Name: _____

Motion 1

Questions

Date:

Time:

Total marks available:

Total marks achieved: _____

Questions

Q1.

The winner of a 400m race must have the greatest

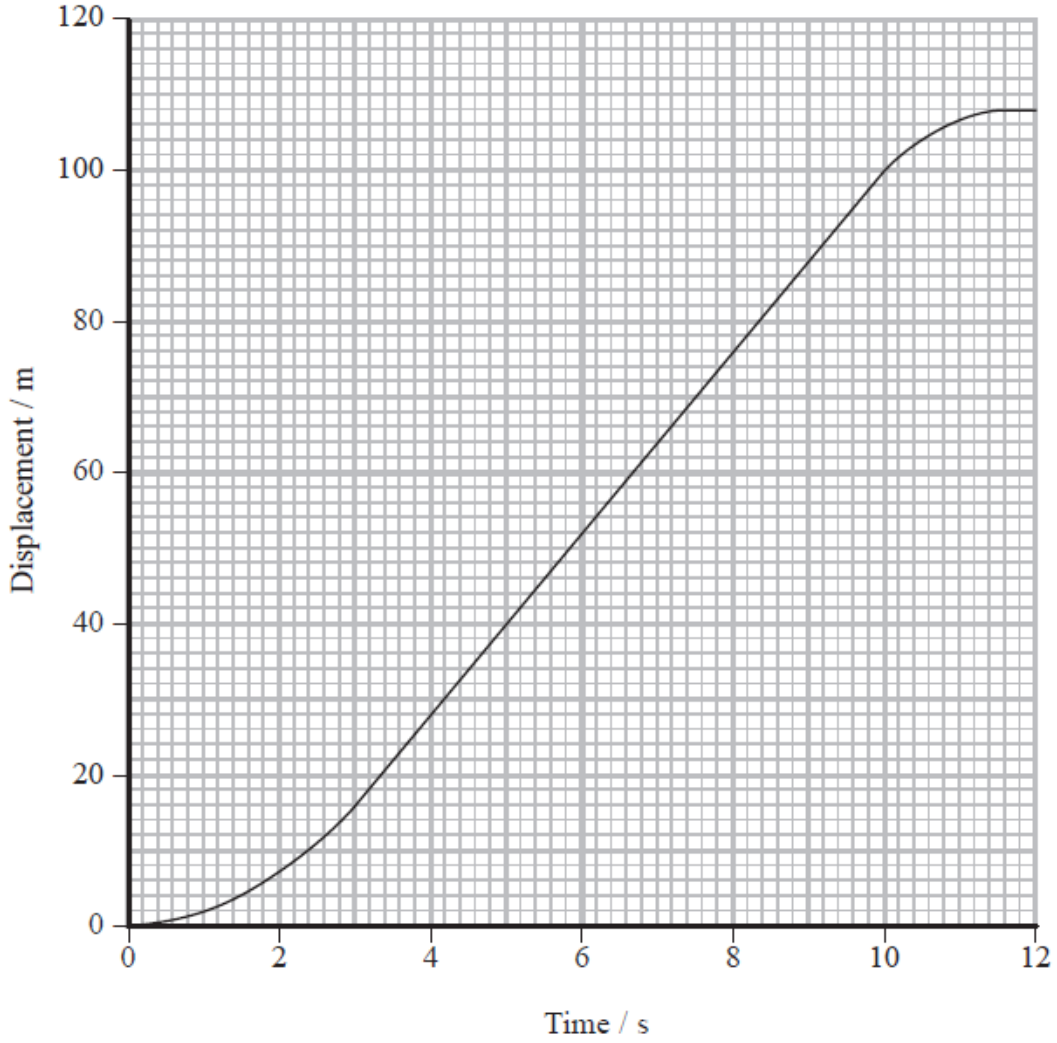
(1)

- ☒ **A** acceleration.
- ☒ **B** average speed.
- ☒ **C** instantaneous speed.
- ☒ **D** maximum speed.

(Total for question = 1 mark)

Q2.

The graph is a displacement-time graph for a runner.



The velocity of the runner at 5 s is approximately

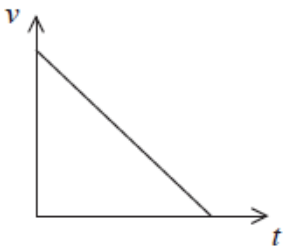
- ☒ **A** 8 m s^{-1}
- ☒ **B** 9 m s^{-1}
- ☒ **C** 12 m s^{-1}
- ☒ **D** 40 m s^{-1}

(Total for question = 1 mark)

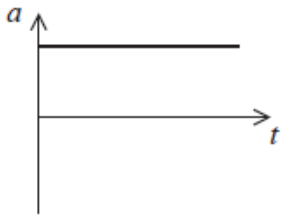
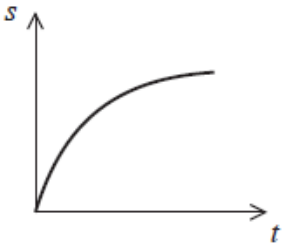
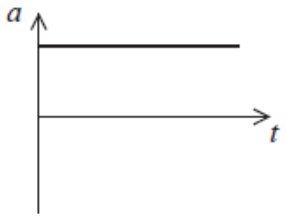
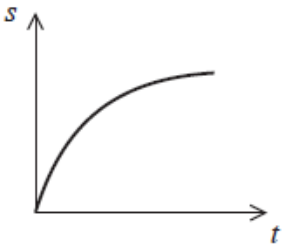
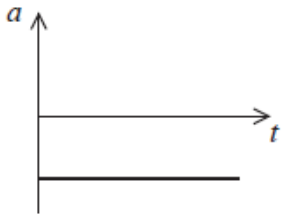
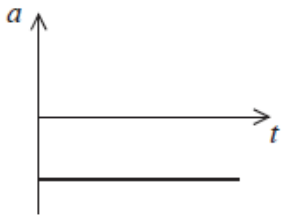
Q3.

A ball is rolled along a horizontal surface. Frictional forces slow the ball to rest.

The velocity-time graph for the ball is shown.



Select the row of the table that correctly gives the corresponding displacement-time and acceleration-time graphs for the ball.

	Displacement-time graph	Acceleration-time graph
☒ A		
☒ B		
☒ C		
☒ D		

(Total for question = 1 mark)

Which of the following can be used to determine the magnitude of velocity?

(1)

- ☒ **A** area under an acceleration-time graph
- ☒ **B** area under a velocity-time graph
- ☒ **C** gradient of an acceleration-time graph
- ☒ **D** gradient of a velocity-time graph

(Total for question = 1 mark)

Q5.

A student is asked to solve the following problem:

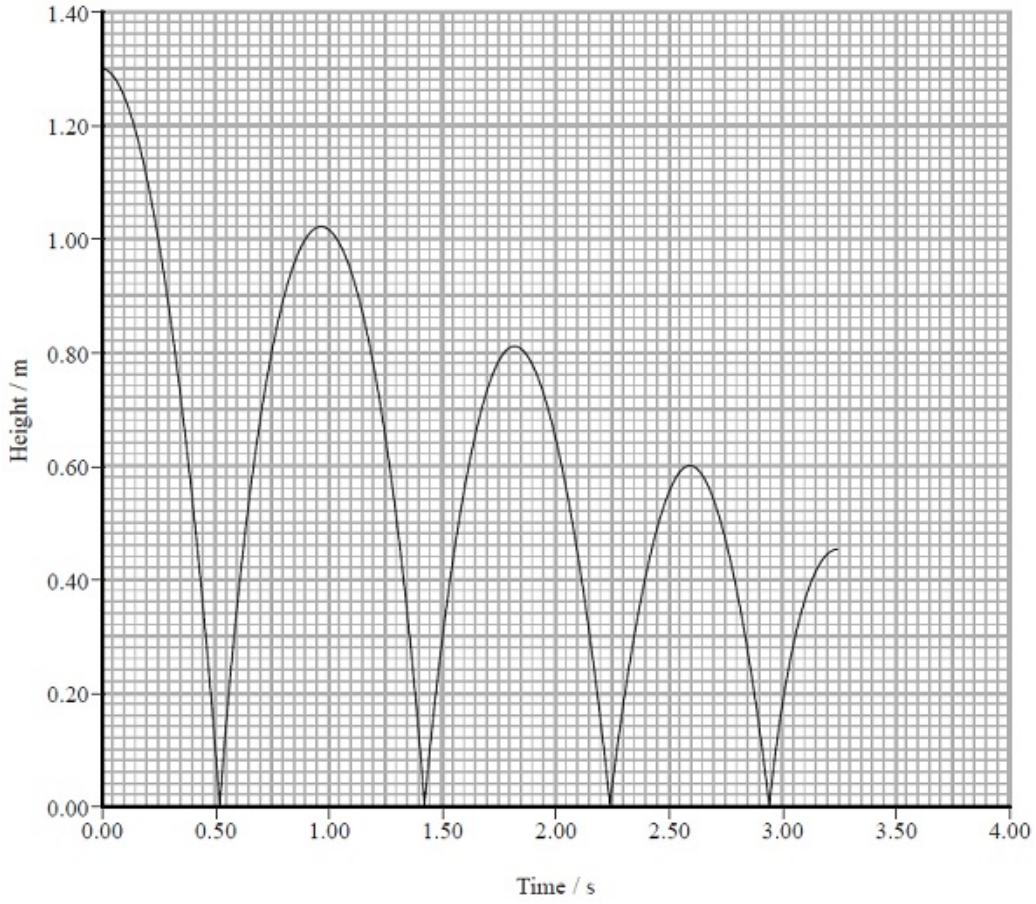
An object is thrown upwards with a speed of 25 m s^{-1}. How high will it be when the speed is 12 m s^{-1}?

Which equation will allow the problem to be solved in a single calculation?

- ☒ **A** $s = ut + ½ at^2$
- ☒ **B** $s = (u + v)t/2$
- ☒ **C** $v = u + at$
- ☒ **D** $v^2 = u^2 + 2as$

(Total for question = 1 marks)

Q6. A ball is dropped from a height of 1.3 m. The graph shows how the height above the ground varies with time for several bounces.

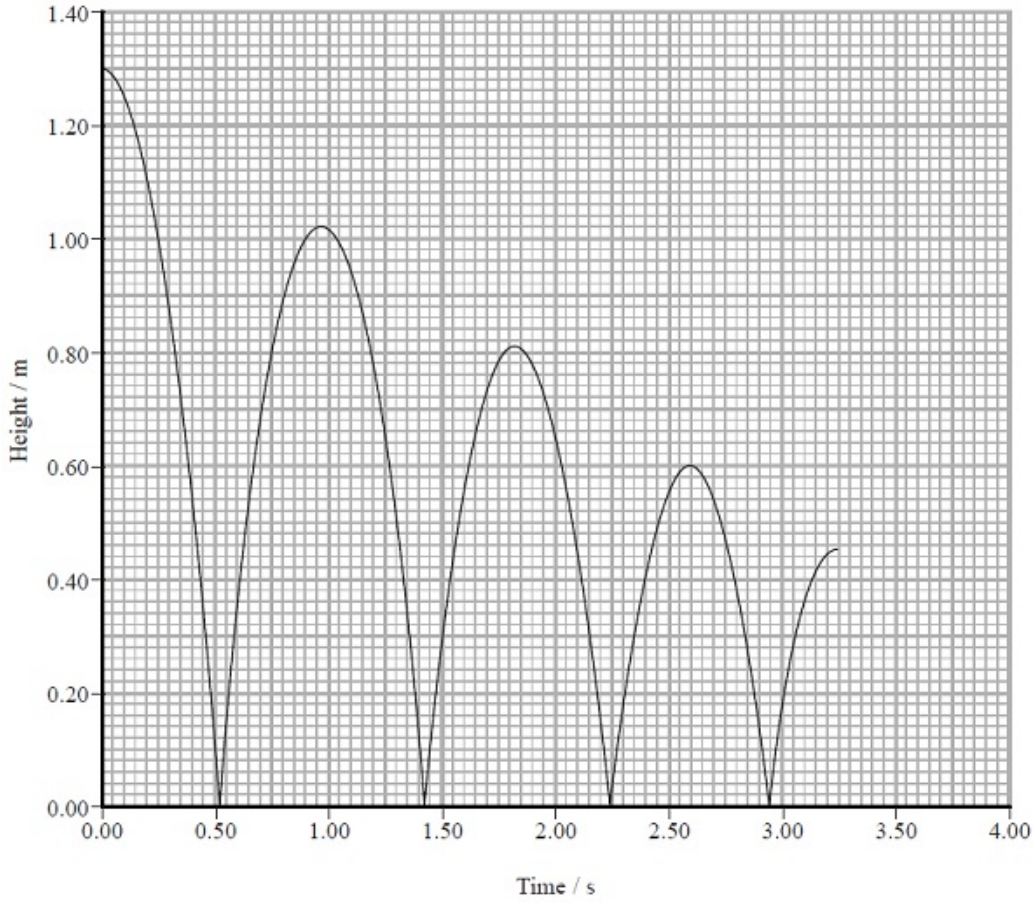


At 2.6 s the magnitude of the displacement from the starting position is

- **A** 0.20 m
- **B** 0.60 m
- **C** 0.70 m
- **D** 1.30 m

(Total for Question = 1 mark)

Q7. A ball is dropped from a height of 1.3 m. The graph shows how the height above the ground varies with time for several bounces.



How can the velocity of the ball at time t = 2.5 s be determined from the graph?

☒ **A** Calculate the area between the graph and the time axis up to t = 2.5 s.

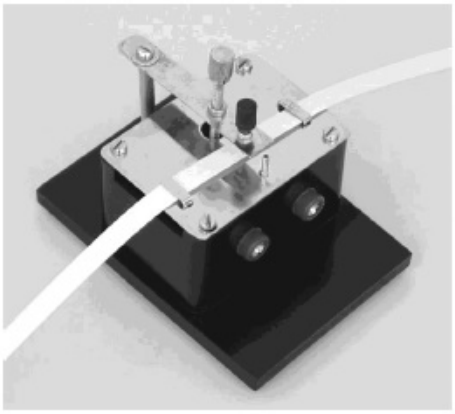
☒ **B** Divide the displacement at t = 2.5 s by 2.5 s.

☒ **C** Divide the height at t = 2.5 s by 2.5 s.

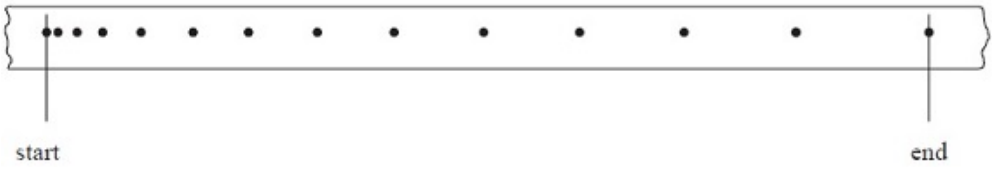
☒ **D** Draw a tangent to the graph at t = 2.5 s and calculate its gradient.

(Total for Question = 1 mark)

Q8. A trolley moves down a ramp from rest. Attached to the trolley is a strip of paper which is pulled through a ticker tape timer. The ticker tape timer makes 50 dots each second on the strip of paper.



The strip of paper is shown below. The start and the end of the journey are indicated.



(a) (i) Using measurements from the tape show that the final velocity of the trolley is about 1 m s^{-1}

(2)

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(ii) Hence calculate the average acceleration of the trolley.

(2)

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Average acceleration = ...

(b) Using a ticker tape timer is one method of measuring the speed of a moving object in a laboratory. Another method is to use a light gate with a data logger and computer.

Suggest an advantage of using the light gate method rather than using a ticker tape timer.

(1)

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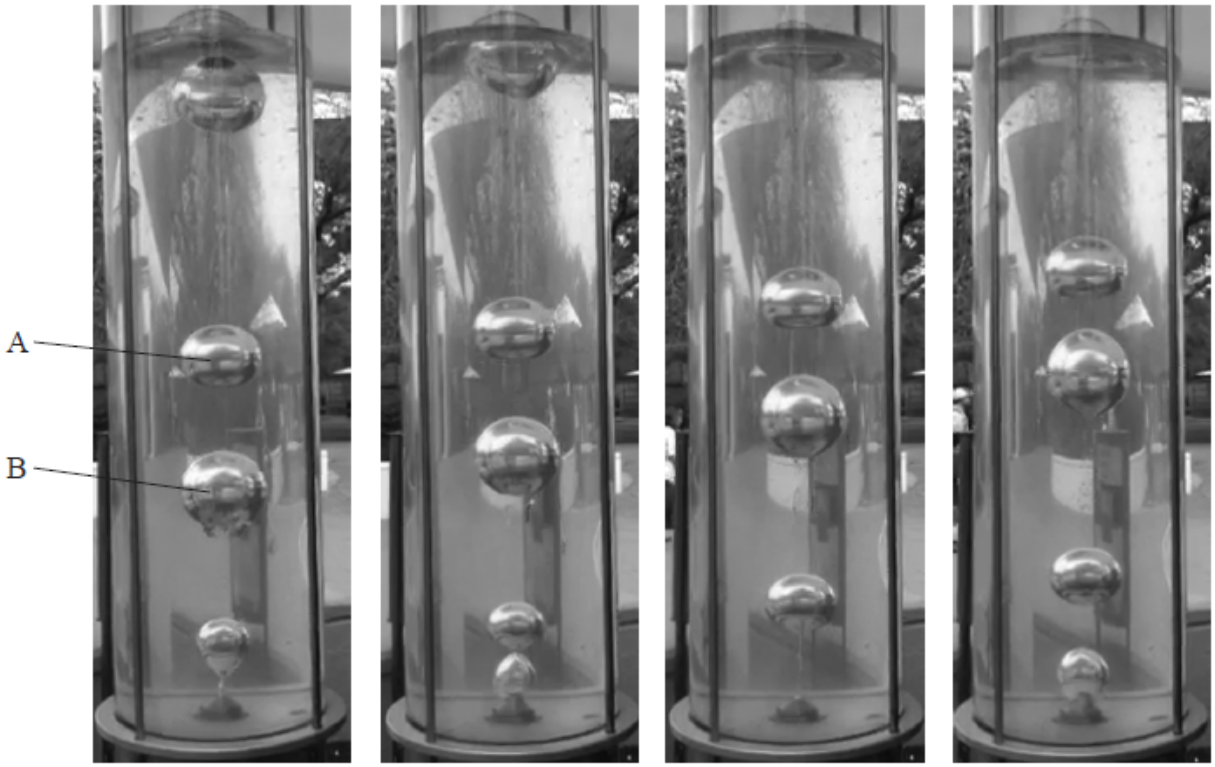
(Total for Question = 5 marks)

Q9.

An exhibit in a science museum requires the observer to use a pump to create air bubbles in a column of liquid. The bubbles then rise through the liquid.

The following photographs were taken at 0.33 s intervals.



Photograph 1
time = 0

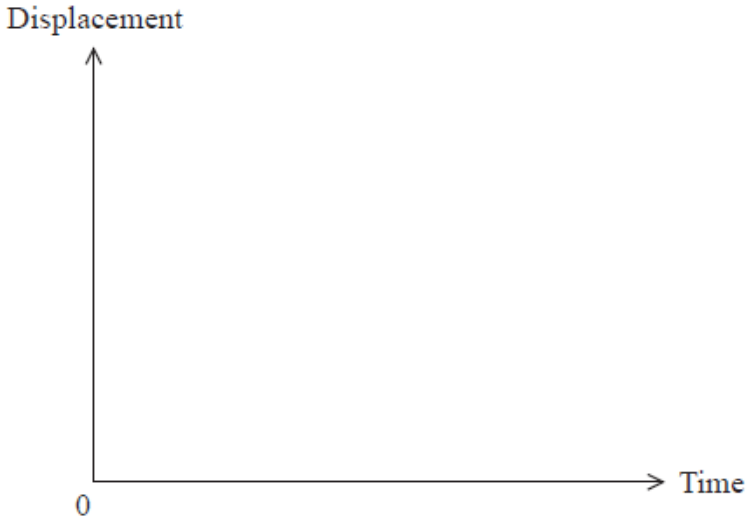
Photograph 2

Photograph 3

Photograph 4

(i) Sketch on the axes below two labelled lines to show how the displacements of the smaller bubble A and the larger bubble B vary with time over the four images.

(2)



(ii) The photographs are at a scale of 1 to 12. By using measurements from the photographs, calculate the speed of bubble B between photographs 2 and 3.

(4)

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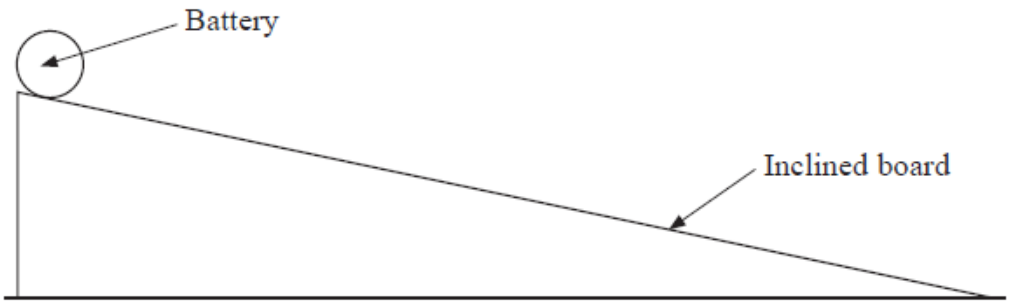
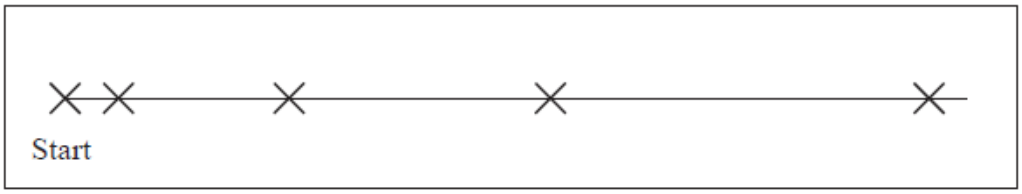
Speed of bubble B = ...

Q10.

A group of students was asked to find how the velocity of a cylindrical battery changes as it rolls down an inclined board.



The group marked the position of the battery on the board every second with an X.



(a) These markings were used to obtain the following results table.

(i) Complete the table.

(3)

		A	B
Time / s	**Distance from start position / m**	**Average velocity in previous second / m s^{-1}**	**Average velocity from the start / m s^{-1}**
0.0	0.00	0	0
1.0	0.18	0.18	0.18
2.0	0.84		
3.0	1.75		
4.0	3.14	1.39	0.79

(ii) Justify which of the columns, A or B, gives a more accurate value for the velocity of the battery at the bottom of the inclined board.

(1)

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(b) The only two pieces of equipment that the students used were a measuring tape and a manual stopwatch.

Give a possible source of error and suggest changes to the equipment and method used to make the values in column A more accurate.

(3)

Source of error

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Changes

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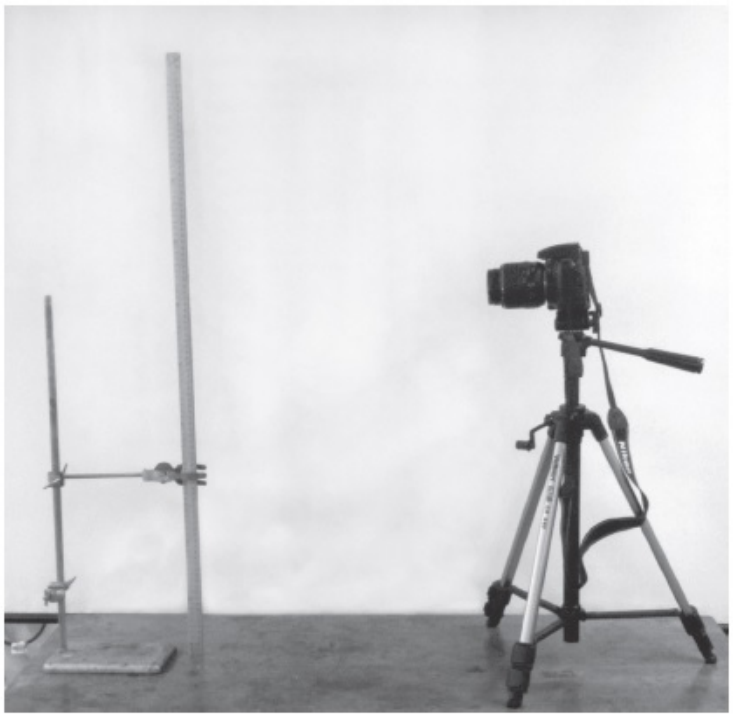
(Total for question = 7 marks)

Q11.

A student carries out an experiment to find the acceleration of free fall.



(a) In this experiment the student releases a small steel ball in front of a metre rule and uses a video camera to record its motion. The camera captures 30 images per second, which may be played back one image at a time.

(i) Explain how the acceleration of free fall could be determined using the recording.

(4)

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(ii) Describe a systematic error which could arise.

(1)

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(b) Describe one property of the steel ball that makes it suitable to use in this experiment and explain why this property makes it suitable.

(2)

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(c) Explain an advantage of using a video camera to take measurements for this experiment rather than using a stopwatch.

(2)

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(Total for question = 9 marks)

Q12. The photograph shows an athlete performing a long jump.

At take-off his horizontal speed is 8.0 m s^{-1} and his vertical speed is 2.8 m s^{-1}.

(a) Show that the total time the athlete spends in the air is about 0.6 s.

Assume that his centre of gravity is at the same height at take-off and landing.

(3)

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(b) Calculate the horizontal distance jumped by the athlete.

(2)

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Horizontal distance = ...

(c) In reality, when the athlete lands his centre of gravity is 50 cm lower than its position at take-off.

Calculate the extra horizontal distance this enables the athlete to jump.

(4)

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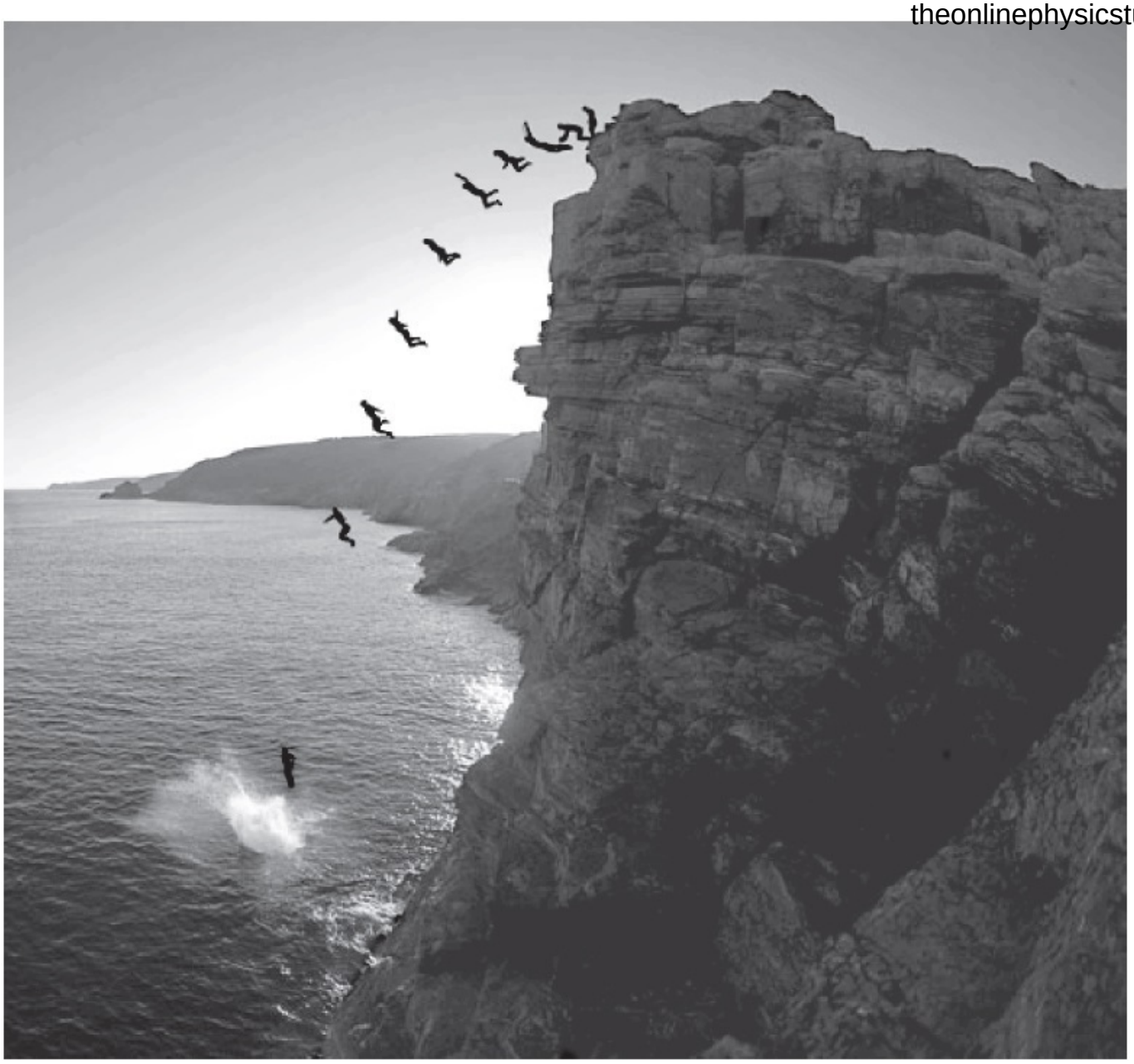
Extra horizontal distance = ...

(Total for Question = 9 marks)

Q13.

The photograph shows a sequence of pictures of a man jumping 30 m from a cliff into the water below.

- Ignore the first picture and consider the second as representing the instant he jumps.
- Ignore the final picture (the splash), taking the tenth picture as showing the time at which he has fallen 30 m.



(a)

The diagram shows the tenth picture of the man.

It is useful to mark the centre of gravity of the man for each picture before taking measurements to analyse the motion.

State what is meant by centre of gravity and mark its approximate position on the diagram.

(2)

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(b) The vertical distance between consecutive pictures increases, but the horizontal distance remains the same. Explain this observation.

(2)

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(c) By considering the vertical motion for pictures 2 to 10, show that the pictures are taken at a rate of about 3 per second.

vertical height fallen = 30 m

(3)

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(d) The vertical height between the second and tenth pictures is 30 m. Take measurements from the photograph and use them to show that the horizontal distance between these pictures is between 12 m and 15 m.

Record your measurements below.

(3)

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(e) Calculate the horizontal velocity and vertical velocity of the man for the tenth picture.

(4)

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Horizontal velocity = ...

Vertical velocity = ...

(Total for question = 14 marks)