

Question	Answer	Mark
1(a)	From time zero, line of constant positive gradient, not necessarily from origin Horizontal line from end of sloping line Line of steeper positive gradient from end of horizontal line	B1 B1 B1
1(b)	(distance =) area under graph stated $0.5 \times 7.5 \times 3.3 (= 12.375)$ $+ 12.5 \times 3.3 (= 41.25)$ $+ 0.5 \times 5 \times 3.3 (= 8.25)$ OR $\frac{1}{2} (a + b)h$ $= 0.5 \times (25 + 12.5) \times 3.3$ OR $(25 \times 3.3) - (0.5 \times 12.5 \times 3.3)$ 62m	C1 C2 (C1) (C1) (C2) A1
		Total: 7

- 2 (a) speed \times time in any form, symbols, numbers or words [1]
 OR any area under graph used or stated [1]
 13 (m/s) OR 24 (s) seen or used in correct context [1]
 312 m (2 or 3 sig. figs.) [1]
- (b) rate of change of speed OR gradient of graph OR 18/12 [1]
 18 (m/s) OR 12 (s) seen or used in correct context [1]
 1.5 m/s² [1]
- (c) same gradient / slope OR equal speed changes in equal times OR [1]
 allow graph symmetrical
- 3 (a) (i) acceleration OR increasing speed C1
 constant acceleration OR constant rate of increase in speed A1
- (ii) decreasing acceleration OR decreasing rate of increase in speed B1
 NOT deceleration
- (b) mention of air resistance AND weight (of object) / force due to gravity B1
 acceleration at start (of fall) is acceleration of gravity / 10 m/s² / a maximum / g B1
 OR acceleration decreases (as it falls)
 air resistance increases as speed increases/as it accelerates B1
 acceleration zero/terminal velocity/constant speed/maximum speed when B1
 air resistance = weight
- [Total: 7]**

- 4 (a) (i) horizontal line at 10 m/s B
(ii) straight line from origin to (5.0, 25) B1
- (b) (i) 50 m B1
(ii) area of triangle OR $\frac{1}{2} \times 25 \times 5.0$
62.5 m OR 63 m A1
(iii) when areas under graphs are equal C1
4.0 s A1

[Total: 7]

- 5 (a) point marked P (on line or time axis) at $t \geq 2.0$ s B1
- (b) attempt at gradient OR $(a =) \Delta v / t$ OR $(v - u) / t$ OR $240 (-0) / 2.0$
OR division of correct points on graph C1
 120 m/s^2 A1
(ii) suggestion of area (under graph) in words or formula or numbers C1
OR $0.5 (120 + 240) \times 1.0$ OR $[(120 \times 1.0) + (0.5 \times 120 \times 1.0)]$ C1
180 m A1
- (c) mass of sled changes / decreases OR fuel used up B1

[Total: 6]

- 6 (a) (i) (it/comet) travels in a straight line B1
- (ii) area (under graph) OR $s = vt$ in any form OR vt C1
220 000 m OR 220 km A1
- (b) negative acceleration OR deceleration OR (it/the comet) is slowing down B1
acceleration/deceleration (only accept **it** if acc/decel already mentioned)
not constant allow either increasing or decreasing B1
- (c) attempt at gradient OR $(a =) \Delta v / \Delta t$ OR $(0-)12000 / 2.0$ OR other correct values for $\Delta v / \Delta t$ C1
 $(-)6000 \text{ m/s}^2$ tolerance 5000 – 7000 m/s^2 A1
- (d) (it/comet) hits surface (of planet) B1
OR stops o.w.t.t.e.

[Total: 8]

- 7 (a) speed is constant/uniform/unchanging OR terminal velocity/speed B1
no net/resultant force OR air resistance cancels/equals weight
- (b) P between 0.25 s and 1.90 s (inclusive) B1
- (c) (i) $(a =) \Delta v / t$ OR 2.5/0.25 OR other point on correct section of line B1
9.6 to 10 m/s^2 (inclusive) B1
- (ii) area under graph OR attempt at counting squares OR between 16.2 and 17.5 m C1
(inclusive)
between 16.5 and 17.1 m (inclusive) A1

[Total: 7]