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Mark Scheme (Results)
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GCE

GCE Chemistry (6242/01)

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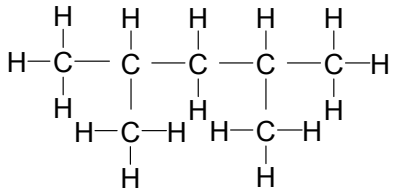
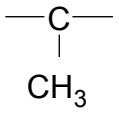
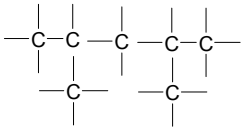
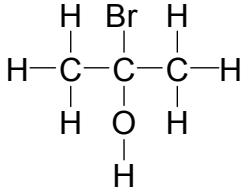
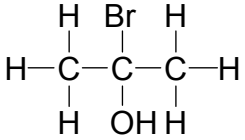
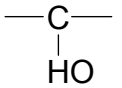
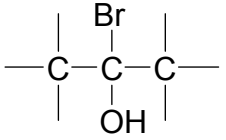
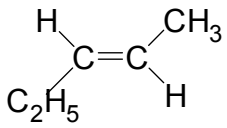
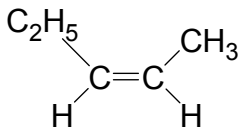
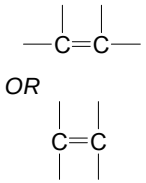
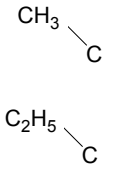
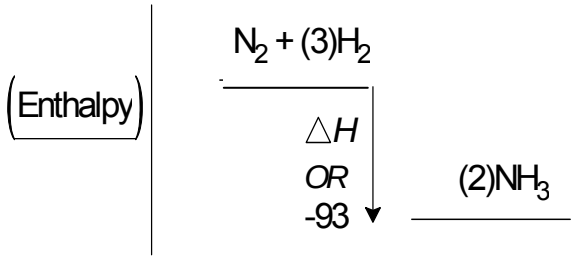
A PEARSON COMPANY

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
1. (a) (i)		CH_3 in branches But do not allow bond directly to H i.e. 		**(1 mark)**
(ii)			Bond pointing directly to H in OH i.e.  Hs missing from carbons i.e. 	**(1 mark)**
(b)	**Isomer 1**  **(1)** **Isomer 2**  **(1)**	90 ° bond angles e.g  ACCEPT 		

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
				(2 marks)
	If incorrect alkene eg but-2-ene, allow **(1)** for both cis and trans isomers			

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
(c) (i)	Nucleophile *OR* nucleophilic reagent *IGNORE type of reaction e.g. substitution addition*		Any answer containing: "free radical" "electrophile"	**(1 mark)**
(ii)	(free) radical *IGNORE type of reaction e.g. substitution addition*		Any answer containing: "nucleophile" "electrophile"	**(1 mark)**
(iii)	Oxidising agent *OR* oxidant	oxidises ethanol/alcohol	"oxidation" on its own "reduced by ethanol" any answer containing "electrophile" "nucleophile" "free radical"	**(1 mark)**
				Total 7 marks

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
2.	(a) Enthalpy/heat/energy change for **one mole** of a compound/substance/ a product **(1)** **NOT** solid/molecule/species/element to be formed from its **elements** in their **standard** states **(1)** ALLOW normal physical state if linked to standard conditions standard conditions of 1 atm pressure and a stated temperature (298 K) **(1)**		"heat released or heat required" *unless both mentioned* "natural state" "most stable state" "room temperature and pressure" "under standard conditions"	**(3 marks)**
	(b) (i) Bonds broken Bonds made N≡N (+)945 6N-H (–)2346 **(1)** and 3H-H (+)1308 **(1)** (+)2253 ΔH = 945 +1308 – 2346 = – 93 sign and value **(1)** $\Delta H^{\ominus}$ = – 93 = – 46.5 (kJ mol^{-1}) 2 sign and value q on 3rd mark **(1)**	– 46.5 (kJ mol^{-1}) with working **(4)** + 46.5 with working **max (3)** +93 with working max **(2)**		**(4 marks)**

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
	(ii)  Correct labelled levels **(1)** ΔH labelled **(1)** direction of arrow must agree with thermicity *Diagram marks cq on sign and value of ΔH in (b)(i)* *IGNORE activation energy humps*	-46.5 double headed arrow	"Reactants" and "Products" as labels	**(2 marks)**
	(iii) 350-500 °C **(1)** higher temperature gives higher rate **(1)** but a lower yield because reaction is exothermic **(1)** OR Lower temperature give higher yield because reaction is exothermic **(1)** but rate is slower **(1)**	any temperature or range within this range favours endothermic reaction **more than** exothermic so lower yield cq on sign of ΔH_f in (b)(i) or levels in (ii)	Lower temp favours exothermic reaction	**(3 marks)**
	(iv) Iron / Fe **(1)** *IGNORE any promoters* no effect on yield **(1)**			**(2 marks)**

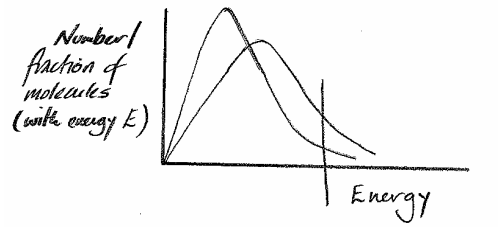
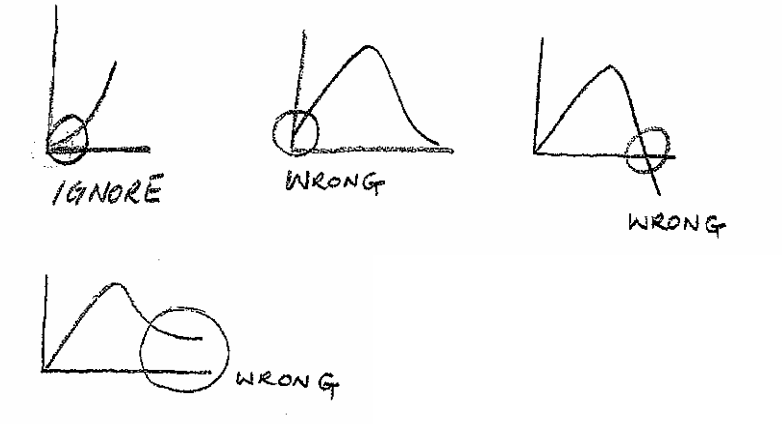
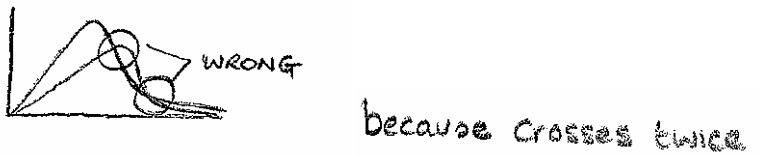
	EXPECTED ANSWER	ACCEPT	REJECT	MARK
	(v) temp would have to be much higher for a reasonable rate then yield would be too low "lower activation energy" implies reasonable rate OR Allows reaction at a lower temp at a reasonable/fast rate giving a reasonable yield.	rate too slow without catalyst at **a** temp giving a reasonable yield	to lower activation energy of reaction	**(1 mark)**
(c)	(i) <u>advantage</u> higher (equilibrium) yield/more NH_3 in equilibrium mixture/equilibrium shifts to right **(1)** because smaller number of (gaseous) moles/molecules on rhs **(1)** *IGNORE any reference to change in rate*		Just "more ammonia"	**(2 marks)**
	(ii) <u>disadvantage</u> (plant more) expensive because thicker pipes would be needed *OR* cost (of energy) for compressing the gases/cost of pump OR Cost of equipment/pressure not justified by higher yield	Stronger or withstand high pressure for thicker Vessel/container/plant /equipment/reaction vessels for pipes	"just more expensive" "just thicker pipes etc" apparatus	**(1 mark)**
				Total 18 marks

		EXPECTED ANSWER	ACCEPT	REJECT	MARK
3.	(a)	**Step 1** NaOH/KOH/sodium hydroxide/potassium hydroxide **(1)** ethanol **and** heat/reflux/heat under reflux/boil/warm **(1)** condition dependent on correct reagent or hydroxide	Ethanolic/alcoholic/ alcohol/ethanol solution for ethanol	aqueous ethanol	**(2 marks)**
	(b)	**Step 2** H_2 / hydrogen **(1)** **Ni** / nickel **and** heat *OR* Pt/Pd/platinum/palladium *IGNORE reference to heat* **(1)**			**(2 marks)**

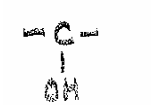
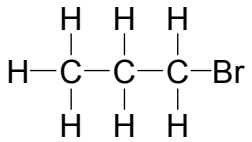
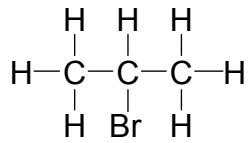
	EXPECTED ANSWER	ACCEPT	REJECT	MARK
4. (a)	aluminium oxide/alumina/Al_2O_3 **dissolved in (1)** molten cryolite or cryolite at temp≥ 800 °C **(1)**		bauxite	**(2 marks)**
(b)	$Al^{3+} + 3e^{(-0} \rightarrow Al$		(aq) as state symbol	**(1 mark)**
(c)	graphite	carbon /C	charcoal	**(1 mark)**
(d)	$C+O_2 \rightarrow CO_2$ *OR* $2C + O_2 \rightarrow 2CO$ *OR* $C + 2O^{2-} \rightarrow CO_2 + 4e^-$ *OR* $C + O^{2-} \rightarrow CO + 2e^-$	Multiples or half		**(1 mark)**
(e)	mol Al = $\frac{1 \times 10^6}{27} = 3.7 \times 10^4$ **(1)** mol Al_2O_3 = ½ mol Al **(1)** mass Al_2O_3 = mol x 102 = 1.9 $\times 10^6$ g / 1.9t**(1)** value and unit required. If atomic numbers used max 2 If mol Al_2 = $\frac{1 \times 10^6}{54}$ **(0)** mol Al_2O_3 = mol Al_2 **(1)** mass Al_2O_3 = 1.9 t **(1)** *OR* 54 g Al made from 102 g Al_2O_3 **(1)** 1g Al made from $\frac{102}{54}$ = 1.9 g **(1)** 1 t Al made from 1.9 t / 1.9$\times 10^6$ g **(1)** *IGNORE s.f.*			**(3 marks)**

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
	(f) (i) (energy) to keep the electrolyte/alumina molten **(1)** OR to produce heat energy to maintain temp 800-1000^{0}C **(1)**		to keep aluminium molten to melt/heat the electrolyte	**(1 mark)**
	(ii) no (electricity needed for) electrolysis **(1)** energy only needed to melt A1 **(1)** OR Low melting point of Al **(1)** Compared to high melting point/800^{0}C-100^{0}C for electrolyte **(1)** OR No (electricity needed for) electrolysis **(1)** Low melting point of Al **(1)**	Cryolite for electrolyte Purification of bauxite not needed	Bauxite aluminium oxide for electrolyte	**(2 marks)**
				Total 11 marks

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
5. (a) (i)	$(C_2H_6 + Br_2) \rightarrow C_2H_5Br + HBr$ *OR* multiple substitution e.g. **$C_2H_6 + 2Br_2$** $\rightarrow C_2H_4Br_2$ / CH_3CHBr_2/CH_2BrCH_2Br + 2HBr **$C_2H_6 + 3Br_2$** $\rightarrow C_3H_3Br_3$ + 3HBr etc	$CH_3C\ H_2Br$ or full structural formula	$C_2H_6+3Br_2 \rightarrow 2C$ +6HBr	**(1 mark)**
(ii)	$(C_2H_4 + Br_2) \rightarrow CH_2BrCH_2Br$		$C_2H_4Br_2$	**(1 mark)**
(b) (i)	ethane C– H bond **and** ethene C=C bond **(1)** ALLOW carbon-carbon if double in type of bond ethane type: σ/sigma **and** ethene type: π/pi (**1**) **OR** mark horizontally		Reject σ and π for ethene	**(2 marks)**
(ii)	π/pi bond is weaker (than the σ/sigma bond) *OR* π/pi bond has higher electron density (than the σ/sigma bond)	π/pi bond requires less energy to break OR π/pi bond has lower bond enthalpy π/pi bond has more accessible electron density	π breaks more easily π bond is weak	**(1 mark)**
				Total 5 marks

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
6	(a) 			
	(i) Axes labelled **(1)** Y: number/fraction of molecules/particles (with energy E) **and** X: (kinetic) energy Correct shape **(1)** starting at origin, and asymptotic to x-axis and not symmetrical 			**(2 marks)**
	(ii) line T_H with peak to the right of temp T and peak lower than temp T 			**(1 mark)**

	EXPECTED ANSWER			ACCEPT	REJECT	MARK
		(iii)	vertical line well to the right of both peaks			**(1 mark)**
	(b)	(i)	higher temp gives molecules higher (average kinetic) energy **(1)** so increase in frequency of collisions **(1)** area (under curve) to right of Ea greater at T_H **(1)** more collisions have a greater energy ≥ Ea OR a greater **proportion** of collisions have energy ≥ Ea *OR* more **of** the collisions are successful OR a greater **proportion** of the collisions result in reaction /are successful **(1)**	more collisions per unit time molecules/particles for collisions	More collisions "more successful collisions" "increase in frequency of successful collisions"	**(4 marks)**
		(ii)	Energy of collisions			**(1 mark)**
						Total 9 marks

	EXPECTED ANSWER	ACCEPT	REJECT	MARK
7. (a) (i)	alcohol/OH	hydroxyl	Hydroxide/OH^- Any additional functional group	**(1 mark)**
(ii)	**W** $(CH_3)_3COH$ **(1)**  **IGNORE** **X** $(CH_3)_3CCl$ must be conseq on their W **(1)**	full structural formulae		**(2 marks)**
(iii)	Butanoic acid / CH_3CHeCH_2COOH but **not** if W is butan-1-ol OR (2) methylpropanoic acid/$(CH_3)_2CHCOOH$ but **not** if W is 2-methylpropan-1-ol if name and formula given, both must be correct			**(1 mark)**
(b)	both isomers **(1)** $CH_3CH_2CH_2Br$/ $C_2H_5CH_2Br$ **and** $CH_3CHBrCH_3$ identification of 2-bromo as the major product **(1)**	full structural formulae  		**(2 marks)**