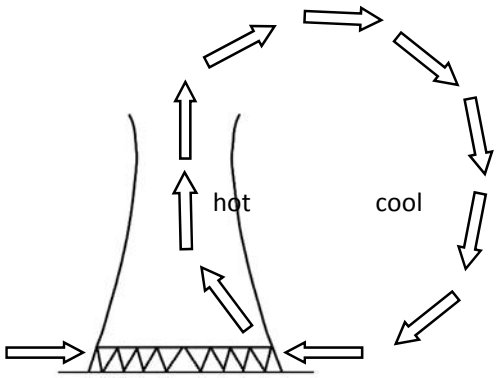
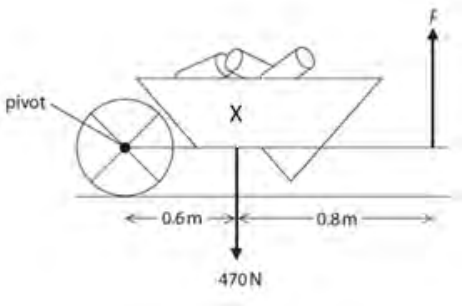
Question number	Answer	Notes	Marks
1 (a)	any four of: MP1. (due to) convection; MP2. (heated) air expands OR molecules move apart; MP3. (heated) air becomes less dense; MP4. **hot** / **less dense** air rises; MP5. idea that air entering from outside is **cool(er)**; MP6. (above the cooling tower) air cools and {contracts / becomes more dense}; MP7. **cool** / **denser** air falls (outside the cooling tower); MP8. process (of convection) is repeated / continuous; e.g. (diagram for MP4, MP5, MP7 and MP8)  	allow particles for molecules reject 'molecules expand' reject 'molecules become less dense'	4
(b)	any three of: MP1. temperature <u>proportional</u> to (average kinetic) energy; MP2. idea that particles leave the surface / escape the liquid / turn into a gas; MP3. highest energy **particles** leave the liquid; MP4. idea that (average kinetic) energy of (remaining particles in) liquid is reduced;	 allow idea that gas **particles** have higher (average kinetic) energy / speed than particles in liquid; allow (average) speed of particles in liquid reduced	3
			Total 7 marks

Question number	Answer	Notes	Marks
2 (a) (i)	385 (J);		1
(ii)		reverse calculation e.g. calculating a voltage or charge gains 1 mark max.	
	substitution into E=QV; evaluation to at least 2 s.f.;	 if no other mark given allow 1 mark for 10^6 or 1000000 seen in working	2
	e. (E =) 385 × 180 000 (E =) 69 000 000 (J) / 69 (MJ)	 allow ecf from 8(a)(i) value	
(iii)	MP1. idea of <u>energy</u> wasted; MP2. appropriate mechanism;	allow not 100% efficient, <u>energy</u> lost e.g. heat in wires	2
2 (b) (i)	charge = current × time;	allow abbreviations e.g. Q = I × t or rearrangements	1
(ii)	substitution; rearrangement; evaluation; e. 180 000 = current x (110 x 60) (current =) 180 000 / (110 × 60) (current =) 27 (A)	ignore not converting time to seconds until evaluation allow 27.3, 27.27… 1600, 1640, 1636 etc. gain 2 marks if no other mark given allow 1 mark for 60 seen anywhere in working (attempt to convert to seconds)	3

Total 9 marks

Question number	Answer	Notes	Marks
3 (a) (i)	Work done = force x distance moved;	Allow W = F x d and rearrangements	1
(ii)	Substitution into correct equation; Calculation; e.g. 13 x 110 1430 (J)	Correct answer without working scores 2 marks	2
(iii)	Same response as for 3(a)(ii)	1430 (J) or ecf	1
(b)	Any two of - MP1 Idea that GPE depends on height OR Statement that GPE = mgh; MP2 Idea that h is reduced; MP3 Idea that centre of gravity (is now) lower;	 Allow centre of mass for centre of gravity	2
(c) (i)	Moment = force x (perpendicular) distance (from the pivot);	Allow moment = F x d and rearrangements	1
(ii)	Calculate given moment; Equate moments; Calculation; e.g. (150 x 0.32) = 48 for one mark 150 x 0.32 = F x 0.87 for two marks F (= 150 x 0.32 / 0.87) = 55 (N) for three marks	If no other mark gained, allow a statement that "clockwise moment = anticlockwise moment" for one mark 55.172 (N)	3

Total 10 marks

Question number	Answer	Notes	Marks
4 (a) (i)	work done = force × distance (moved);	Accept correct symbols e.g. W = F x d W = F x s	1
(ii)	substitution; evaluation; e.g. (work =) 140 × 39 5500 (J)	 5460	2
(iii)	same answer as 5(a)(ii)	allow 'the same'	1
(b) (i)	X in line with the weight arrow and vertically between the tail of the arrow and the top of the wheelbarrow (not including the logs);  	judge alignment with weight arrow by eye	1
(ii)	moment = force × (perpendicular) distance (from pivot);	condone M = F x d M = F x s	1
(iii)	principle of moments (stated or implied); total distance hand to pivot calculated; substitution showing either correct moment (or both); final rearrangement and evaluation; e.g. (total) clockwise (moment) = (total) anticlockwise (moment) (distance) = 0.6 + 0.8 = 1.4 m 470 × 0.6 = F × 1.4 F = 470 × 0.6 / 1.4 = 200 (N)	 accept 1.4 or 0.6 + 0.8 seen in working accept 282 seen in working allow 201, 201.43 350, 352, 353, 352.5 gets 2 marks	4

Total 10 marks

Question number			Answer	Notes	Marks
5	a		B;		1
			E;		1
	b	i	p = m.v	in words or accepted symbols do not accept 'M' for momentum	1
		ii	substitution; evaluation; e.g. 900 x 15 14 000 unit = kg m/s OR N s;	 13 500 Independent Allow kg ms^{-1}	3
		iii	KE = ½ m.v^2;	in words or accepted symbols allow speed for velocity	1
		iv	substitution; evaluation; e.g. 0.5 x 900 x 15^2 100 000(J)	 101 250 Allow 101 000	2
				total = 9 marks	