Energy, Work & Power 2 MS

Q1.

3	**(i)**	PE gain is 32 000 J	B1	[1]	
	(ii)	[KE gain = ½ 160 × 1.25^2]	M1		For using KE gain = ½ mv^2
		KE gain is 125 J	A1	[2]	
	(iii)	WD by drum = 32 000 + 125 + 20 000	B1ft		
		[P = 52 125 ÷ 41.7]	M1		For using P = Δ (WD) ÷ Δ T
		Power is 1250 W	A1	[3]	

Q2.

6	**(i)**	PE gain = 1250 × 10 x 400 × 0.125	B1		
		WD against resistance is 800 × 400 J	B1		
			M1		For using WD by car's engine = Gain in PE + WD against resistance
		WD by car's engine is 945 000 J (945 kJ)	A1	[4]	
	(ii)				For using P = Fv ➔ $\frac{v_2}{v_1} = \frac{P_2}{P_1} \times \frac{F_1}{F_2}$
		[$v_2/6 = 5 \times (1/3)$]	M1		
		$v_2 = 10$	A1		
		KE gain = ½ 1250($10^2 - 6^2$)	B1ft		
		[WD by car's engine = 945 000 + 40 000]	M1		For using WD by car's engine = (Gain in PE + WD against resistance) + KE gain
		WD by car's engine is 985 000 J (985 kJ)	A1ft	[5]	ft incorrect ans**(i)**
		Alternative scheme for part (i)			
	(i)		M1		For using Newton's second law with a = 0
		DF = 1250g × 0.125 + 800	A1		
			M1		For using WD = DF × 400
		WD by car's engine is 945 00 J (945 kJ)	A1	[4]	

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Q3.

2	Increase in PE = $1250 \times 10 \times 600 \sin 2.5^\circ$	B1		
	Decrease in KE = $\frac{1}{2}\ 1250(30^2 - v_{top}^2)$	B1		
	WD against resistance = 400×600	B1		
	$[562500 - 625v_{top}^2 = 327145 + 240000 - 450000]$	M1		For using WD by DF = Increase in PE – decrease in KE + WD against resistance
	Speed is 26.7 ms^{-1}	A1	[5]	

Special Ruling for candidates who assume, without justification, that the driving force (DF) is constant (maximum mark 4).				
	[DF – Weight component – Resistance = Mass × Accel'n]	M1		For applying Newton's second law.
	$750 - 545 - 400 = 1250a$	A1		
	$v^2 = 30^2 + 2 \times (-0.156) \times 600$	B1ft		ft value of a
	Speed is 26.7 ms^{-1}	B1	[4]	

Q4.

4	**(i)**	DF = 1500 000/37.5 (= 40 000)	B1		
		[DF – R = ma]	M1		For using Newton's second law
		DF – 30 000 = 400 000a	A1		
		Acceleration is 0.025 ms^{-2}	A1	[4]	
	(ii)	[1500 000/v – 30 000 = 0]	M1		For using Newton's 2nd law with a = 0
		Steady speed is 50 ms^{-1}	A1	[2]	

Q5.

2	**(i)**		M1		For using work done by pulling force = increase in KE – decrease in PE + WD by resistance
		$1150 = \frac{1}{2}\ 16 \times 10^2 - 16g(50 \times 0.05)$ + WD by resistance	A1		
		WD by resistance = 750 J	A1	[3]	
	(ii)	1150 = increase in KE + 16 g(50 × 0.05) + 750	M1		For WD by pulling force = KE gain + PE gain + WD by resistance
		KE gain = 0 → speed at top = speed at bottom	A1	[2]	AG

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Q6.

2	**(i)** [WD = 30 × 20 × 0.6 + 40 × 20 × 0.8]	M1		For using WD = Fdcosθ
	Work done is 1000 J	A1	2	
	(ii)	M1		For applying F = μW and Newton's 2nd law with a = 0
	30 × 0.6 + 40 × 0.8 – 0.625W = 0	A1		
	Weight is 80 N	A1	3	

Q7.

5	**(i)** Gain in PE =15000g × 16	B1		
	WD against resistance = 1800 × 1440	B1		
		M1		For using:– WD by driving force = Gain in PE + WD against resistance
	Work done is 4.99×10^6 J	A1	4	
	(ii)	M1		For using :– WD by engine = Increase in KE + WD against resistance
	5030 000 = ½ 15 000($24^2 - 15^2$) + 1600d	A1		
	Distance is 1500 m	A1	3	

Energy, Work & Power 2 MS

Q8.

5	**(i)** Gain in PE =15000g × 16	B1		
	WD against resistance = 1800 × 1440	B1		For using:– WD by driving force = Gain in PE + WD against resistance
		M1		
	Work done is 4.99×10^6 J	A1	4	
	(ii)	M1		For using :– WD by engine = Increase in KE + WD against resistance
	5030 000 = ½ 15 000($24^2 - 15^2$) + 1600d	A1		
	Distance is 1500 m	A1	3	

Q9.

5	**(i)**	KE gain = $550v^2$	B1		
		PE gain = $1000x$	B1		
		$[1800x = 550v^2 + 1000x + 700x]$	M1		
		$k = 5.5$	A1√	[4]	ft for incorrect coeff(s) of v^2 and/or of x
	(ii)	At A $5.5v^2 = 1760 \rightarrow v^2 = 320$	B1		
			M1		For using from A, KEgain= WD by DF –WD against R
		$550(v^2 - 320) =$ $1800(x - 1760) - 700(x - 1760)$	A1		
		$v^2 = 2x - 3200$ (cwo)	A1	[4]	AG
		Alternative for part (ii) $[1800 - 700 = 1100a$ and $5.5v^2 = 1760]$	M1		For applying Newton's 2nd Law to find acceleration along AB **and** for using $kv^2 = x$ to find v^2 at A
		$a = 1$ and $v^2 = 320$	A1		
		$[v^2 = 320 + 2 \times 1 \times (x - 1760)]$	M1		For using $v^2 = u^2 + 2as$ for motion from A to B
		$v^2 = 2x - 3200$	A1	[4]	