Ex 9B Q1 to 6 and 15 to 19.

(1) (i) $PE = mgh = 2.5 \times 10 \times 0.4 = 10\,J$

(ii) $PE = 3(10)(5\sin 40) = 96.4\,J$ (3 SF)

(iii) $PE = 2(10)(-3) = -60\,J$

(iv) $PE = 1.6(10)(-4\cos 20) = -60.1\,J$ (3SF)

(2) (i) at A $PE = 2(10)(2.6) = 52\,J$

at B $PE = 2(10)(1.2) = 24\,J$

Decrease.

(ii) at A $PE = 4(10)(0.8) = 32\,J$

at B $PE = 4(10)(2.2) = 88\,J$

Increase

(iii) at A $PE = 0.6(10)(-1) = -6\,J$

at B $PE = 0.6(10)(-3) = -18\,J$

Decrease.

(3) At start $KE = 0$ $PE = 0$

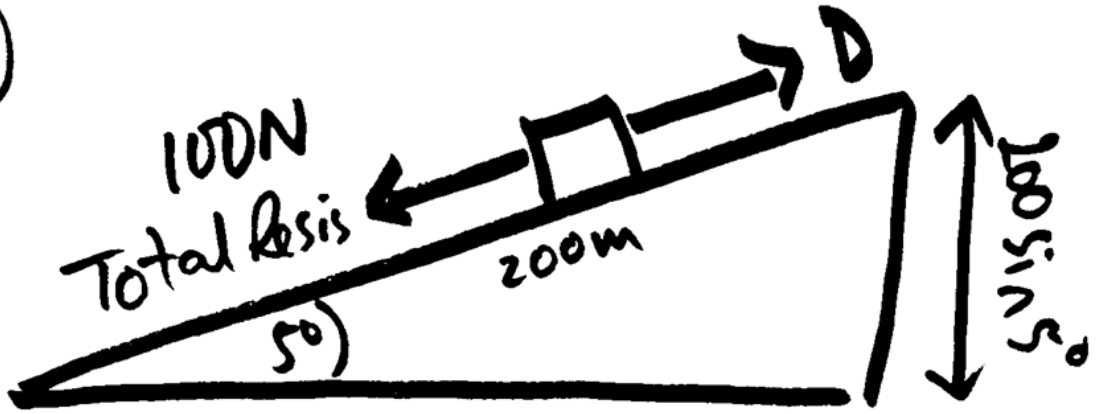
+ Wd against gravity

At end $KE = 0$ $PE = 1.2 \times 10 \times 1.5 = 18$

So Wd against gravity $= 18\,J$

(4) PE = 60 (10)(12×3.3)
= 23760 J

(5) (i)



(i) PE = 900 (10)(200 sin 5°)
= 157 000 J (3SF)

(ii) Over 200 m Wd by resistance
= 100 × 200 = 20000 J

(iii) The weight (9000N) can be split into 9000 cos 5° perpendicular to the slope and 9000 sin 5° parallel to the slope. Although not obvious in this question, the weight component parallel to the slope is included in the 100 N total resistance. The car has to overcome the Workdone by resistance (20000J) and workdone by gravity or PE which is 200 sin 5° × 900 × 10.

(5)(iv) At start

$KE = \frac{1}{2}(900)12^2$ $\quad PE = 0$

$= 64800\ J$

+ Wd by Engine

− Wd by resistance $= 20000\ J$

At End

$KE = \frac{1}{2}(900)8^2$ + $PE = 9000(200\sin 5)$

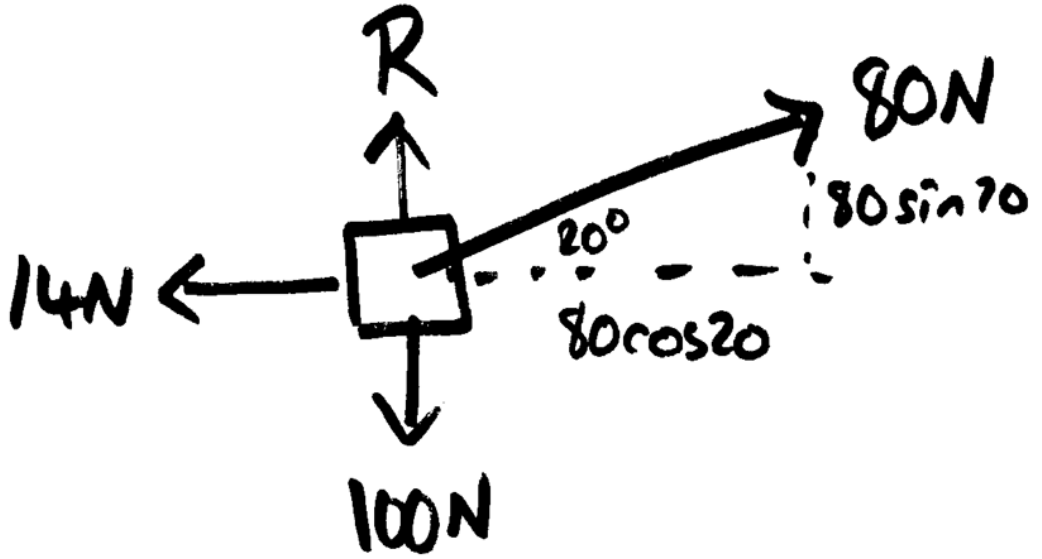
So:

$64800 + Wd_E - 20000 = 185680.3369$

$Wd_E = 140880.3369\ J$

$= \underline{141000}\ J$ (3SF)

(6)



(i) (a) $20 \times 80\cos 20 = 1500\ J$ (3SF)

(ii) (b) $14 \times 20 = 280\ J$

(a) At start $KE = 0$ $PE = 0$

$+ WD_T = 80\cos 20 \times 20$

$- WD_R = 14 \times 20$

At end $KE = \frac{1}{2}(10)v^2$

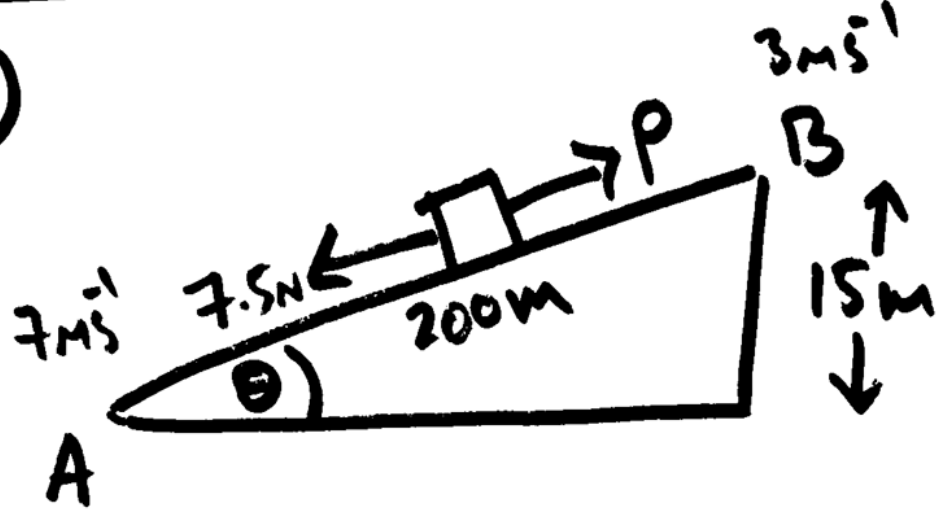
$1500 - 280 = 5v^2$

$v = 15.6\ ms^{-1}$ (3SF)

(b) $\frac{1}{2}(10)4^2 + 1500 - 280 = 5v^2$

$v = 16.1\ ms^{-1}$ (3SF)

(15)



(i) At A, $KE = \frac{1}{2}(50)7^2$

$= 1225\ J$

At B, $KE = \frac{1}{2}(50)3^2$

$= 225\ J$

Loss of 1000 J

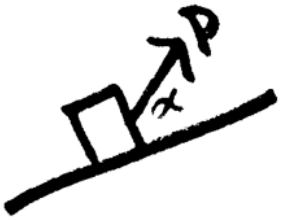
(ii) PE at B $= 50(10)(15)$

$= 7500\ J$

(iii) $1225 + WD_P - 7.5 \times 200 = 225 + 7500$

$WD_P = 8000\ J$

(iv)



$P\cos\alpha \times 200 = 8000$

$\cos\alpha = 8000 \div (200 \times 45)$

$\alpha = 27.3°$ (1DP)

(16) (i) At start

$KE = \frac{1}{2}(12500)\,17^2$ $\quad PE = 0$

+ Wd by Driving force
− Wd by Resistance

At end $\quad KE = \frac{1}{2}(12500)\,25^2$ $\quad PE = 0$

(B)

$$1806250 + Wd_D - 5000000 = 3906250$$

$$Wd_D = \underline{7100000}\ J$$

(ii) At start

$KE = 3906250$

+ Wd by Driving Force
− Wd by Resistance

$KE = \frac{1}{2}(12500)17^2$ $\quad PE = 12500h$

$$3906250 + 3300000 - 4800 \times 500$$

$$= 12500h + 1806250$$

$$h = 24m.$$

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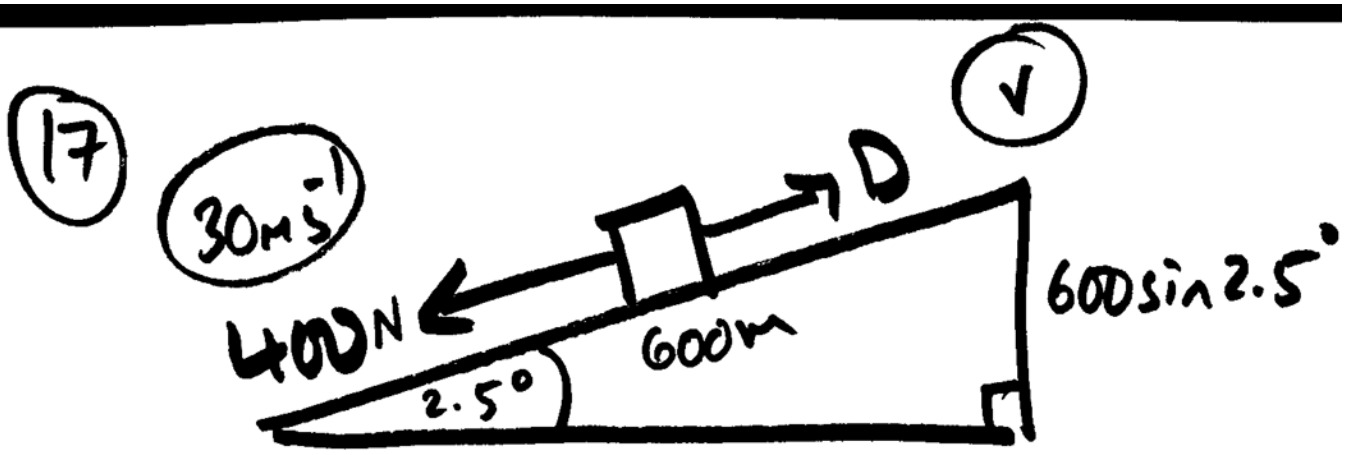

At start $KE = \frac{1}{2}(1250)30^2$ $PE = 0$

$+ Wd_D = 450kJ$

$- 400 \times 600$

$KE = \frac{1}{2}(1250)v^2 + 12500$ $\times 600\sin 2.5$.

$562500 + 450000 - 240000$

$= 625v^2 + 327145.4052$

$v = 26.7\ ms^{-1}$

(18) (i) **At start**

$KE = \frac{1}{2}(0.35)7^2 \quad PE = 0.35(10)5$

No driving force
No resistance

At end

$KE = \frac{1}{2}(0.35)v^2 \quad PE = 0$

$26.075 = 0.175\,v^2$

$v = \underline{12.2\ ms^{-1}}$ (3SF)

(ii) $26.075 - Wd_R = \frac{1}{2}(0.35)11^2$

$Wd_R = \underline{4.9}\ J$

(19) A ↑ $KE = \frac{1}{2}(160)0.5^2 = 20$

$+PE = 1600h$

O × $KE = 0$ $PE = 0$

$s = ?$
$u = 0$
$v = 0.5$
a
$t = 7$

$s = \left(\frac{u+v}{2}\right)t$

$s = 0.25(7)$

$= 7/4$ m

can use suvat because acceleration is constant

So $20 + 1600h = 0 + Wd_{crane}$

$20 + 1600(7/4) = Wd_{crane}$

$Wd_{crane} = \underline{2820\ J}$