edexcel

Edexcel GCE

Chemistry

6242/01

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Results Mark Scheme

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Chemistry

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1. (a) (i) (aqueous) sodium hydroxide
ALLOW formula **(1 mark)**

(ii) Cryolite/Sodium aluminofluoride/Na_3AlF_6 **(1 mark)**

(iii) Melting temperature/point is too/very high
NOT "too much energy is required" **(1 mark)**

(b) (i) $Al^{3+} + 3e^{(-)} \rightarrow Al$
IGNORE state symbols **(1 mark)**

(ii) liberated oxygen *OR* $2O^{2-} \rightarrow O_2 + 4e^{(-)}$ **(1)**
If say O_2 is liberated but equation wrong, give the mark, ignoring the equation

Oxidises/reacts with **carbon** anodes
OR burns away **(1)**
The carbon can come from an equation

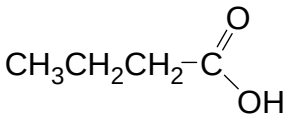
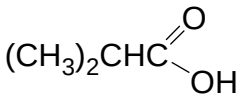
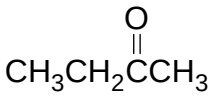
Either $C + O_2 \rightarrow CO_2$
OR $C + 2O^{2-} \rightarrow CO_2 + 4e^{(-)}$
OR $C + O^{2-} \rightarrow CO + 2e^{(-)}$
OR $2C + O_2 \rightarrow 2CO$ **(1)** **(3 marks)**

(c)

Use	Property
Cans **(1)**	Does not corrode *OR* non-toxic **(1)**
Aeroplanes **(1)**	Low density *OR* high strength:weight ratio **(1)** *NOT* 'light'
Saucepans **(1)**	Good conductor of heat *OR* non-toxic **(1)**
Cooking foil **(1)**	Good conductor of heat *OR* non-toxic **(1)**
Car bodies/engines **(1)**	Does not corrode *OR* Does not oxidise *OR* low density **(1)**
Power cables **(1)** *NOT* electrical wiring - *though this can score the second mark*	**High** conductivity *OR* low density **(1)**
Window/greenhouse **frames** **(1)**	Does not corrode *OR* easily extruded **(1)** *NOT* 'do not rust' as synonym for 'corrode'
Bicycle frames/parts **(1)**	Low density **(1)**

(2 marks)
Total 9 marks

2 (a)

	Isomer	Complete oxidation
Primary	$CH_3CH_2CH_2CH_2OH$ **(1)** *OR* $C_2H_5CH_2CH_2OH$ *OR* $(CH_3)_2CHCH_2OH$ **(1)** *NOT* $C_3H_7CH_2OH$ etc *NOT* O**HC**$H_2CH_2CH_2CH_3$	$CH_3CH_2CH_2COOH$ **(1)** $(CH_3)_2CHCOOH$ **(1)**  **(1)** *ALLOW* $C_2H_5CH_2COOH$ *OR*  *ALLOW* $(CH_3)_2CH$ COOH -CO_2H *allowable for COOH* C_2H_5 *allowable for* CH_3CH_2-
Secondary	$CH_3CH_2CH(OH)CH_3$ **(1)**	 **(1)** *ALLOW* $CH_3CH_2COCH_3$
Tertiary	$(CH_3)_3COH$ **(1)**	None **(1)** *ALLOW* "No structure" *MUST be stated e.g.* n/a *OR* no product *OR* repeat the test alcohol formula i.e. $(CH_3)_3COH$ *NOT just a line* *Stand alone mark*
	Incorrect alcohol repeated 0 (out of 2)	

The oxidation products are stand alone marks
If three carbon alcohols shown, correct oxidation products only score

(6 marks)

(b) (i) 1(-)iodopropane **(1 mark)**

(ii) Moist/wet/damp/aqueous/aq
IGNORE any reference to heat **(1 mark)**

(iii) PI_3 **(1 mark)**
ALLOW PI_5
NOT names

(c) (i) Ethanol/propanone/aqueous ethanol/alcohol **(1)**

heat **(1)**
OR warm (under reflux)
OR boil under reflux
ALLOW 'reflux'
If a temperature is stated must be between 30 ° and 80 °C **(2 marks)**

(ii) $CH_3CH_2CH_2CN$
ALLOW $C_2H_5CH_2CN$
NOT C_3H_7CN
Cyanide group can be –C≡N but not –N≡C – if bond shown it must be correct
(1 mark)

(iii) nucleophilic substitution **(1 mark)**

Total 13 marks

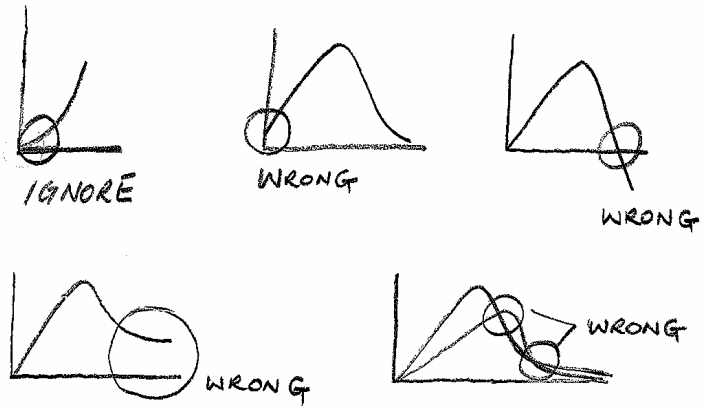
3 (a) Fine powder because it has larger surface area **(1)**

so more collisions per unit time OR greater collision frequency (between the peroxide and the catalyst) **(1)**
OR 'more active sites'
OR 'more likely for collisions to occur'
NOT 'more successful collisions'.
NOT 'more collisions' on its own **(2 marks)**

(b) (i) Axes labels **(1)**
i.e. y-axis = Number/"N" /fraction of molecules
x-axis = (kinetic) energy/E *NOT* potential energy

Start at or going towards origin, asymmetric, asymptotic to x-axis, T_1 line correct shape **(1)**

T_2 line peak lower **(1)** and to the right **(1)**
T_2 line must only cross T_1, line once, otherwise max **(1)**



(4 marks)

(ii) *E*a shown well to the right of both peaks **(1)**

larger area for T_2 **shown on diagram** and related to number of collisions/molecules with E ≥ Ea **(1) –** *need to refer to shading*

Greater proportion of successful collisions
OR more of the collisions are successful **(1)**
ACCEPT more successful collisions per unit time
NOT 'more successful collisions' alone **(3 marks)**

(iii) $E_{a\,(cat)}$ at a lower energy than E_a **(1)** – *check diagram, it is enough to draw it on the diagram*

Greater proportion of molecules have energy greater than the new activation energy OR relates areas to frequency of successful collisions **(1)** **(2 marks)**

Total 11 marks

4 (a) Heat/enthalpy/energy **change** per mole of substance/compound/product
OR
heat/enthalpy/energy **change** for the formation of 1 mol of substance/ compound/product **(1)**
"heat released" *and* "heat required" *not allowed unless both mentioned*
NOT molecule

from its **elements** in their standard states **(1)**

at 1 atm pressure and a stated temperature/298 K **(1)**
NOT "room temperature and pressure"
NOT "under standard conditions" **(3 marks)**

(b) (i) (ΔH = - 306 – (- 399)) = (+) **93** (kJ mol^{-1})

ALLOW kJ
Incorrect units lose mark otherwise **(1 mark)**

(ii) The equilibrium moves to right hand side
OR amount of dissociation increases **(1)**

Because the (forward) reaction is endothermic **(1)**

Needs to be consistent with (i)

If (i) has a negative answer (exothermic)
equilibrium moves to left hand side **(1)**
Because (forward) reaction is exothermic **(1)**

If answer to (i) is +93 or 93 but state that this is exothermic
If reaction moves to left hand side **(1)**
If reaction moves to right hand side **(0)** **(2 marks)**

(iii) add chlorine **(1)**
which drives equilibrium to the left **(1)**

OR
increase the (total) pressure **(1)**
because there are fewer (gas) molecules on left hand side **(1)**

OR
add PCl_3 **(1)**
Which drives equilibrium to the left **(1)** **(2 marks)**

Total 8 marks

5 (a) (i) ÷Ar to give 1.06, 2.13 and 1.06 **(1)**
DO NOT ALLOW 1, 2, 1 for this mark

(divide by smallest to) to give CH_2Br **(1)**
CH_2Br *on its own* **1 (out of 2)** **(2 marks)**

(ii) CH_2Br mass = 94 **(1)**
(which is half 188) so MF is $C_2H_4Br_2$ **(1)**
$C_2H_4Br_2$ *on its own* **1 (out of 2)** **(2 marks)**

(iii) $HOCH_2CH_2OH$ / CH_2OHCH_2OH **(1 mark)**
ALLOW $(CH_2OH)_2$

(iv) $BrCH_2CH_2Br$ / CH_2BrCH_2Br
ALLOW CH_3CHBr_2 *only if in (iii) they have* $CH_3CH(OH)_2$.
No other consequential marking allowed **(1 mark)**

(b) Strength of bonds C-I < C-Br < C-Cl **(1)**
Must be bonds to carbon.

C-I bond is weakest because C- I bond longest
OR I largest atom **(1)** *NOT* ion

so E_a for the reaction with the iodide is lower **(1)**
NOT kinetically more stable

The marks can be awarded for the inverse argument based on the C-Cl bond being the strongest because Cl is the smaller atom.

The 3rd mark is stand alone

If electronegativity differences are used then they must be used correctly; so if electronegativity difference is said to increase rates in the same way as bond strength then **2 max** **(3 marks)**

Total 9 marks

6 (a) (i) **Concentrated/saturated** sodium chloride
OR **concentrated/saturated** brine
NOT sodium chloride *on its own*
NOT aqueous sodium chloride alone *on its own* **(1 mark)**

(ii) anode
$2Cl^- \rightarrow Cl_2 + 2e^{(-)}$ **(1)**
OR halved
ALLOW **$-2e^{(-)}$ on LHS**

Cathode
$2H_2O + 2e^{(-)} \rightarrow H_2 + 2OH^-$
OR $2H^+ + 2e^{(-)} \rightarrow H_2$ **(1)**
OR halved

IGNORE state symbols
NOT CI for ½ CI_2
NOT H for ½ H_2.

If these equations are interchanged then (1) if they are otherwise correct. **(2 marks)**

(iii) Water sterilisation/treatment *NOT* purification
Manufacture of anaesthetics
Bleaching
Bleach manufacture
Specified solvent manufacture
Papermaking
Manufacture of HCI/hydrochloric acid
Extraction of bromine from sea water
Manufacture of titanium
Manufacture of herbicides or insecticides.
} *Any one*

NOT swimming pools *on its own*
NOT PVC manufacture **(1 mark)**

(iv) Permits passage of sodium ions/cations **(1)**
Does not allow Cl^-/anions through **(1)**

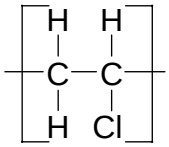
OR
selectively permeable **(1)** *NOT* semi-permeable
allows Na^+ /does not allow Cl^- to pass **(1)**

NOT 'prevents hydrogen and chlorine from reacting'
NOT 'prevents chlorine and sodium hydroxide from reacting' **(2 marks)**

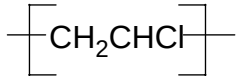
(b) Skeleton **(1) -** *This must show a 2-carbon repeat unit although number of C's does not matter*

Continuation bonds **(1) -** *This is allowable if hydrogens are missed, or if a long chain is shown.*

IGNORE any n



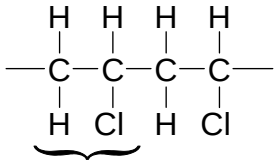
ACCEPT



brackets not needed here

(2)

ACCEPT



repeat unit

If C=C bond shown then **(0)**

(2 marks)

(c) resistant to chemical attack
OR
not biodegradable
NOT "does not decompose"
NOT rigidity

(1 mark)

(d) produces **toxic**/poisonous/acidic fumes
ALLOW HCl instead of "fumes"
NOT chlorine
If a list is given and one item is wrong then **(0)**

(1 mark)

Total 10 marks

Total for paper: 60 marks