Kinematics with Constant Acceleration (SUVAT) Exam Questions (From OCR 4728)

Q1, (Jun 2009, Q4)

An object is projected vertically upwards with speed $7\,\text{m s}^{-1}$. Calculate

(i) the speed of the object when it is 2.1 m above the point of projection, **[3]**

(ii) the greatest height above the point of projection reached by the object, **[3]**

(iii) the time after projection when the object is travelling downwards with speed $5.7\,\text{m s}^{-1}$. **[3]**

Q2, (Jun 2008, Q1)

A car of mass 900 kg is travelling in a straight line on a horizontal road. The driving force acting on the car is 600 N, and a resisting force of 240 N opposes the motion.

(i) Show that the acceleration of the car is $0.4\,\text{m s}^{-2}$. [2]

(ii) Calculate the time and the distance required for the speed of the car to increase from $5\,\text{m s}^{-1}$ to $9\,\text{m s}^{-1}$. [4]

Q3, (Jun 2007, Q5)

A particle P is projected vertically upwards, from horizontal ground, with speed $8.4\,\text{m s}^{-1}$.

(i) Show that the greatest height above the ground reached by P is 3.6 m. [3]

A particle Q is projected vertically upwards, from a point 2 m above the ground, with speed $u\,\text{m s}^{-1}$. The greatest height **above the ground** reached by Q is also 3.6 m.

(ii) Find the value of u. [2]

It is given that P and Q are projected simultaneously.

(iii) Show that, at the instant when P and Q are at the same height, the particles have the same speed and are moving in opposite directions. [6]

Q5, (Jun 2013, Q2)

A particle P is projected vertically upwards and reaches its greatest height 0.5 s after the instant of projection. Calculate

(i) the speed of projection of P, **[2]**

(ii) the greatest height of P above the point of projection. **[3]**

It is given that the point of projection is 0.539 m above the ground.

(iii) Find the speed of P immediately before it strikes the ground. **[3]**

Q6, (Jun 2014, Q1i,ii) [Modified]

A particle P is projected vertically downwards with initial speed $3.5\,\text{m s}^{-1}$ from a point A which is 5 m above horizontal ground.

(i) Find the speed of P immediately before it strikes the ground. **[2]**

After striking the ground, P rebounds and moves vertically upwards and 0.87 s after leaving the ground P passes through A.

(ii) Calculate the speed of P immediately after it leaves the ground. **[3]**

Q7, (Jun 2015, Q1)

A particle P is projected vertically downwards with speed $14\,\text{m s}^{-1}$ from a point 30 m above the ground.

(i) Calculate the speed of P when it reaches the ground. **[2]**

(ii) Find the distance travelled by P in the first 0.4 s of its motion. **[2]**

(iii) Calculate the time taken for P to travel the final 15 m of its descent. **[3]**

Q8, (Jun 2016, Q1)

A stone is released from rest on a bridge and falls vertically into a lake. The stone has velocity $14\,\text{m s}^{-1}$ when it enters the lake.

(i) Calculate the distance the stone falls before it enters the lake, and the time after its release when it enters the lake. **[4]**

The lake is 15 m deep and the stone has velocity $20\,\text{m s}^{-1}$ immediately before it reaches the bed of the lake.

(ii) Given that there is no sudden change in the velocity of the stone when it enters the lake, find the acceleration of the stone while it is falling through the lake. **[3]**
