8

A ball is released from rest on a smooth slope PQR.

It moves down the slope, along a smooth horizontal surface QR and rebounds inelastically at R.

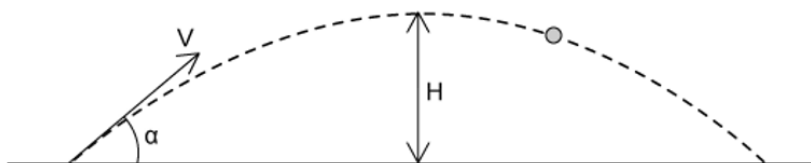Then it moves back to Q and comes to rest momentarily somewhere on PQ.

Which velocity-time graph represents the motion of the ball?

[1 mark]

Question 9

A cannon fires a cannonball with an initial speed *v* at an angle α to the horizontal.

Which equation is correct for the maximum height H reached?

A $\quad H = \dfrac{v \sin \alpha}{2g}$

B $\quad H = \dfrac{g \sin \alpha}{2v}$

C $\quad H = \dfrac{(v \sin \alpha)^2}{2g}$

D $\quad H = \dfrac{g^2 \sin \alpha}{2v}$

[1 mark]

Question 10

A body having uniform acceleration *a* increases its velocity from *u* to *v* in time *t*.

Which expression would **not** give a correct value for the body's displacement during time *t*?

A $\quad ut + \dfrac{1}{2}at^2$

B $\quad vt - \dfrac{1}{2}at^2$

C $\quad \dfrac{(v+u)(v-u)}{2a}$

D $\quad \dfrac{(v-u)t}{2}$

[1 mark]