4/ [13-14] Aminur 1104016

1) (b)

F	70	3.45	11515
P	10	0.35	3845
C	2	0.02	1120
P	10	0.35	11410
R	5	0.135	4037.5
D	2	0.03	990

Total mass = 3.5 kg

Σ 33962.5 kJ

From one family amount of energy = 8 × 33962.5 kJ/day = 271740 kJ/day

So, the number of family = $\frac{10000 \times 10^3}{271740}$

= 36.799

= 37 Ans

2(b) On the given day, the canneny receives,
15 tons of naw produce
5 tons of cans
0.5 " " cantons
0.3 tons of miscellaneous

Using 1 ton = 10^3 kg

(a) Waste generated from naw produce,
(i) Solid waste fed to cattle = 2.2 ton = 2200 kg
(i) Waste produce discharge with wastewater = (15 - 12 - 2.2) = 0.8 ton = 800 kg

(b) Cans,

(i) Damaged and recycled $= 0.05 \times (5-9) \times 10^3 = 50\,kg$

(ii) Used for production of product $= (1-0.05) \times 10^3$

$= 950\,kg$

(c) Cartons,

(i) Damaged and recycled $= 0.05 \times 0.5 \times 10^3 = 25\,kg$

(ii) Used for production $= 0.95 \times 0.5 \times 10^3 = 475\,kg$

(d) Miscellaneous materials,

(i) Amount stored $= 0.25 \times 0.3 \times 10^3 = 75\,kg$

(ii) Paper is seperated for recycling $= 0.5 \times 0.35 \times 0.3 \times 10^3$

(iii) Mixed waste $= 0.3 \times 10^3 - 75 - 52.5 = 52.5\,kg$

$= 172.5\,kg$

The materials balance quantities are as follows;

(i) Material stored $= 4 + 0.075 = 4.075$ tons

(ii) Material input $= ~~12 +~~ 15 + 5 + 0.5 + 0.3 = 20.8$ tons

(iii) Material output $=$ 12 (without waste) $+$ 0.95 (new) $+$ 0.475 (cans) $+$ 2.2 (cartons) $+$ 0.025 (new) $+$ 0.0525 (cartons) $+$ 0.05 (miscellaneous) (cans)

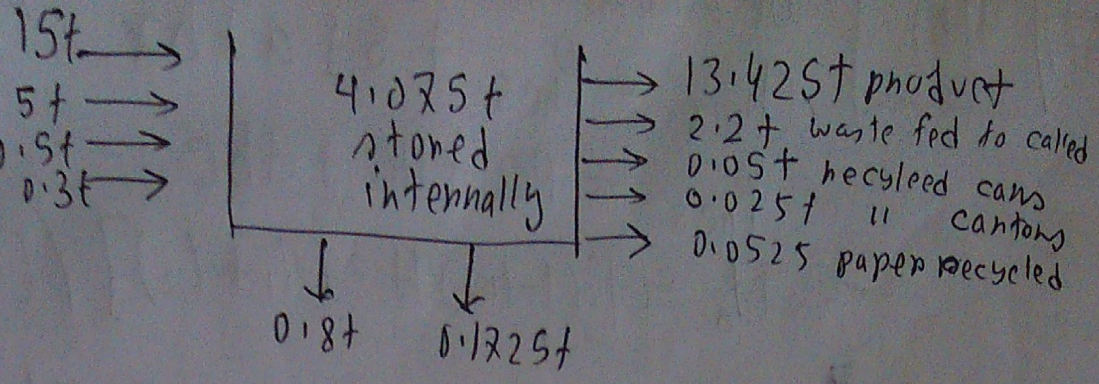
$= 15.7525$ tons

(iv) Waste generation $= 0.8 + 0.1725 = 0.9725$ tons

(v) The final materials balance is,

$4.075 = 20.8 - 15.7525 - 0.9725$

(input) (output) (waste)



Amount of waste per ton of product:

(a) Recyclable material $= \frac{2.2+0.05+0.025+0.0525}{13.425} = 0.17$ ton/ton

(b) Mixed waste $= \frac{0.8+0.1225}{13.425} = 0.0272$ ton/ton

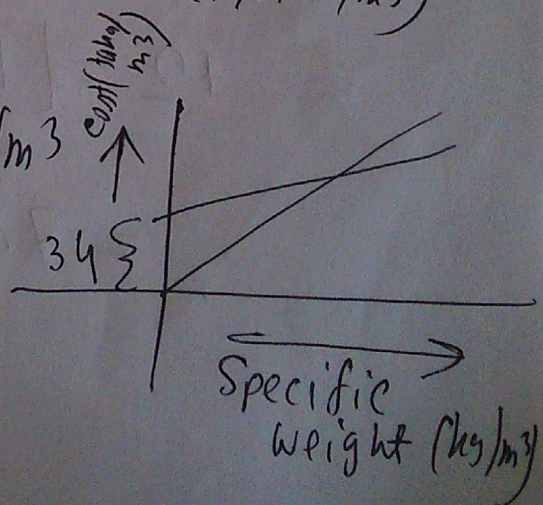
3(b) For ~~Haut~~ HCS, $C_h = \frac{1825}{6 \times 225} w$ $\left(\frac{taka}{m^3}\right)$.

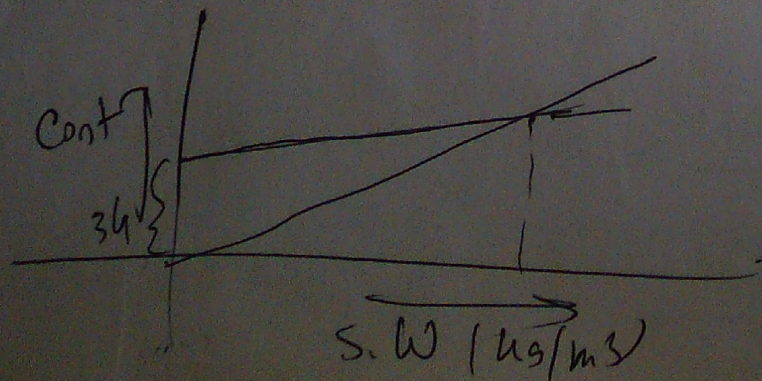
For BSCS, $C_s = \frac{3000}{15 \times 325} w$

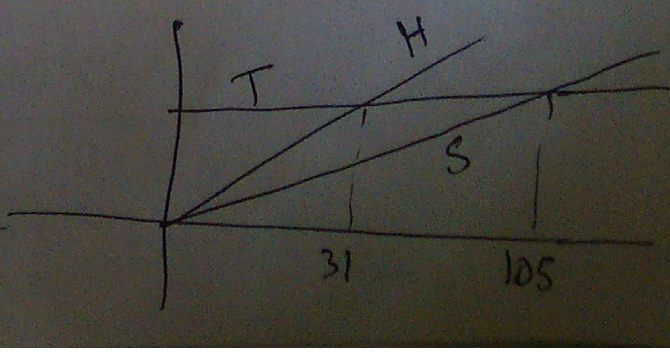
For Jamsport, $C_T = \frac{3500}{80 \times 150} w + 34$ (~~8~~ Tk/m3)

Solving C_h and C_T,
we get, $w = 31$ kg/m3

Solving C_s and C_T,
we get, $w = 105$ kg/m3







~~3rd~~ 4(b)

we know,

$T_{hcs} = P_{hcs} + S + a + bx$

$P_{hcs} = PC + UC + dbc$

$N_d = [(1-W)H - (t_1 + t_2)] / (P_{hcs} + S + a + bx)$

$P_{hcs} = 4 + 4 + 6 = 14 \text{ min/trip}$

$= 0.2333 \text{ hr/trip}$

$12 = \dfrac{[(1-W)8 - (0.25 + 0.33)]}{0.23 + 0.1 + 0.004 + 0.015 \times 12}$

$W = 0.1565 = 15.65\% = 15\%$

So the management is right.

length of the work day,

$12 = \dfrac{[H(1-0.15) - (0.25 + 0.33)]}{0.23 + 0.1 + 0.004 + 0.015 \times 12}$

$= 7.9 \text{ hr}$

$a = 0.004 \text{ hr/trip}$

$b = 0.015 \text{ hr/mile}$

$x = 12 \text{ miles/trip}$

$N_d = 12$

$t_1 = 15 \text{ min} = 0.25 \text{ hr}$

$t_2 = 20 \text{ min} = 0.33 \text{ hr}$

$PC = 4 \text{ min}$

$UC = 6 \text{ min}$

$dbc = 4 \text{ min}$

$S = 6 \text{ min}$

$H = 8 \text{ hr}$

12-13

1(c)

Rank serial no. m	Waste wd Y/day x	Plotting position	$(x_i-\bar{x})$	$(x_i-\bar{x})^2$	$(x_i-\bar{x})^4$
1	1	6.2	-9.8	96.04	
2	1.9	13.3	-8.9	79.21	
3	6.86	20	-4.2	12.64	
4	6.8	~~26.7~~	-4	16	
5	7	33.3	-3.8	14.44	
6	7.4	40	-3.4	11.56	
7	10.4	46.7	-0.4	0.16	
8	10.6	53.3	-0.2	0.04	
9	12.0	60	1.2	1.44	
10	12.6	~~66.7~~	1.8	3.24	
11	15.8	73.3	5	25	
12	17	80	6.2	38.44	
13	20	86.7	9.2	84.64	
14	22.2	93.3	11.4	129.96	
	$\Sigma x = 151.3$		~~511.06~~	511.06	~~42575.98~~ 42925.98

Position $= \frac{m}{n+1} \times 100$

$n = 14$

(a) Mean $\bar{x} = 10.8 = \frac{151.3}{14}$

(b) Median $= \frac{10.4 + 10.6}{2} = 10.5$

(c) Mode $= 3\,\text{Median} - 2\bar{x} = 3 \times 10.5 - 10.8 = 20.7$

(d) S.D, $S = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} = 6.04$

(e) $CV = \frac{100 S}{\bar{x}} = \frac{100 \times 6.04}{10.8} = 55.93$

(f) Skewness, $\alpha_3 = \frac{2(\bar{x} - \text{mod})}{S} = \frac{2 \times (10.8 - 20.7)}{6.04} = -3.28$

(8) Coefficient of kutosis, $\alpha_4 = \frac{\Sigma (x_i - \bar{x})^4}{s^4 \times n}$

$= \frac{42575.98}{14 \times 6.044}$

$= 2.28$

~~2(b)~~ ~~Amount of solid waste = 0.032 × 800~~

~~= 25.6 yd³/day~~

2(b)

Component, weight(kg)	Total Weight (KG)
C	25.34
H	3.87
O	23.83
N	0.63
S	0.13
Ash	3.61

Neglecting the Ash,

Component	Atomic Weight kg/mole	Mole	Component mole ratio (S = 1)
C	12	2.11	527.5
H	1.01	3.83	957.5
O	16	1.489	372.25
N	14	0.045	11.25
S	32	0.004	1

Chemical formula with Sulfur: $C_{527.5}H_{957.5}O_{372.25}N_{11.25}S$

Energy content (kg/kg) $= 337C + 1428\left(H - \frac{O}{8}\right) + 95S$

Molecular mass = 13433

Component	Percentage (%)
C	47.12
H	7.13
O	44.34
N	1.17
S	0.24

Energy content in Btu per lb $= 145C + 610\left(H_2 - \frac{1}{8}O_2\right) + 40S + 10N$

$= 145 \times 47.12 + 610 \times \left(2 \times 7.13 - \frac{1}{8} \times 44.34 \times 2\right) + 40 \times 0.24 + 10 \times 1.17$

$= 8290.45$ Btu/lb

in kJ per kg $= 337C + 1428\left(H - \frac{O}{8}\right) + 95S$

$= 337 \times 47.12 + 1428 \times \left(7.13 - \frac{44.34}{8}\right) + 95 \times 0.24$

$= 18172.56$ kJ/kg

3(b) $t_1 = 15\text{min}$, $t_2 = 25\text{min}$, $dbc = 10\text{min}$, $x = 20\text{km}$,
$S = 0.122\text{hr/trip}$, $a = 0.05$, $b = 0.025$, $pc = 0.4\text{hr/trip}$
$w = 0.15$, $H = 8\text{hr}$, $P_{hes} = 0.4 + \frac{10}{60} = 0.567$ +uc

$$N_d = \frac{[(1-w)H - (t_1+t_2)]}{(P_{hes} + S + a + bx)} = \frac{[(1-0.15)\times 8 - (0.25+0.416)}{0.567 + 0.122 + 0.05 + 0.025\times 20}$$

$$= 4.93$$

So, $N_d = 4\text{ trips/day}$

or,

As the number of trip is 4.93 which is very closer to 5.00 it may be cost-effective to pay the driver for the overtime and make 5 trips/day.