Question 1

	answers	extra information	mark
	plants use <u>carbon dioxide</u> during <u>photosynthesis</u>	references to oxygen / energy are neutral	4
	carbon is used to make carbohydrates **or** named carbohydrate	accept to make fats / proteins / sugars do **not** accept food	
	plants eaten by animals for carbohydrates **or** named carbohydrate	accept for / carbon / fats / proteins / sugars	
	during <u>respiration</u> animals release <u>carbon</u> <u>dioxide</u>		
total			4

Question 2

	answers	extra information	mark
(a)	any **two** from • deforestation reduces carbon dioxide remova*l* from the atmosphere • burning wood / trees (releases carbon dioxide) • microbes decay / decompose wood / trees (releasing carbon dioxide)	accept less photosynthesis for reduces carbon dioxide removal accept cutting down trees for deforestation ignore cutting down plants accept there are less trees to remove carbon dioxide	2
(b)	may cause a rise in sea level may cause changes in the Earth's climate	accept may cause polar / ice caps to melt / flooding do **not** accept global warming **or** greenhouse effect **or** erosion accept causes changes in the weather **or** named, comparative **type** of weather **or** drought accept seasonal changes	1 1
(c)	methane	accept natural gas **or** CH_4	1
total			5

Question 3

	answers	extra information	mark
(a)	as a catalyst	accept to speed up the reaction (equilibrium)	1
(b)	nitrogen + hydrogen $\rightleftharpoons$ ammonia $N_2 + H_2 \rightleftharpoons NH_3$	accept mixed formula / word equations ignore balancing	1
(c)(i)	the reaction is reversible / an equilibrium	accept that ammonia can break down again into nitrogen and hydrogen accept reaction goes both ways do **not** accept some nitrogen and hydrogen do not react	1
(ii)	(the gases are cooled)	no marks as given in the diagram accept correct formulae NH_3, N_2 H_2	
	ammonia removed as a liquid	accept ammonia liquefies **or** condenses	1
	nitrogen and hydrogen are recycled	accept nitrogen and hydrogen are put back through the converter accept 'other gases' only if ammonia identified for first mark	1
total			5

Question 4

	answers	extra information	mark
(a)	the concentration of the (nitric) acid is decreasing	accept the number of acid particles is decreasing **or** there are fewer collisions	1
	(the volume of carbon dioxide remains at 83 cm^3) when the concentration of the (nitric) acid is zero	accept no acid remains **or** all the acid is used up **or** no acid particles	1
(b)	line starts at origin is steeper **and** remains to the left of the original line		1
	graph line levels off at 83 cm^3 **and** before 12 minutes	tolerance $\pm \frac{1}{2}$ square	1
(c)	change the temperature	accept increase **or** decrease the temperature accept change (increase **or** decrease) the concentration (of the nitric acid) ignore amounts of reactants **or** changes in pressure **or** stirring **or** use of catalyst	1
total			5

Question 5

	answers	extra information	mark
(a)	mass		1
(b)	work (done) = force (applied) × distance (moved in the direction of the force)	do **not** accept correctly substituted figures for this equation mark accept W = Fs **or** W = Fd **or** W = Fh **or** W = force × height) mark formula independently	1
	1 000 000 × 15 = 15 000 000 J / joules	allow 1 000 000 × $\frac{15}{1000}$ = 15 000 kJ/ kilojoules allow 1 000 000 × 1500 = 1 500 000 000 for 1 mark only – no unit mark allow 3 marks for correct answer if no working / correct working is shown	1 1 1
(c)	**Quality of written communication** *The answer to this question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Max. 4 if ideas not well expressed*	
	A – B not moving	accept stationary **or** at rest	1
	B – C acceleration **or** **C – D** acceleration	accept increases speed / velocity accept gets faster	1
	comparison made that the acceleration **B – C** is less than **C – D**	accept comparison made that the acceleration **C-D** is greater than **B-C**	1
	D – E constant velocity	accept steady speed **or** at 0.4 m/s	1
	E – F deceleration	accept decreases speed / velocity accept gets slower	1
total			10

Question 6

	answers	extra information	mark
(a)(i)	variable resistor	accept rheostat accept change resistor / resistance	1
(ii)	potential difference = current × resistance	accept V = IR **or** any correct combinations	1
(b)(i)	as the potential difference increases, the current increases	accept it increases	1
	at low values of the potential difference the current is (directly) proportional **or** at higher values of potential difference the current is not (directly) proportional	accept at low values of the potential difference (the filament) obeys Ohm's law **or** accept at higher values of the potential difference (the filament) does not obey Ohm's law accept it increases but not proportionally for 2 marks levels off is neutral	1
(ii)	the resistance (of the filament) increases		1
	the temperature (of the filament) increases		1
total			6

Question 7

	answers	extra information	mark
(a)	(permanent) magnet		1
(b)	any **three** from • the speed of the bicycle increases • the strength of the magnetic field is increased • the number of turns on the coil is increased • the area of the coil is greater • use a smaller rotor • move magnet closer to coil • add an iron core to coil • move the wire turns closer together	accept turn magnet faster accept use a stronger magnet do **not** accept use a bigger magnet accept increase number of coils accept diameter of <u>coil</u> is increased	3
total			4

Question 8

	answers	extra information	mark
(a)	to reduce energy 'lost' (by movement) so more energy is available for growth	accept need less energy accept prevents loss of body mass to provide energy accept so need less food accept get fatter accept so weight gain accept so more growth	2
(b)	**Quality of written communication.** *The answer to this question requires ideas in good English, in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **four** from • the microorganisms feed on / decay sewage • will increase in numbers • (so there will be an increase in the) use of oxygen • in respiration • this depletion of oxygen results in the death of fish **or** other aquatic animals	*Max. 3 if ideas not well expressed* idea that microorganisms feed on dead plants accept suffocate	4
total			6

Question 9

	answers	extra information	mark
(a)	3060 (kJ)		1
(b)(i)	22060 (kJ)		1
(ii)	photosynthesis		1
(c)	faeces / undigested food urine / urea	reference to movement and respiration are neutral accept excretion / waste / droppings if <u>both</u> of the mark points are not gained	2
(d)	any **two** from • control ripening • herbicides • prevent over ripening in transport • stimulate root growth • use in tissue culture to produce large numbers of plantlets	 other growth references are neutral	2
total			7

Question 10

		answers	extra information	mark
(a)		(1) + 3 → 2 + 3	accept correct multiples	1
(b)		any **three** from • to react particles must collide • with sufficient energy • reference to activation energy • (to cause) bond breaking		3
(c)(i)		(436 × 2) + 498 = 1370 (kJ)	accept (436 × 2) + 498 **or** 934 kJ for only one mark allow 2 marks for 1370 if no working **or** correct working is shown	1 1
(ii)		calculation of bond energy or product 464 + 464 = 928 × 2 = 1856 correct deduction	incorrect calculation = 0 marks allow deduction on ecf exothermic / endothermic on own without calculation are neutral	1 1
total				8

Question 11

	answers	extra information	mark
(a)	1400		1
(b)	980	correct answer gains full credit	4
	160 tonnes Fe_2O_3 produces 112 tonnes Fe	if incorrect allow one mark for relative formula mass iron oxide $=$ 160 allow e.c.f.	(2)
	1400 tonnes Fe_2O_3 will produce 1400 / 160 $\times$ 112 tonnes Fe	use of 2000 tonnes Fe_2O_3 – deduct one mark only if working out is correct	(1)
total			5

Question 12

	answers	extra information	mark
(a)	the greater the mass / weight		1
	then the greater the <u>kinetic</u> energy	accept the greater the momentum accept greater mass / weight therefore greater force = 2	1
(b)(i)		<u>Note: this calculation requires candidates to show clearly how they work out their answer</u>	
	k.e. = $\frac{1}{2}$ mv^2	accept evidence of equation	1
	86 400 (J) at 12 m/s	accept $\frac{1}{2}$ × 1200 × 12^2 **or** 86.4 KJ	1
	194 400 (J) at 18 m/s	accept $\frac{1}{2}$ × 1200 × 18^2 **or** 194.4 KJ	1
	increase in k.e. = 108 000 NB 10800 = 0 marks	N.B. if no working at all then max 3 for a correct numerical answer	1
	joules **or** J	accept 108 kilojoules **or** kJ	1
(ii)	explanation that ke ∝ v^2		
total			8

Question 13

	answers	extra information	mark
(a)	any **three** from	max 2 if stages but no explanation	3
	• the star (Sun) expands because (inward) gravitational forces no longer balance (outward) force	accept the star collapses rapidly causing the core temperature to increase and the star to expand accept it expands because the forces are unbalanced	
	• to become a red giant		
	• when the fusion stops it contracts / cools	accept (when hydrogen is used up) it collapses under gravity accept when fusion stops it contracts and explodes	
	• to become a white dwarf	accept to become a supernova / pulsar / neutron star / black hole (only if red giant has exploded)	
(b)	light from distant galaxies red shifted	accept longer wavelength for red shifted	1
	further galaxies display greater red shift		1
	the further away galaxies are the faster they are moving away from us (our galaxy)		1
total			6

Question 14

	answers		extra information	mark
(a)	any **three** from			3
	carbon (atom) spine / chain		accept idea of 'backbone' of carbon (atoms)	
	surrounded by hydrogen (atoms)		accept idea of only bonded to hydrogen (atoms)	
	single (covalent) bonds between carbon atoms		accept no double bonds	
	saturated (hydrocarbons)			
	(general formula) C_nH_{2n+2}			
(b)	many small molecules / monomers		accept many unsaturated molecules **or** alkenes	1
	join together to form a large / long molecule / polymer			1
total				5

Question 15

		answers	extra information	mark
(a)			do **not** give any credit for renewable **or** non-renewable **or** installation **or** decommissioning costs	
		fossil fuel advantage		1
		a reliable source of energy		
		fossil fuel disadvantage		1
		pollution by carbon dioxide / greenhouse gas	accept causes acid rain accept highest costs / more expensive than nuclear / more expensive than renewable	
		nuclear advantage		1
		do not produce gases that increase the greenhouse effect **or** cause acid rain	accept nuclear is cheaper than fossil	
		nuclear disadvantage		1
		accidents / waste can release very dangerous radioactive material / radiation	accept it produces waste that stays dangerously radioactive for thousands of years **or** radioactive waste has to be stored safely for thousands of years	
		renewable advantage		1
		there are no fuel costs	almost pollution free (apart from noise and visual) accept cheaper than fossil	
		renewable disadvantage		1
		not a reliable source of energy except for hydroelectric	accept (most) require large areas of land accept visual / noise pollution	
total				6

TOTAL MARKS FOR PAPER = 90