

- 1 (a) (i) $a = (v - u) \div t$ OR $a = \Delta v \div t$ in any form OR in words in any form
AND with correct numbers substituted B1
- (ii) Straight line from origin to point (3.2 s, 32 m/s)
- (iii) Area under graph OR $\frac{1}{2} \times 3.2 \times 32$
OR $s = \frac{1}{2} at^2$ OR $\frac{1}{2} \times 10 \times 3.2^2$ C1
51 m A1
- (b) (i) Air resistance increases B1
- (ii) Graph line Y under graph line X B1
Graph has decreasing gradient B1
Graph extends to value of t greater than 3.5 s and greater than X B1

[Total: 8]

- 2 (a) (i) decreases / average speed 2 m/s B1
- (ii) constant / speed 0.8 m/s B1
- (b) negative B1
- (ii) zero B1
- (c) uses $v = d/t$ in any form or d/t C1
(av. vel = $50/40 =$) 1.3 m/s or 1.25 m/s A1

[Total: 6]

- 3 (a) (i) A marked between $t = 0$ and $t = 6.0$ s B
(ii) B marked between $t = 6.0$ s and $t = 7.0$ s B
(iii) C marked on clearly curved section before $t = 14$ s B
- (b) (i) $(a =) \Delta v / t$ OR 30/1 OR 15/0.5 etc. OR triangle on graph / tangent
(ignore – sign) $25 \text{ m/s}^2 < a < 35 \text{ m/s}^2$ A1
- (ii) $(F =) ma$ OR 750×30 e.c.f. from (b)(i) C1
 $2.2/2.25/2.3 \times 10^4$ N e.c.f. from (b)(i) A1
- (c) acceleration / rate of change of speed is zero OR speed is constant OR air resistance / backwards force equal and opposite to driving / forwards force B1
- [Total: 8]**

- 4 (a) A increasing speed
B constant speed
C stationary B2
Note: one mark lost for e.e.o.o.
- (b) D increasing acceleration
E constant acceleration
F constant speed B2
Note: one mark lost for e.e.o.o.
- (c) $(a =) \Delta v / t$ OR $(v - u) / t$ OR 10.5/1.5
 $= 7.0 \text{ m/s}^2$ A1
- (ii) $(a =) 0 \text{ (m/s}^2)$ B
- (iii) upward and downward forces equal OR no resultant force
OR forces equal and opposite OR forces balanced
OR weight (of body) = tension (in rope) B1
- [Total: 8]**

- 5 (a) (i) 10 m/s^2 ignore sign B1
- (ii) (same as) acceleration (of rocket at B) **OR** gravitational acceleration B1
- (b) same area B1
 area represents distance travelled B1
- distance up = distance down
OR overall displacement = 0
OR area above = distance up **AND** area below = distance below B1
- (c) any three from:
 • all of graph below x-axis after B
 • final section horizontal and above CD **AND** gradient always ≤ 0
 • continuous graph from B until time $>$ at DE
 • new area not clearly different from old B3
- [Total: 8]**

- 6 (a) (i) (gradient =) $10 \text{ (m/s}^2\text{)}$ B
- (ii) any linking of gradient to acceleration of freefall **OR** gravitational field strength B1
- (b) gradient decreases B1
- (c) speed/velocity stays constant **OR** terminal velocity/speed
 no resultant force **OR** forces cancel/balance
- (d) initially gradient steeper B1
 graph lower in second half of BC B1
 horizontal final section **and** lower than CD B1
- [Total: 8]**

- 7 (a) underline or circle force B1
underline or circle velocity B1
- (b) 4.07 – 4.1 (s) B1
- (ii) $(v - u)/t$ OR $\Delta v/t$ OR in words OR use of $40 \div$ (ans. to (b)(i)) C1
OR other correct values from graph A1
answer between 9.7 and 10 m/s^2 or m/s/s
- (iii) area under graph OR $\frac{1}{2}(u + v)t$ OR $\frac{1}{2} \times 40 \times$ (ans. to (b)(i)) C
OR $s = ut + \frac{1}{2}at^2$ OR $v^2 = u^2 + 2as$ OR numbers substituted A1
82 m
- (c) graph continues in straight line to 6 s B1

[Total 8]