Question 1

(i)	[½ 5 × 50 + ½ 7(8 + 50) + 90 × 8]	M1		For using the area property for distance or s = ½ (u + v)t
	Distance is 1048 m	A1	**[2]**	AG
(ii)		M1		For use of the gradient property for acceleration (deceleration)
	a = (8 – 50)/(12 – 5) or d = (50 – 8)/(12 – 5)	A1		
		M1		For using Newton's second law (3 terms)
	850 – F = 85a (or –85d)	A1		
	Upward force is 1360 N	A1	**[5]**	

Question 2

(i)	[1.3 = 0.9 + 0.004T, $1.3^2 = 0.9^2 + 2 \times 0.004S$]	M1		For using v = u + at or $v^2 = u^2 + 2as$
	Time is 100 s (or distance is 110 m)	A1		
	Distance is 110 m (or time is 100 s)	B1	**[3]**	

Question 3

(i) →) $\sum F = ma$

$F_D - F_R = ma$

$1440 - 960 = 1200a$

∴ $a = 0.4$ m/s^2

(ii) →) $\sum F = ma$

$F_D - F_R = 0$ (Velocity is constant $\Rightarrow a = 0$)

$F_D - 960 = 0$

∴ $F_D = 960$ N

(iii) For *BC*:

→) $\sum F = ma$:

$F_D - F_R = ma$

$0 - 960 = 1200a$

∴ $a = -0.8$ m/s^2

$v = u + at$

$0 = 18 + (-0.8)t_{BC}$

∴ $t_{BC} = 22.5$ s

$v^2 = u^2 + 2as$

$0 = 18^2 + 2(-0.8)s_{BC}$

∴ $s_{BC} = 202.5$ m

For *AB*:

$s = ut + 0.5at^2$

$s_{AB} = 18(52.5 - 22.5) + 0$

$\therefore \quad s_{AB} = 540$ m

$\therefore \quad s_{AC} = s_{AB} + s_{BC}$ m

$\therefore \quad s_{AC} = 540 + 202.5 = 742.5$ m

Question 4

$(1.5 + 3.5)/2 = s/10$	B1	For using $(u + v)/2 = s/t$
Displacement is 25 m	B1 [2]	

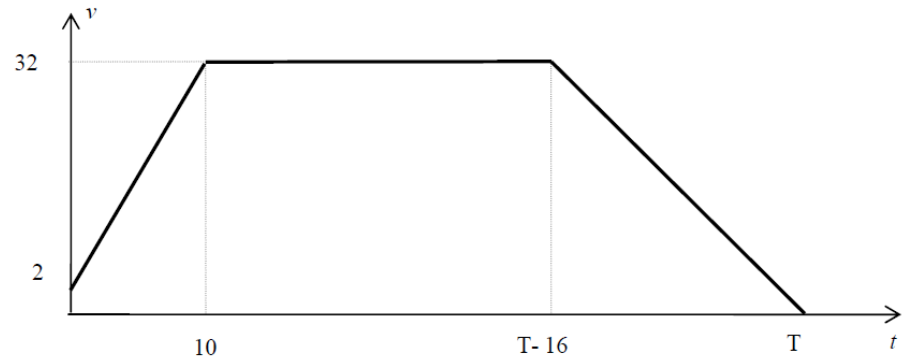
Question 5

For maximum speed: $u = 2$ m s^{-1}, $a = 3$ m s^{-2}, $t = 10$ s:

$v = u + at$ $\Rightarrow v = 32$ ms^{-1} is maximum speed.

For deceleration: $u = 32$ m s^{-1}, $a = -2$ m s^{-2}, $v = 0$:
$v = u + at$ $\Rightarrow 0 = 32 + (-2)t$ $\Rightarrow t = 32/2 = 16$ s time decelerating.

Let *T* be the total time travelled over the distance 1130 m. Then the velocity time graph is as follows:



Distance travelled in first 10 s is area of trapezium = ½(2 + 32) × 10 = 170 m.

Distance travelled in last 16 s is area of triangle = ½ × 16 × 32 = 256 m.

⇒ distance travelled at constant speed = 1130 - (170 + 256) = 704 metres
⇒ time taken at speed of 32 m s^{-1} is 704 ÷ 32 = 22 s.

Question 6

$+\downarrow)$ $\quad v = v_0 + a_c t$

$0 = 10 - 0.4t$

$\therefore \quad t = 25$ s

$\therefore s = s_0 + v_0 t + \frac{1}{2} a_c t^2 = 300 - 10(25) + \frac{1}{2} 0.4(25^2) = 175$ m

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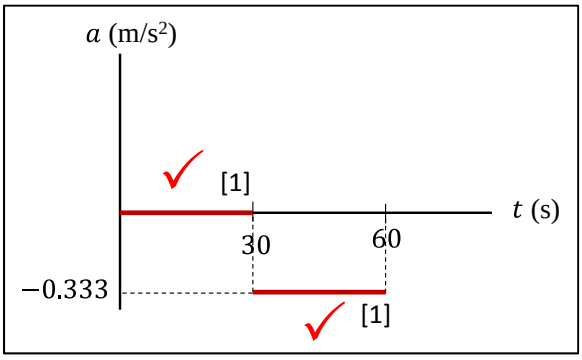
Question 7

(i) $s = Area\ under\ v - t\ graph = 450$ m

(ii)



Question 8

$[12 = 15\sin\alpha]$	M1		For resolving forces in the direction of the force of magnitude 12 N
$\alpha = 53.1$	A1		
$[F = 15\cos\alpha]$	M1		For resolving forces in the direction of the force of magnitude F N
F = 9N	A1	[4]	