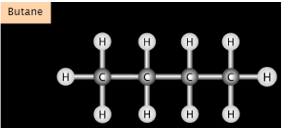
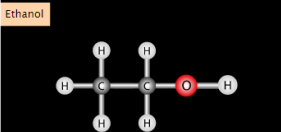


Question	Answers	Notes	Marks	Criterion
1	<p>a</p> <p>Butane</p>  <p>Ethanol</p> 		2	A
	<p>b</p> <p>(butane:) alkane/hydrocarbon (ethanol:) alcohol / alkanol</p>		2	A
	<p>c</p> <p>attempt to substitute into equation</p> <p>(energy released =) 147.488 kJ or 147 488 J</p> <p>(mass of ethanol = 147.488/30.0 =) 4.91626...</p> <p>answer given correctly to 3 sig figs 4.92 (g)</p> <p>unit of g/gram</p>	<p><i>Seen or implied</i></p> <p><i>Accept incorrect use of kJ for 3rd marking point</i></p> <p><i>Unit required</i> <i>Award unit mark separately</i></p> <p><i>ECF from 1c</i></p>	5	A
	<p>d</p> <p>so 1 g releases 49.6 kJ or ethanol releases 1380 kJmol⁻¹ and butane release 2877kJmol⁻¹</p> <p>butane is a better fuel for portable heaters because it releases more energy per gram or butane is a better fuel as it releases more energy per mole</p>	<p><i>WTTE</i></p>	2	A

2	a		Property 1	Property 2	Accept the properties listed in any order for the correct element	4	C
		Aluminium	malleable	corrosion resistant			
		Carbon	high strength to weight ratio	does not react easily or rigid			
	b	Sc reacts with air or water				1	C
	c	(adding scandium) increases the <u>yield strength</u>				2	C
3	a	orange-red and bright red and green			All correct WTTE	1	A
	b	energy/heat is released or release (much) more energy/heat than they absorb (so) the reaction is exothermic				2	A
	c	Cu (copper) or Fe (iron)			1	A	
	d	isotopes are atoms of the same element and have different number of neutrons/mass numbers or isotopes are atoms that have the same number of protons and have different number of neutrons/mass numbers			1	A	
	e	12 (neutrons)			Do not accept 12.31	1	A
4	a	air is mostly a combination of N ₂ and O ₂ or air is a mixture of gases and mostly N ₂ (and N ₂ and O ₂ /molecules in air) are bigger or have a greater mass than He atoms or (and N ₂ and O ₂ /molecules in air) move at a slower speed (so) He molecules will diffuse through the balloon's membrane faster at the same temperature				3	A

	<p>b hot air rises or the density of warm air is less than the density of colder air (because) the kinetic energy of the molecules is greater in warm air (so) the same mass of gas has a bigger volume it is the lower density of the warm air inside the balloon that will make it float up in the sky</p>		4	A
	<p>c the size of the bag increases/inflates (because) the external pressure decreases and the internal pressure is unchanged</p>		2	A

5	a	<ul style="list-style-type: none"> plans to test metal but incomplete details given one relevant piece of equipment suggested 	1-2		18	B
		<ul style="list-style-type: none"> a dependent variable is suggested but measurement is qualitative only metal identified as independent variable two relevant pieces of equipment attempt at a method but detail is insufficient for another student to follow 	3-6			
		<ul style="list-style-type: none"> a correct dependent variable identified and measurement is quantitative metal identified as independent variable a control variables identified with details of how it is controlled at least two relevant pieces of equipment likely to generate quantitative data method is described and could easily be followed by another student care is needed with acids 	7-12			
		<ul style="list-style-type: none"> a correct dependent variable identified and measurement is quantitative metal identified as independent variable at least two control variables identified control variables justified with details complete details of equipment likely to generate quantitative data complete method is described, fully explained and could easily be followed by another student plans to repeat experiment and calculate average care is needed with acids 	13-18			

	b	needs to include all metals dependent variable – eg mass lost after set time, rate of production of gas unit for dependent variable included columns for repeats column for average calculation		5	C
6	a	<u>ion(s)</u>	<i>Do not accept positive ions</i>	1	A
	b	ions cannot move through the salt bridge or electrons cannot flow circuit is now broken / incomplete or no more charge exchange possible (so) the circuit is broken / incomplete	<i>ECF from part a</i> <i>Accept "no electricity can flow"</i>	2	B
7	a	Voltage / V		1	B
		1.607			
		3.155			
2.227					
2.707					
	0.000				
		one value correctly recorded			
	b	the bigger the difference in reactivity and the higher the cell potential	<i>Accept "further apart in the reactivity series"</i> <i>Accept "the elements become more reactive"</i>	1	B
	c	independent variable – metal in the positive half cell dependent variable – cell potential any two controlled variables, for example size of electrodes, surface area of the electrodes, volume of the electrolyte, concentration of the electrolyte, temperature, pressure, <u>magnesium</u> in the negative/left half cell		4	B

	d	Any four reasonable points, for example <ul style="list-style-type: none"> • non-standard conditions might have been used • different concentrations • the electrodes may not have been clean • the temperature might not have been constant • heat may have been lost 		4	C
	e	Any reasonable precaution, for example <ul style="list-style-type: none"> • eye protection should be worn • wash hands after experiment 		1	B
	f	Anode oxidation or electrons are lost electrons are lost and oxidation Cathode electrons are gained or reduction electrons are gained and reduction	1 mark for correct identification of reduction and oxidation in terms of electron gain or loss wherever seen	2	A
	g	metal atoms deposited at the cathode (so) mass of the cathode increases anode dissolves in the solution (so) mass of anode decreases	no ECF	4	C
8	a	(diluting the copper ions solutions) increases the cell voltage		1	C
	b	colour becomes paler fewer Cu ²⁺ / copper ions are present Cu ²⁺ / copper ions give the blue colour	Do not accept copper/Cu	3	C
	c	(diluting the silver ions solutions) decreases the cell voltage		1	C
	d	Cu (s) + 2Ag⁺ (aq) → 2Ag (s) + Cu²⁺ (aq) reactants and products all correct no electrons shown correct balancing correct use of arrow rather than equilibrium sign and correct state symbols		4	D

9	a	the <u>lower the temperature</u> , the longer the time the charge is maintained	<i>WTTE</i>	1	B
	b	xy scatter graph selected		1	C
	c	70±5%	<i>Accept a range of % as long as the full range falls within 70±5 %</i>	1	C
	d	30±5 %	<i>Accept a range of % as long as the full range falls within 30±5 %</i>	1	C
	e	for the value at 50°C the estimate is <u>valid</u> because it falls within the data set/interpolation for the value at 80°C the estimate may be <u>invalid</u> because it falls outside the data set/extrapolation	<i>WTTE</i>	2	C

10	a	<p>Any reasonable answer, for example</p> <ul style="list-style-type: none"> • countries not chosen are politically unstable • majority of countries not chosen are in the Southern hemisphere • poorer economic conditions / LEDC (less economically developed country) • identification of the fact that Olympic Games are hosted by rich/developed countries only • link between economics and (un)equal opportunities 		1	D
	b	<p>hydrogen ion concentration decreases</p> <p>iron oxide is a basic oxide/alkaline</p> <p>hydroxide ions react/neutralize with (some of) hydrogen ions in the water</p>		3	A
	c	<p>a change in pH, for example living organisms in the water can survive only within a certain range of pH</p> <p>an effect of changing pH, for example change in pH / hydrogen ion concentration of water will cause many organisms to die</p> <p>a change in colour, for example the soil that gets washed into the water changes the clarity/colour of water causing less sunlight to penetrate</p> <p>an effect of change in clarity/colour, for example (this) affects the photosynthesis of aquatic plants poor visibility for aquatic animals reduced oxygen for fish</p>	WTTE	4	D

11	<ul style="list-style-type: none"> • brief account of an impact on either environment or community • a comment about industrial process eg roads/noise/power demand/dust/technology 	1–2		17	D
	<ul style="list-style-type: none"> • brief account of an impact on environment • brief account of an impact on community • an account of the impact of an industrial process eg about roads/noise/power demand/dust/technology 	3–5			
	<ul style="list-style-type: none"> • account of more than one impact on environment • account of more than one impact on community • more than one impact of an industrial process • a detailed account of the impact of at least one industrial process eg about roads/noise/power demand/dust/technology supported with specific examples • suggestion for the future unsupported by science 	6–10			
	<ul style="list-style-type: none"> • account of more than one impact on environment • account of one positive impact on community • account of one negative impact on community • a detailed account of the impact of more than one industrial process eg about roads/noise/power demand/dust/technology supported with specific examples • consideration of tech that could be used to counter industrial impacts • more than one suggestion for the future supported by science • a concluding appraisal linking all the issues discussed previously 	11–17			
12	<p>Any reasonable points, for example max 4</p> <ul style="list-style-type: none"> • conserving finite raw materials • conserving natural resources • (conserving natural resources) for other uses • reduction in CO₂ emissions/reduction in climate change • reduction in waste as products are recycled/waste management • reduction in waste material associated with mining • reduced destruction of environment/habitats 			4	D