

Science (Chemistry) 5086/5088 – Set IV
Suggested Solutions

Paper 1

1	2	3	4	5	6	7	8	9	10
D	D	C	A	B	B	D	C	B	D
11	12	13	14	15	16	17	18	19	20
B	C	C	A	A	B	D	C	C	D

Paper 3

- 1 (a) **U** [1] [1]
 (b) **V** [1] [1]
 (c) **W** [1] [1]
 (d) **Y and Z** [1] [1]

[Total: 4]

- 2
- | experiment | observation if sample is a pure substance |
|---|---|
| perform paper chromatography and analyse the chromatogram | one spot on chromatogram [1] |
| measure melting point of the sample | fixed / exact melting point [1] |
- [2]
[Total: 2]

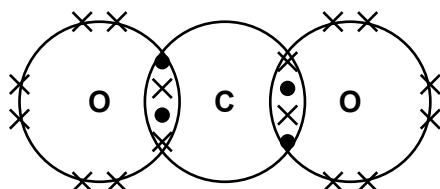
- 3 (a)(i) contains only carbon and hydrogen (atoms) [1] [1]
 (ii) methane [1] [1]

- (b)
- | process | exothermic or endothermic? |
|---|----------------------------|
| combustion of natural gas | exothermic |
| evaporation of water in the beaker | endothermic |
| condensation of water droplets on the sides of the beaker | exothermic |
- [2]

Two correct – 1 m

- (c) closely packed to far apart [1] [2]
 sliding over one another to rapidly in all directions [1]

- (d) [2]



1 m – shared electrons

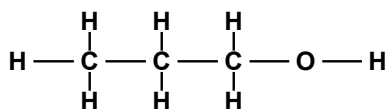
1 m – lone pairs

[Total: 8]

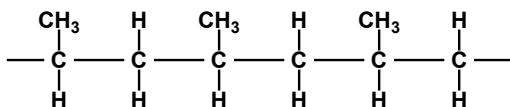
- 4 (a) sour taste / turn blue litmus red / conduct electricity [1] [1]

	(b)	Car <u>engines</u> / lightning [1] High temperature + nitrogen and oxygen react [1]	[2]
	(c)	+4 to +3 [1]	[1]
	(d)(i)	Any one of [1] • reduce pH of rivers/lakes AND kill fish, • damage/corrode <u>metal/limestone</u> structures (Ignore: destroy/dissolve, BOD: erode)	[1]
	(ii)	calcium oxide / calcium hydroxide / quicklime / slaked lime [1]	[1]
	(iii)	$\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$ [1]	[1]
	(e)(i)	conc. of $(\text{NH}_4)_2\text{SO}_4$ in g/dm^3 = mass in g $\div$ volume in dm^3 = $75.9 \div (100/1000) = \mathbf{759 \text{ g/dm}^3}$ [1]	[1]
	(ii)	$M_r = 2(14) + 8(1) + 32 + 4(16) = \mathbf{132}$ [1] conc. of $(\text{NH}_4)_2\text{SO}_4$ in mol/dm^3 = conc. in $\text{g/dm}^3 \div M_r = 759 \div 132 = \mathbf{5.75 \text{ mol/dm}^3}$ [1] allow ecf from (e)(i)	[2] [Total: 10]
5	(a)	M lead(II) oxide / aluminium oxide N nitric acid O lead(II) nitrate or aluminium nitrate P ammonia Q lead(II) hydroxide / aluminium hydroxide Accept either name or formula	[5]
	(b)	reacts with both acid and alkali/base	[1]
	(c)	$\text{Pb}^{2+}(\text{aq}) + 2 \text{OH}^-(\text{aq}) \rightarrow \text{Pb}(\text{OH})_2(\text{s})$ $\text{Al}^{3+}(\text{aq}) + 3 \text{OH}^-(\text{aq}) \rightarrow \text{Al}(\text{OH})_3(\text{s})$ [1]	[1] [Total: 7]
6	(a)	most reactive X metal X (most reactive) and copper (least reactive) [1] magnesium Y magnesium more reactive than metal Y [1] least reactive copper	[2]
	(b)	ion <u>hydroxide</u> / OH^- [1] explanation <u>solution is alkaline</u> / metal + water produces alkali [1]	[2]
	(c)	X sinks while potassium floats / idea of potassium reacting explosively / flame [1]	[1]
	(d)	copper [1]	[1] [Total: 6]
7	(a)	bubble gas into aqueous bromine / bromine water [1] Reject: <u>add aqueous bromine</u> A : reddish-brown colour remains, B : reddish-brown colour decolourises [1]	[2]
	(b)	$\text{C}_3\text{H}_8 + 5 \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$ 1 m – correct formulae; 1 m – balanced	[2]

(c) propanol [2]



(d) [2]



[Total: 8]

Correct number of C and H atoms [1]

Correct structure [1]

Max 1 without extension bonds

8 (a) gas/carbon dioxide produced AND lost/escapes/could no longer be included in total mass being measured [1] BOD: 'Given off' [1]

(b) trap / prevent / stop acid spray [1] [1]

Allow: prevent the contents spitting out

(c) Any one [1] [1]

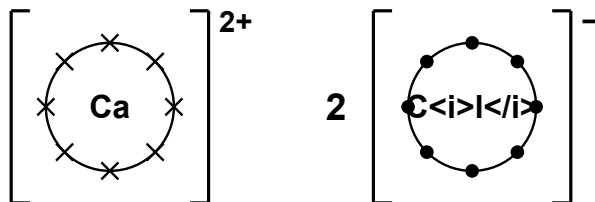
- volume of acid
- concentration of acid
- size/surface area of calcium carbonate pieces

(d) as temperature increases, particles have greater kinetic energy / moving faster in C [1] [3]

higher frequency of effective collisions in C [1]

rate of reaction is higher in C AND steeper graph [1]

(e)(i) [2]



1 m per ion, max 1 if incorrect coefficient

(ii) In solid calcium chloride, ions held in fixed positions by strong electrostatic forces of attraction therefore cannot move freely / no mobile ions [1] [2]

in aqueous calcium chloride, ions can move freely / mobile ions [1]

[Total: 10]

9 (a) metallic character decreases / metallic to non-metallic [1] [3]

increase in number of valence electrons [1]

tendency to lose electrons decreases / gain electrons increases [1]

(b) argon has a fully-filled valence shell therefore unreactive / inert / does not gain/lose or share electrons [1] [1]

(c) oxidation : sodium is oxidised AND loses electron(s) [1] [2]

Note: to penalise for electrons only under circumstances where question mentions 'a sodium atom'.

reduction : chlorine is reduced AND gains electron(s) [1]

(d)(i) no. of moles of $\text{C}_2 = \text{volume of gas} \div 24 \text{ dm}^3 = 1.2 \div 24 = 0.0500 \text{ mol}$ [1] [1]

(ii) no. of moles of Na = mass $\div$ molar mass = $1.84 \div 23 = 0.0800 \text{ mol}$ [1] [1]

- (iii) Na is limiting [1] (because 0.05 mol of C_{12} required 0.10 mol of Na for complete reaction, but only 0.08 mol of Na is available) [2]
 Mass of NaCl = mass $\times$ molar mass = $0.08 \times (23 + 35.5) = 4.68 \text{ g}$ [1] [Total: 10]
 No ECF if incorrect limiting reactant identified.

OLD SYLLABUS 5076/5078

- 10 (a)(i) haematite [1] [1]
 (ii) limestone / calcium carbonate [1] [3]
 [Max 2]
 to remove impurities / remove silicon dioxide [1]
 provide carbon dioxide [1] which then becomes carbon monoxide [1]
 accept 'to provide calcium oxide' or 'to form a slag'
 (Ref: Specimen paper 2014)
 (iii) $Fe_2O_3 + 3 CO \rightarrow 2 Fe + 3 CO_2$ [2]
 1 m – correct formulae
 1 m – balanced
 (b) add excess dilute nitric acid to barium carbonate to form barium nitrate solution [1] [3]
 (allow if solid barium carbonate is in excess but mixture must be filtered)
 mix barium nitrate solution with aqueous sodium sulfate/potassium sulfate/ammonium sulfate/sulfuric acid (any solution containing sulfate ions) [1]
 filter, wash residue with distilled water, dry with filter paper [1]
 (c) It is a finite resource / rarity of metals AND recycling will conserve it / so that it can last a longer time / available for future use (Ref 2014 Marker's report) [1]
 [Total: 10]

NEW SYLLABUS 5086/5088

- 10 (a)(i) cracking [1]
 (ii) ethene obtained from crude oil/petroleum/fossil fuels which is a finite resource/will run out [1] [2]
 glucose obtained from sugarcane (Allow: named example/plants) so continuous supply/won't run out/sugarcane plants can be re-grown [1]
 (ethene from petroleum and glucose from plants = 1 m)
 (iii) People think that ethanol is 'carbon neutral' because carbon dioxide absorbed during photosynthesis when sugarcane grows offsets the carbon dioxide produced when ethanol is burnt. [1] [2]
 Separation/transport/treating them/fractional distillation produce carbon dioxide or require the burning of fossil fuels. [1]
 (b)(i) respiration releases CO_2 AND photosynthesis absorbs CO_2 [1] [2]
 The (rate of) CO_2 released into the atmosphere is (roughly) the same as the amount absorbed from the atmosphere [1]
Students need to mention the idea of a balance between the amount of carbon dioxide released in respiration and absorbed in photosynthesis.
 (This ensures that the amount of carbon dioxide in the atmosphere remains relatively constant over time)
 (ii) gas which absorbs/traps infra-red radiation / energy / heat [1] [1]

(iii)

Any two from

[2]

- sea level rise / flooding of low lying land / Allow: floods
- climate change / extreme weather / increased rainfall /
- desertification / more forest fires / more droughts / melting of glaciers / melting of polar ice caps / melting icebergs

[Total: 10]

Reject: increase in water level / weather unpredictable / increase in temperature / greenhouse effect skin cancers