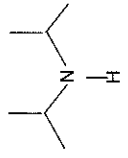


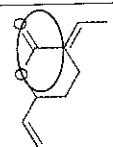
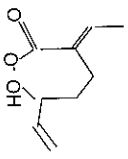
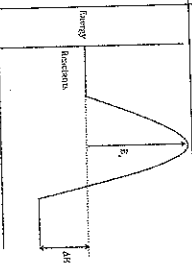
2015 QUESTION 12

a i	0.28 ± 0.05 or $0.23 - 0.33$ readings off graph accepted: 0.27 to 0.29 ± 0.05
ii 1	volumetric/analytical flask volumetric/analytical bulb/teat/pipette
2	lamp will emit wavelength of light only silver ions/no other ion can absorb
iii	scatter about line of best fit
iv	line could go through (0,0) given the resolution of spectrometer
v	$5 \text{ ppm} = 5 \text{ mg L}^{-1}$ $5 \text{ mg L}^{-1} = 0.005 \text{ g L}^{-1}$ $0.005 \times 50 = 0.25 \text{ g}$
b	H_2O 

2015 QUESTION 10

a i	$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}) \quad \Delta H = -890 \text{ kJ}$
ii	$M(\text{methane}) = 16.042 \text{ g mol}^{-1}$ $n = m/M$ $= 1/16.042 = 0.06233637 \text{ mol}$ $\therefore q = 890 \times 0.06233637 = 55.47936 \text{ kJ (2sf)}$ or $1 \text{ mol} = 890 \text{ kJ}$ $\therefore 1 \text{ g} = 890/16.042$ $= 55.47936 \text{ kJ (2sf)}$
b i	anaerobic
ii	preserves methane from mining for other uses/ mined methane in non-renewable/ captured methane is renewable/ less damage to the environment from mining methane
c i	$q_{\text{methane}} = 17/16.042 = 1.05971824$ $\Delta T = 80$ $\Delta H = Cp \times \Delta T \times m$ $n \times 1000$ $= 4.18 \times 80 \times 900$ 1.05971824×1000 $= 284 \text{ kJ}$
ii	heat loss/not all heat is absorbed by the water / incomplete combustion/ impurities present in fuel
d	lower temp means not enough energy particles don't reach E_a / strong bonds aren't broken less N_2 and O_2 react to form NO

2015 QUESTION 11

a i	alkene
ii	non-polar no separation of charge or bonds are arranged in such a way that the polarities of the bonds cancel out or vector sums of dipoles is zero
b i	
ii	
c i	addition COO- OK
ii 1	heat produced/releases energy can be used to supply E_a for other reactions/generate electricity/heat the factory
2	
d	product energy lower than reactant label E_a label ΔH must have less CO_2 in the atmosphere less heat is absorbed/retained plus CO_2 is a greenhouse gas lower contribution to global warming or can go into any of the effects of global warming

2015 QUESTION 8

a	$286.45 + 10(1.008)$ $= 296.53 \text{ g mol}^{-1}$
b i	retinol has long non-polar component/large non-polar chain with polar hydroxyl group or because C and H have little difference in electronegativity
ii	propan-2-ol is less polar than water or has a non-polar component or water very polar, so H ₂ O molecules H bond to themselves
iii	oxidizing agent/oxidant
c i	aldehyde
ii	need to describe all three reagents and their observations. Tollen's reagent silver mirror forms with retinol Na ₂ CO ₃ bubbles observed with retinoic acid acidified dichromate orange → green for retinol and retinal Spelling and grammar Flow

2015 QUESTION 9

a	no more bubbles all solid has disappeared
b i	significant figures for (b) n = CV = 0.6293×0.025 = 0.0157325 = 0.01573 (4sf)
ii	n = CV = 0.1423×0.02367 = 0.003368241 = 3.368×10^{-3} (4sf)
iii 1	$n_{\text{unreacted acid}} = n_{\text{NaOH}}$ = 3.368×10^{-3} (4sf)
2	$n_{\text{reacted acid}} = 0.0157325 - 3.368241 \times 10^{-3}$ = 0.01236426 = 0.01236 (4sf and 5 dp)
iv	$n_{\text{PbCO}_3} = \frac{1}{2}n_{\text{HNO}_3}$ = $0.01236426/2$ = 0.00618213 = 6.182×10^{-3} (4sf)
v	$M_{\text{PbCO}_3} = 267.21$ $m_{\text{PbCO}_3} = nM$ = 0.00618213×267.21 = 1.65192696 g % = $1.651\dots/3.15 \times 100$ = 52.4% (3sf)
c	%PbCO ₃ will be higher/increased than true value CaCO ₃ also reacts with HNO ₃ there will be less unreacted acid left/more HNO ₃ used

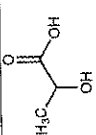
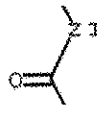
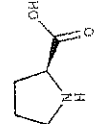
2015 QUESTION 6

a i 1	$2\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{HNO}_3$ or $2\text{NO}_2 + \text{H}_2\text{O} + \frac{1}{2}\text{O}_2 \rightarrow 2\text{HNO}_3$ or $3\text{NO}_2 + \text{H}_2\text{O} \rightarrow 2\text{HNO}_3 + \text{NO}$
2	ionises completely in water or acid has formed or $\text{HNO}_3 \rightarrow \text{NO}_3^- + \text{H}^+$ $[\text{H}^+]$ increases so pH decreases
ii	SO_2, SO_3 NO
b i	$\text{CaCO}_3 + 2\text{H}^+ \rightarrow \text{Ca}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$
ii 1	$\text{Al}_2\text{Si}_2\text{O}_5^{2-}$
2	50%
iii	increased $[\text{H}^+]_{\text{aq}}$ causes equilibrium to shift R $[\text{H}^+]_{\text{aq}}$ increases/ $[\text{H}^+]_{\text{aq}}$ decreases or Ca^{2+} is displaced from the clay/ $[\text{Ca}^{2+}]_{\text{aq}}$ decreases
iv	causes hard water or forms scum with soaps/complexes with detergents or forms deposits with ions in water or deposits scum on surfaces soaps/detergents clean less efficiently forms deposits in kettles/hot water systems

2015 QUESTION 7

a	$\text{C}_6\text{H}_{10}\text{N}_4\text{O}_2$
b i	primary 1°
ii	no carboxyl/-COOH group
iii	$\begin{array}{c} \text{O} \\ \parallel \\ \text{O}-\text{S} \quad \text{NH}_3^+ \\ \parallel \\ \text{O} \end{array}$
	CH_2CH_2 instead of ---OK
c i 1	maltose
2	fructose moved most quickly/shortest retention time most soluble in polar mobile phase/least strongly attracted/adsorbed to non-polar stationary phase/moves most with polar solvent/mobile phase
ii 1	$\text{C}_{12}\text{H}_{22}\text{O}_{11} + \text{H}_2\text{O} \rightarrow 2\text{C}_6\text{H}_{12}\text{O}_5$
2	maltose peak would be absent only 2 peaks now glucose peak would be bigger

2015 QUESTION 5	
a i	electrolytic
ii	negative
iii 1	$2\text{Al} + 3\text{H}_2\text{O} \rightarrow \text{Al}_2\text{O}_3 + 6\text{H}^+ + 6\text{e}^-$
2	anode
iv	tetrahedral 4 electron clouds all clouds are bonded distribute evenly around central S atom or distribute to minimize repulsion/maximize distance between them
b i	+2 or 2+
ii	$1s^2 2s^2 2p^6 3s^2 3p^5 3d^7$ correct convention correct # of electrons
c i	$\text{Al}_2\text{O}_3 + 2\text{OH}^- \rightarrow 2\text{AlO}_2^- + \text{H}_2\text{O}$ or $\text{Al}_2\text{O}_3 + 2\text{OH}^- + 3\text{H}_2\text{O} \rightarrow 2\text{Al}(\text{OH})_4^-$ or $\text{Al}_2\text{O}_3 + 2\text{OH}^- + \text{H}_2\text{O} \rightarrow 2\text{AlO}_2 \cdot 2\text{H}_2\text{O}$
ii	corrodes utensils removes surface dulls the shine

2015 QUESTION 4	
a i	Carbohydrate
ii	 condensed structural formula OK
b i	 Circle
ii 1	Can point to any section of the 2 nd amino acid in A2
2	
iii 1	$\text{H}^{\delta+}$ $\text{N}^{\delta-}$
2	Hydrogen bond
iv	strong/covalent/1° bonds/cross links chains can't slip over/past each other

2015 QUESTION 2

a	Increases rate of reaction	
b	$C_2H_4 + H_2O \leftrightarrow C_2H_5OH$	
	start	0
	change	+0.1
	equilibrium	0.1
	mole ratio moles C_2H_5OH moles H_2O	
c i	decreased yield	
ii	less product = back reaction favoured \uparrow temperature favours endothermic \therefore backward = endothermic	
d	6 points must state 2 advantages <u>and</u> explain high pressure increases yield pushes equilibrium to the right/the side with less moles of gas high pressure increases rate of reaction allows for more successful collisions per unit time moderate pressure is safer less risk of pressure build-up and accidents or moderate pressure is cheaper lower grade equipment can be used	

2015 QUESTION 3

a i	<p>$CH_3(CH_2)_7CH=CH(CH_2)_7C\sim$ etc</p>
ii	water H_2O
b i	hydrogenation/addition
ii	becomes more solid/less liquid easier to spread/store
c i	$[H^+] = 10^{-5.5}$ $= 3.2 \times 10^{-6}$
ii	oleic acid carboxylic acid
d i 1	<p>or $CH_3(CH_2)_7CH=CH(CH_2)_7COO^-$</p>
2	non-polar/hydrophobic/lipophilic tail is attracted to grease ionic/negative/charged/carboxylate/hydrophilic head is attracted to water
ii	$0.87 \text{ g mL}^{-3} \times 1000 = 870 \text{ g L}^{-3}$ $37.8 \times 870 = 32886 \text{ kJ}$ $= 33000 \text{ kJ (2sf)}$

