Question	Answer	Marks	AO Element	Notes	Guidance
1	(v =) gradient **OR** 1800 / 60 **OR** 900 / 30 (1) 30 m / s (1)	**2**			
2	area under line **OR** three areas indicated **OR** (dist=) (average) speed × time **OR** 1/2 (b + h) × L (1) $\frac{1}{2}$ × 3.5 × 4.0 **OR** 7 (m) seen **OR** 6 × 3.5 **OR** 21 (m) (1) 6 × 3.5 **OR** 21 (m) **AND** {$\frac{1}{2}$ × 3.5 × 4.0 **OR** 7 (m)} **OR** 14 (m) (1) (21 + 14 =) 35 (m) (1)	**4**			
3	area under graph (1) distance = (20 × 40) + (½ × 40 × 10) **OR** ½ × (30 + 20) × 40 (1) 1000 m (1)	**3**			
4	area under graph **OR** (distance =) average speed × time (1) 4550 × 100 **OR** (4100 + 5000) ÷ 2 × 100 (1) 4.5/4.55/4.6 × 10^5 m (1)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
5(a)	straight line down from any point on y-axis to any speed at 100 s (1) from (0,50) to (100,15) (1)	**2**			
5(b)	uses area under graph **OR** av speed × time **OR** $s=ut + ½ at^2$ **OR** $v^2=u^2 + 2as$ (1) 100 × (50 + 15) ÷ 2 **OR** 100 × 15 + ½ (100 × 35) **OR** 5000 – ½ × 0.35 × 100^2 (1) 3300 m (1)	**3**			
6	acceleration less/at a slower rate (1) less driving force **OR** greater resistive force/friction/air resistance/drag (1) resultant force less (1)	**3**			
7	mention of gradient of graph at t = 30 s **OR** tangent drawn at t = 30 s and triangle drawn (1) acceleration in range 0.30 to 0.45 m / s^2 (1)	**2**			
8(a)	**1.** straight line from (0,0) to (10,50) (1) **2.** gradient/slope (1)	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
8(b)	a = $\Delta v \div \Delta t$ in any form **OR** (a=) $\Delta v \div \Delta t$ **OR** (a =) (9–5) ÷ 10 **OR** 4 ÷ 10 (1) (a =) 0.40 m/s^2 (1)	**2**		Δ or change in *t* must be seen	
9	(average speed =) (total) dist ÷ (total) time (1) (250 × 4) (1) 1000 ÷ 80 (1) 12.5 (m / s) (1)	**4**			
10	distance = area under graph or line or 0.5 × base × height (1) 20 × 5 × 0.5 (1) 50 (m) (1)	**3**			
11	B	**1**			
12(a)(i)	A **AND** B cars identified A = fastest AND B = slowest	**2**			
12(a)(ii)	speed = distance ÷ time in any recognised form 50 ÷ 4	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
12(b)(i)	12.5 (m / s) 100 x 3.6 **OR** 360 (s) indicated answers in the range 5-7 minutes	**2**			
12(b)(ii)	any one from: car will move faster / slower at times / speed not constant road will have bends / hills etc. slower moving traffic or other sensible road conditions	**1**			
13(a)	A - accelerates (from rest) B - constant speed (of 2 m / s) C - accelerates at faster rate / higher acceleration than previously D - faster constant speed (of 10 m / s)	**4**			
13(b)	2 minutes = 120 s area under the graph **OR** $d = s \times t$ **OR** 2 x 120 240 (m)	**3**			

Question	Answer	Marks	AO Element	Notes	Guidance
14	B - 3.7 cm / s	**1**			
15	B - 10 m / s^2	**1**			
16	C	**1**			
17	B - There is acceleration upwards.	**1**			
18(a)	flexible rule/tape measure/measuring tape	**1**			
18(b)(i)	58.75 (s)	**1**			
18(b)(ii)	speed = distance ÷ time in any form 0.85 (m/s)	**2**			
18(b)(iii)	7.12 (s)	**1**			
19(a)(i)	1.75 (hours) 1 hour 45 minutes	**1**			
19(a)(ii)	0.5 (hours) 30 minutes	**1**			
19(a)(iii)	100 (km)	**1**			

Question	Answer	Marks	AO Element	Notes	Guidance
19(a)(iv)	speed = distance ÷ time in any form 50 ÷ 0.75 66.67 (km / h)	**3**			
19(b)	(average) speed after stopping is faster line on graph is steeper	**2**			
20(a)	35 m / s	**1**			
20(b)	area under line/graph 0.5×15×25 187.5 (m)	**3**			
20(c)	single straight line with steeper gradient than car A horizontal line below 25 m / s	**2**			
21(a)	decrease of velocity / speed **OR** slows / slowing down	**1**			
21(b)(i)	area under graph **OR** ½ (u + v)t **OR** ½ × (11 + 5) × 3 **OR** ½(6 × 3) + (3 × 5) 24 m	**2**			

Question	Answer	Marks	AO Element	Notes	Guidance
21(b)(ii)	(a =) Δv / Δt **OR** (v-u) / t **OR** (5 - 11) / (6 - 3) 2.0 m/s^2	**2**			
21(c)(i)	(deceleration) decreases	**1**			
21(c)(ii)	(resultant force) decreases	**1**			
22	D - It is the same value at 50 cm as at 150 cm.	**1**			
23	B - 50 km / h	**1**			
24(a)	time of burning: 2 hours 15 minutes	**B1**			
	2.25 hours	**B1**			accept $2\frac{1}{4}$ hours
24(b)	(speed =) distance÷time in any form: symbols, words, numbers	**C1**			ecf from **(a)**

Question	Answer	Marks	AO Element	Notes	Guidance
	0.8(0) cm / hour	**A1**			ecf from **(a)**
24(c)	correct deduction from candidate's **(b)**	**B1**			
	correct reasoning from candidate's **(b)** e.g. 24 cm candle would burn for 30 h **OR** 19.2 cm will burn in 24 h	**B1**			
25	distance travelled = area under slope **OR** $0.5 \times 15 \times 6$	**C1**			
	45 (m)	**A1**			
26(a)	1100 (m) ± 20	**B1**			
26(b)	(speed=) distance ÷ time, in any form: symbols, words, numbers	**C1**			ecf from **(a)**

Question	Answer	Marks	AO Element	Notes	Guidance
	use of 300 s **OR** conversion of time to s **OR** ÷ 60	**C1**			
	3.7 **OR** 3.67 (m / s)	**A1**			
27	(straight) line from 15 m / s to 0 in 2.0 seconds	**A1**			
28	speed is changing/increasing **OR** it is accelerating **OR** accelerating at first (when curved line) then steady speed (when line is straight)	**B1**			
	(because) graph is a curve **OR** gradient is changing **OR** different distances travelled in equal time intervals	**B1**			**OR** accept ‘due to force of gravity’
29	D **AND** E	**B1**			
30	speed = distance ÷ time in any form	**C1**			
	0.5 ÷ 0.04	**C1**			

Question	Answer	Marks	AO Element	Notes	Guidance
	12.5 m / s	**A1**			
31	speed = distance÷time **OR** 7.5 × 4.0 **OR** speed × time	**C1**			
	30 (cm)	**A1**			
32	dots farther apart (in 2nd time interval)	**B1**			owtte
33(a)	2800 (N)	**B1**			
33(b)(i)	straight line	**B1**			
	line slopes down	**M1**			
	clearly indicated on axes 36 (m / s) and 18 (s)	**A1**			
33(b)(ii)	area under graph **OR** distance = (average) speed × time, in any form	**C1**			
	½ × 36 × 18	**C1**			
	324 (m)	**A1**			

Question	Answer	Marks	AO Element	Notes	Guidance
34(a)	(speed =) distance ÷ time	**C1**			
	100 ÷ 12.5	**C1**			
	8.0 (m / s)	**A1**			
34(b)	acceleration (at the start) or similar idea **OR** indication of slowing down at the end (due to tiredness)	**B1**			
35(a)	speed = distance / time in any form **OR** (distance =) speed × time	**C1**			
	330 × 1.8 **OR** 330 × 0.9 **OR** 594	**C1**			
	297 (m)	**A1**		accept 2 or 3 sig. figs.	
35(b)	0.9 (s)	**B1**			
36(a)	$10\,m/s^2$	**B1**			ignore sign

Question	Answer	Marks	AO Element	Notes	Guidance
36(b)	(same as) acceleration (of rocket at B) **OR** gravitational acceleration	**B1**			
37	gradient decreases	**B1**			
38	D increasing acceleration E constant acceleration F constant speed	**B2**			Note: one mark lost for e.e.o.o.
39	A increasing speed B constant speed C stationary	**B2**			Note: one mark lost for e.e.o.o.
40(a)	(a =) 0 (m/s^2)	**B1**			
40(b)	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**			

Question	Answer	Marks	AO Element	Notes	Guidance
					[Total: 127]