1 Figure 1 shows part of a roller coaster ride seen from the side.
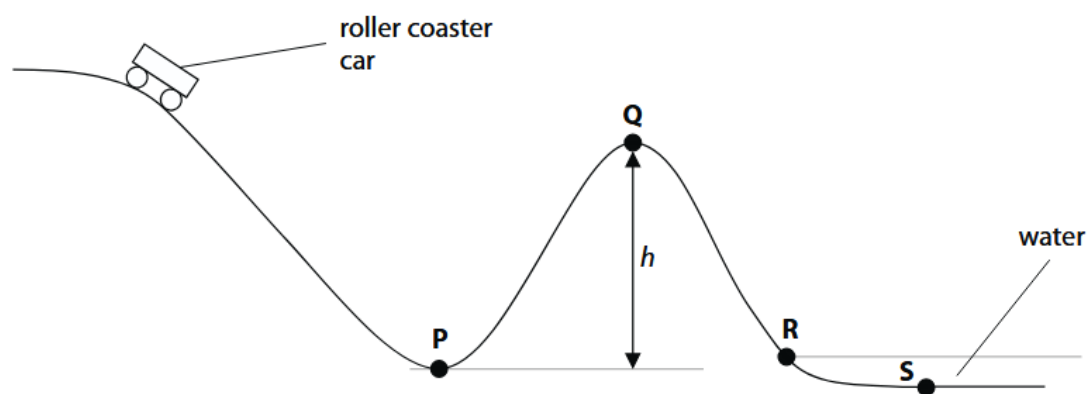

Figure 1

(a) The roller coaster car rolls down towards **P**. The car has mass, m kg and velocity v m/s.

Which of these is the correct equation for calculating the kinetic energy of the car?

(1)

☒ **A** $KE = mv$

☒ **B** $KE = mv^2$

☒ **C** $KE = \frac{1}{2}mv^2$

☒ **D** $KE = 2mv^2$

(b) The mass of the car is 580 kg.

The car gains 39 000 J of gravitational potential energy as it climbs from **P** to **Q**.

(i) State the equation relating change in gravitational potential energy, mass, gravitational field strength and change in vertical height.

(1)

(ii) Calculate the height h, shown in Figure 1.

(gravitational field strength, $g = 10$ N/kg)

(3)

$h =$ .... m

(c) The car enters a pool of water at **R**. It slows down and stops at **S**.

Describe how the total energy of the system is conserved as the car travels between **R** and **S**.

(2)

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(Total for Question 1 = 7 marks)

Question number	Answer	Mark
1(a)	C	(1)

Question number	Answer	Mark
1(b)(i)	change in GPE = mass × gravitational field strength × change in vertical height	(1)

Question number	Answer	Additional guidance	Mark
1(b)(ii)	transformation (1) $h = \Delta E \div mg$ substitution (1) $h = 39\,000 \div (580 \times 10)$ evaluation (1) 6.7 (m)	accept use of $g = 9.81$ accept 6.72 accept 6.85 (from $g = 9.81$)	(3)

Question number	Answer	Additional guidance	Mark
1(c)	An answer that combines the following points of application of knowledge and understanding to provide a logical description: • work is done against friction (1) • energy is stored in another specified way (1)	ignore references to friction as energy store acceptable stores are: • KE of water • thermal energy of water • thermal energy of air • (G)PE of water	(2)