1	(a)		Should be 'The temperature of the oven.....'	1		
	(b)		Although 5 °C is correctly 278 K a rise in temperature	1		
			of 5 °C is (exactly) equal to a rise in temperature of 5 K	1		
	(c)		'weight' should be 'mass'	1		
	(d)		mW should be MW / allow " 500mW is far too small "	1		
	(e)		tonne is a unit of mass	1		
			pressure requires unit of force per unit area / Pascal / Pa	1		
	OR		pressure should be replaced by force (1)			
			5 tonnes = 5000*g* N (1)			
	(f)		Being in space does not of itself result in weightlessness	1		
			reason - such as weightlessness being when in free fall	1		
	(g)		Weight is not a force on your feet	1		
			it is the pull of gravity on your body	1		11
2	(a)	(i)	A quantity having direction (as well as magnitude)	1	1	
		(ii)	displacement, magnetic flux density, weight to be underlined			
			mass, density, time, distance and kinetic energy not to be underlined			
			8 correct (4): 7,6 correct (3): 5,4 correct (2): 3,2 correct (1)	4	4	
	(b)	(i)	18 000	1		
			N s (OR kg m s^{-1})	1		
			In a direction to the right	1		
		(ii)	30 000 to the left (OR –30 000 to the right)	1		
		(iii)	18 000 to the left (OR –18 000 to the right)	1	5	
	(c)	(i)	e.g. adding two forces	1		
			to obtain a resultant force	1		
		(ii)	2 correct vectors, e.g. force x velocity or force x displacement	1		
			correct equation and scalar	1	4	14
			(Allow (1) for force x distance = work)			

3	(a)	correct direction of arrows shown	1		
		(Circular arrow in clockwise direction allowed)			
		use of motor rule / (Fleming's) left hand rule	1		
		left hand first finger - field, second finger – current	1		
		thumb (correctly) giving direction of force / motion	1	4	
		(These answers can be credited if right hand rule is incorrectly given)			
	(b) (i)	12 V / 24 Ω (= 0.5 A)	1		
	(ii)	3.0 A – 0.5 A = 2.5 A	1		
	(iii)	$V \times I = P$	1		
		12 V x 3.0 A = 36	1		
		watt / W	1		
	(iv)	1. for electromagnet = 0.5^2 x 24 = 6 W OR 12 x 0.5 = 6W	1		
		2. for armature power wasted = I^2R	1		
		power wasted = 2.5^2 x 2 = 12.5 W	1		
	(v)	36 – 12.5 – 6 = 17.5 W	1	9	
	(c) (i)	The field remains constant (for most of the time)	1		
		so the power supplied cannot be changed to magnetic energy / field	1		
	(ii)	the armature is supplying mechanical power	1		
		6 A would be the current only if the armature was a pure resistor	1		
	(iii)	although off load there is still friction / wind resistance	1	5	
	(d) (i)	current to armature 12 V / 2 Ω = 6 A	1		
		current to electromagnet still 0.5 A so total current 6.5 A	1		
	(ii)	When the armature is jammed power wasted in armature is heat	1		
		power = $I^2R = 6^2$ x 2 = 72 W	1		
		insulation on the wires of the armature may well melt	1	5	23
		OR temperature of wires may be high enough to melt / fuse wire			

4 (a)		resultant force must be zero		1	
		resultant torque must be zero		1	2
		or in terms of moments			
(b)		e.g. during construction (it is not loaded, but) it must not collapse (for the safety of personnel)		1	
		e.g. during use, when it is loaded, it must not break		1	2
(c)		e.g. acceleration must be zero; e.g. lift must equal weight		1	1
(d)	(i)	e.g. a bottle of milk after being in a fridge all night		1	
	(ii)	e.g. a person at a temperature above his surroundings		1	2
(e)		<u>energy gains</u>	MAXIMUM 2		
		almost all energy gains are electromagnetic radiation from the Sun		1	
		in the form of infra-red radiation (+ some others)		1	
		not uniform over the whole Earth		1	
		not uniform over any short period of time		1	
		other valid point e.g. some heat from interior of Earth		1	
		<u>energy losses</u>	MAXIMUM 2		
		(infra red) radiation from the Earth		1	
		longer wavelength than radiation heating the Earth		1	
		in absence of cloud cover rate of radiation increases		1	
		other valid point		1	
		<u>Balance of gains and losses</u>	MAXIMUM 2		
		Need to consider gains and losses over an extended period of time		1	
		For global warming net gains must exceed net losses		1	
		If total energy gain equals total energy loss then mean temperature is unchanged		1	
		other valid point		1	
			OVERALL MAXIMUM 5		5 12