Past-paper walk-through

2.1.3 The equations of uniformly accelerated motion

A-Level Physics

Questions in this set

- 9702/13 J23 Q5 ▪ 1 mark p.5
  Which equation, representing uniformly accelerated motion in a straight...
- 9702/11 J24 Q4 ▪ 1 mark p.7
  An object is moving with initial velocity u . The object then moves...
- 9702/12 M22 Q6 ▪ 1 mark p.9
  A sprinter takes a time of 11.0 s to run a 100 m race. She first...
- 9702/11 J21 Q7 ▪ 1 mark p.11
  A train, initially at rest at a station, has a uniform acceleration of...
- 9702/11 N21 Q7 ▪ 1 mark p.13
  Two cars X and Y are positioned as shown at time t = 0. They are...
- 9702/12 M24 Q6 ▪ 1 mark p.16
  A ball is released from rest at position X at time zero. At 1.0 s , it...

Questions in this set

- 9702/22 J21 Q2 ▪ 3 marks p.19

  A ball is thrown vertically downwards to the ground, as illustrated in...

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 5

9702/13 J23 ▪ Q5 ▪ 1 mark

Which equation, representing uniformly accelerated motion in a straight line, can be determined using **only** the definition of acceleration? **[1]**

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

B $s = \frac{1}{2}(u + v)t$

C $v = u + at$

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

Solution 5

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

B $s = \frac{1}{2}(u + v)t$

C $v = u + at$ ✓

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

Answer: **C**

Question 4

9702/11 J24 ▪ Q4 ▪ 1 mark

An object is moving with initial velocity u. The object then moves with uniform acceleration a for time t until it reaches final velocity v.

Which equation describes the motion of the object? **[1]**

A $u = v - 2at$

B $u = v - at$

C $v = u + at^2$

D $v = u + 2at^2$

Solution 4

A $u = v - 2at$

B $u = v - at$ ✓

C $v = u + at^2$

D $v = u + 2at^2$

Answer: **B**

Question 6

9702/12 M22 ▪ Q6 ▪ 1 mark

6 A sprinter takes a time of 11.0 s to run a 100 m race. She first accelerates uniformly from rest, reaching a speed of $10\,m\,s^{-1}$. She then runs at a constant speed of $10\,m\,s^{-1}$ until the finish line.

What is the uniform acceleration of the sprinter for the first part of the race?

A $0.5\,m\,s^{-2}$ **B** $0.91\,m\,s^{-2}$ **C** $1.7\,m\,s^{-2}$ **D** $5.0\,m\,s^{-2}$

Solution 6

Answer: **D**

Question 7

9702/11 J21 ▪ Q7 ▪ 1 mark

7 A train, initially at rest at a station, has a uniform acceleration of $0.20\,\text{m}\,\text{s}^{-2}$ until it reaches a speed of $20\,\text{m}\,\text{s}^{-1}$. It travels for a time at this constant speed and then has a uniform deceleration of $0.40\,\text{m}\,\text{s}^{-2}$ until it comes to rest at the next station. The distance between the two stations is 3000 m.

What is the time taken by the train to travel between the two stations?

A 75 s **B** 150 s **C** 230 s **D** 300 s

Solution 7

Answer: **C**

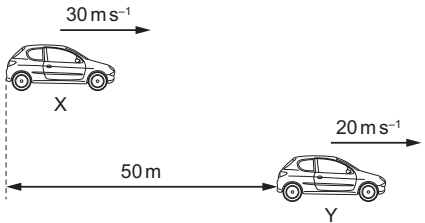
Question 7

9702/11 N21 ▪ Q7 ▪ 1 mark

7 Two cars X and Y are positioned as shown at time $t = 0$.

They are travelling in the same direction.

X is 50 m behind Y and has a constant velocity of 30 m s^{-1}. Y has a constant velocity of 20 m s^{-1}.



Question 7

9702/11 N21 ▪ Q7 ▪ 1 mark

What is the value of t when X is level with Y?

A 1.0 s **B** 1.7 s **C** 2.5 s **D** 5.0 s

Solution 7

Answer: **D**

Question 6

9702/12 M24 ▪ Q6 ▪ 1 mark

A ball is released from rest at position X at time zero. At 1.0 s, it bounces inelastically from a horizontal surface and rebounds, reaching the top of its first bounce at 1.5 s. What is the total displacement of the ball from its original position X at 1.5 s? **[1]**

A 1.25 m

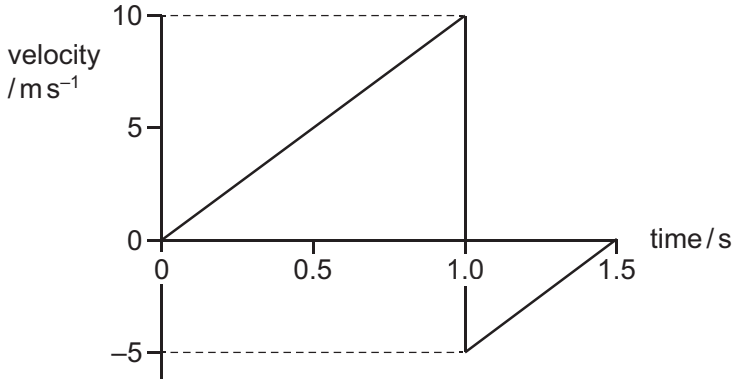
B 3.75 m

C 5.00 m

D 6.25 m

Question 6

A ball is released from rest at position X at time zero.



Solution 6

A 1.25 m

B 3.75 m ✓

C 5.00 m

D 6.25 m

Answer: **B**

Question 2

9702/22 J21 ▪ Q2 ▪ 3 marks

A ball is thrown vertically downwards to the ground, as illustrated in Fig. 2.1. speed u speed 8.7 m s–1 1.5 m ball ground path of ball Fig. 2.1

The ball is thrown with speed u from a height of 1.5 m. The ball then hits the ground with speed 8.7 m s–1. Assume that air resistance is negligible.

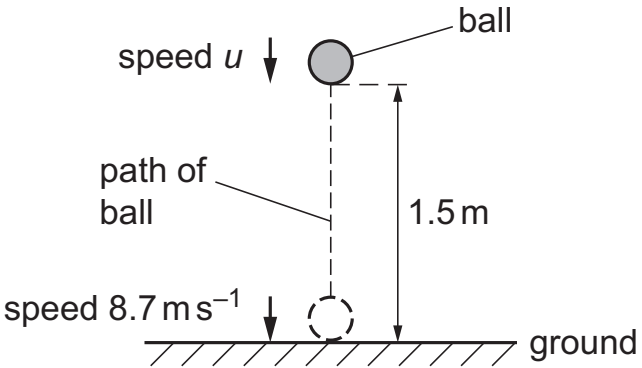
(a) Calculate speed u.

u = ... m s–1 [2] **[2]**

(d) The ball was thrown downwards at time t = 0 and hits the ground at time t = T. On Fig. 2.2, sketch a graph to show the variation of the speed of the ball with time t from t = 0 to t = T. Numerical values are not required. speed 0 T t 0 Fig. 2.2 [1] **[1]**

Question 2

(a) Calculate speed u.



Solution 2

(a)

Mark scheme

- $v2 = u2 + 2as$ $u2 = 8.72 - (2 \times 9.81 \times 1.5)$ C1
- $u = 6.8$ m s–1 A1

Solution 2

(d)

Mark scheme

- straight line with a positive gradient and starting from a non-zero value of speed at $t = 0$ and ending when $t = T$ **B1**