SUVAT Equations

Have a go at the following exam equations.

OCR, G481, JUNE 2009

2 Fig. 2.1 shows a graph of velocity against time for an object travelling in a straight line.

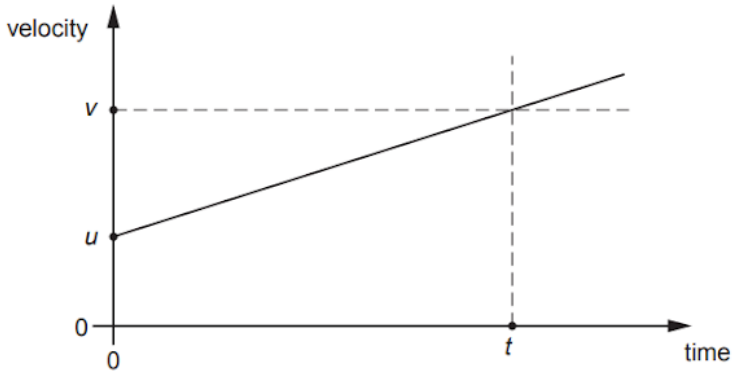

Fig. 2.1

The object has a constant acceleration *a*. In a time *t* its velocity increases from *u* to *v*.

(a) Describe how the graph of Fig. 2.1 can be used to determine

(i) the acceleration *a* of the object

In your answer, you should use appropriate technical terms, spelled correctly.

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..... **[1]**

(ii) the displacement *s* of the object.

.....

..... **[1]**

(b) Use the graph of Fig. 2.1 to show that the displacement s of the object is given by the equation:

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

[2]

(c) In order to estimate the acceleration g of free fall, a student drops a large stone from a tall building. The height of the building is known to be 32 m. Using a stopwatch, the time taken for the stone to fall to the ground is 2.8 s.

(i) Use this information to determine the acceleration of free fall.

acceleration = ... $m\,s^{-2}$ **[2]**

(ii) One possible reason why your answer to **(c)(i)** is smaller than the accepted value of $9.81\,m\,s^{-2}$ is the reaction time of the student. State another reason why the answer is smaller than $9.81\,m\,s^{-2}$.

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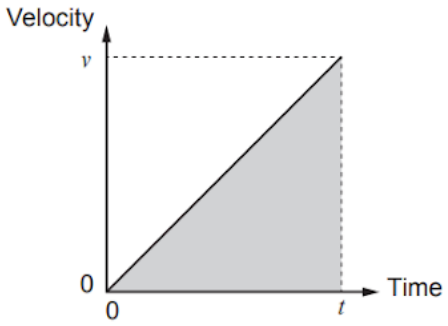
..... **[1]**

[Total: 7]

WJEC, 1321/01, JANUARY 2014

3. *(a)* A velocity-time graph is given for a body which is accelerating from rest in a straight line.



(i) What does the shaded area under the graph represent? [1]

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(ii) Use the graph to show that, using the usual symbols:

$$x = \tfrac{1}{2}\, at^2$$

[3]

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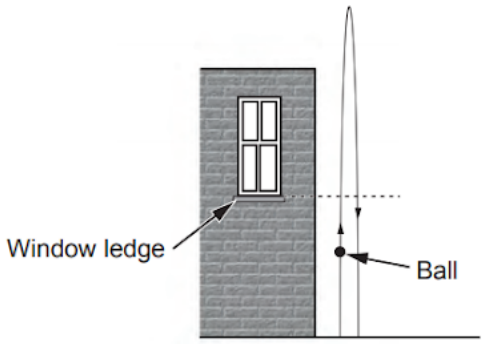
(b) A ball is thrown vertically upwards and passes a window ledge 0.3 s after being released. It passes the window ledge on its way back down, 1.6 s **later**. Ignore air resistance.



(i) Determine the time of flight of the ball. [1]

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(ii) Calculate the initial velocity of the ball when it is released. [3]

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(iii) Calculate the height of the window ledge above the ground. [2]

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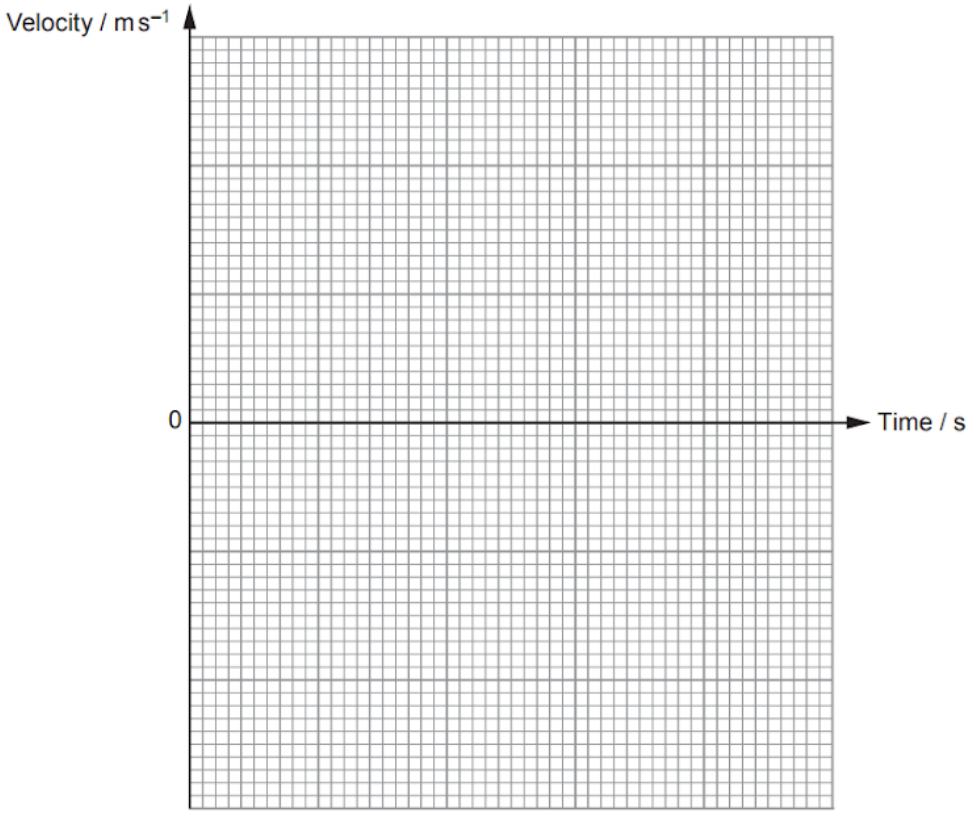
(c) Draw, on the grid below, a velocity-time graph for the whole of the ball's flight. Include suitable scales on both axes. [3]



(d) In reality, air resistance also acts on the ball. In the spaces provided draw **three** free body diagrams showing the forces acting on the ball at the positions indicated. **Label** these forces. [4]

As the ball passes the window ledge **travelling upwards**

At maximum height above the ground

As the ball passes the window ledge **travelling downwards**

WJEC, 1321/01, JUNE 2013

1. *(a)* Velocity and acceleration are both vector quantities.

(i) State what is meant by a vector quantity. [1]

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(ii) Name **one** other vector quantity. [1]

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(b) One of the equations of motion for constant acceleration is $x = ut + \frac{1}{2}at^2$.

(i) Show that this equation is correct in terms of units. [3]

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(ii) The displacement x, in metres, of a car travelling in a straight line with uniform acceleration at a time t, in seconds, from the start of the motion is given by

$$x = 8t + 3t^2$$

(I) State the initial velocity, u, of the car (at $t = 0$). ..... [1]

(II) Determine the car's acceleration. [1]

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(III) Calculate the displacement when $t = 5.0$ s. [1]

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(IV) Calculate the velocity when $t = 5.0$ s. [3]

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