Past Papers Int 2 Chemistry

2006 Marking Scheme

Grade Awarded	Mark Required (/80)	%	% candidates achieving grade
A	59+	74%	36.6%
B	51+	64%	19.8%
C	43+	54%	19.2%
D	39+	49%	5.7%
No award	<39	<49%	18.7%

Section:	Multiple Choice	Extended Answer
Average Mark:	21.1 /30	31.2 /50

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MC Qu	Answer	% Pupils Correct	Reasoning
1	D	83	☒A Aluminium is in group 3 and is not a Group 1 Alkali Metal ☒B Calcium is in group 2 and is not a Group 1 Alkali Metal ☒C Copper is a transition metal and is not a Group 1 Alkali Metal ☑D Sodium is in group 1 and is a Group 1 Alkali Metals
2	A	63	Solute: Sugar / Lemon Juice / carbon dioxide — The substance which is dissolved Solvent: Water — The liquid which does the dissolving Solution: Lemonade — The mixture produced when solute dissolves in solvent
3	C	80	Mass number ⟶ 23 $^{23}_{11}Na$ ⟵ Atomic number Mass number = no of protons + neutrons Atomic number = no of protons
4	C	68	☒A Nitrogen has the electron arrangement of 2,5 and is found in group 5 ☒B Oxygen has the electron arrangement of 2,5 and is found in group 6 ☑C Fluorine has the electron arrangement of 2,7 and is a group 7 Halogen ☒D Neon has the electron arrangement of 2,8 and is a group 0 Noble gas
5	B	82	Isotopes: Same atomic number but different mass number Same number of protons but different number of neutrons
6	A	73	☑A Lead is a metal and fluorine is a non-metal ∴ ionic bonding in compound ☒B sulphur and oxygen are both non-metals ∴ covalent bonding in compound ☒C carbon and nitrogen are both non-metals ∴ covalent bonding in compound ☒D phosphorus and chlorine are both non-metals ∴ covalent bonding in compound
7	D	66	☒A Chlorine atoms have electron arrangement 2,8,7 ∴ Cl^- is 2,8,8 ☒B Sulphur atoms have electron arrangement 2,8,6 ∴ S^{2-} is 2,8,8 ☒C Argon atoms have electron arrangement 2,8,8 ☑D Sodium atoms have electron arrangement 2,8,1 ∴ Na^+ is 2,8
8	C	71	Write down Formulae of ions: $Al\ SO_4^{2-}$ Write down Valency below each ion: $Al\ SO_4$; 3 2 Put in Cross-over Arrows: $Al\ SO_4$; 3 2 Follow arrows to get formula: $Al_2(SO_4)_3$
9	B	71	**gfm** $C_6H_{12}O_6$ = (6x12) + (12x1) + (6x16) = 72 + 12 + 96 = 180g no. of mol = $\frac{\text{mass}}{\text{gfm}} = \frac{18}{180}$ = 0.1 mol
10	A	76	☑A **gfm** SO_2 = (1x32)+(2x16) = 32+32 = 64g ∴ mass = $^{\text{no. of mol}}/_{\text{gfm}} = {}^{12.8}/_{64}$ = 0.20mol ☒B **gfm** CO = (1x12)+(1x16) = 12+16 = 28g ∴ mass = $^{\text{no. of mol}}/_{\text{gfm}} = {}^{12.8}/_{28}$ = 0.46mol ☒C **gfm** CO_2 = (1x12)+(2x16) = 12+32 = 44g ∴ mass = $^{\text{no. of mol}}/_{\text{gfm}} = {}^{12.8}/_{44}$ = 0.29mol ☒D **gfm** NH_3 = (1x14)+(3x1) = 14+3 = 17g ∴ mass = $^{\text{no. of mol}}/_{\text{gfm}} = {}^{12.8}/_{17}$ = 0.75mol
11	B	89	catalytic converter: carbon monoxide ⟶ carbon dioxide nitrogen dioxide ⟶ nitrogen unburnt hydrocarbons ⟶ carbon dioxide + water

12 D 66

Property	Petroleum Gas	Gasoline	Kerosene	Light gas Oil	Heavy Gas Oil	Residue
Viscosity	Low	←	—	→		High
Evaporation	Quickly	←	—	→		Slowly
Flammability	High	←	—	→		Low
Boiling Point	Low	←	—	→		High

13 A 43

☑A Both molecules are the same – Alkane with 5 carbons on main chain
☒B Although the molecules look different, both are alkanes with 5 carbons on main chain
☒C Isomers have same formula and different structures but they are the same
☒D Isotopes have same atomic number but different mass number

14 B 86

Correct general formula: $C_nH_{2n}O$

If n=3: 2n = (2x3) = 6	If n=4: 2n = (2x4) = 8	If n=5: 2n = (2x5) = 10
C_3H_6O	C_4H_8O	$C_5H_{10}O$

15 B 41

☒A ester shown is ethyl ethanoate
☑B ester shown is propyl ethanoate
☒C ester shown is ethyl propanoate
☒D ester shown is propyl propanoate

16 C 72

☒A Hydrocarbon X is but-1-ene not but-2-ene due to position of C=C double bond
☒B Hydrocarbon X is unsaturated due to presence of C=C double bond
☑C Hydrocarbon X decolourises bromine solution due to C=C double bond
☒D Hydrocarbon X has formula is C_4H_8 so has general formula C_nH_{2n}

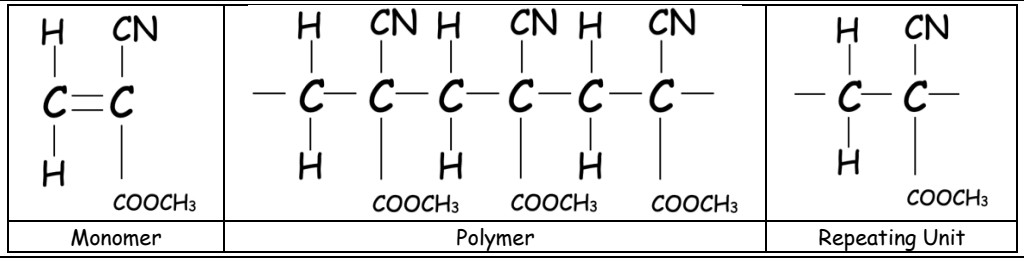
17 B 94

$$C_{22}H_{46} \longrightarrow C_{18}H_{38} + C_4H_8$$

18 C 75

☒A Cracking: large saturated hydrocarbons break into more useful, unsaturated hydrocarbons
☒B Dehydration: water is removed leaving a C=C double bond behind
☑C Distillation: separates ethanol and water as they have different boiling points
☒D Hydrolysis: Breaking down polymers adding water at the breaks

19 A 85



20 C 67

Hormones, including insulin, can be made of protein

21 D 50

☒A Hydration: Water is added across a C=C double bond
☒B Hydrolysis: Breaking down molecules adding water at the breaks
☒C Dehydration: Removing water leaving behind a C=C double bond
☑D Condensation: Monomers joining up to form polymers removing water at the join

22 C 81

☒A Ethanol is formed by fermentation of glucose into ethanol and carbon dioxide
☒B Glucose is obtained by hydrolysis of starch into glucose
☑C Glycerol and fatty acids are obtained from hydrolysis of fats & oils
☒D Propanol is not formed from hydrolysis of fats as glycerol has 3 –OH bonds

23 A 79

☑A Hydrogen H^+ ion concentration decreases as acid is diluted from pH=3 to pH=6
☒B Hydroxide OH^- ion concentration does not decrease when water is added
☒C At pH=6, concentration of H^+ ions is greater the concentration of OH^- ions
☒D Hydrogen H^+ ion concentration decreases as acid is diluted from pH=3 to pH=6

24 A 56

A base is a chemical which neutralises an acid:
Metal Hydroxides (Alkalis) Metal Oxide Metal Carbonate

25	D	83	☒A Condensation: physical change where a gas turns into a liquid ☒B Distillation: separates liquids with different boiling points ☒C Evaporation removes water from a solution and solid is left behind ☑D Filtration: separates insoluble solids from liquids
26	A	76	Silver – Copper has the closest pairing of metals on the electrochemical series ∴silver - copper cell has the smallest voltage
27	C	55	☒A Copper ions are reacting into copper atoms at the negative electrode ☒B Copper ions are reacting into copper atoms at the negative electrode ☑C Copper ions gain electrons (reduction) to become copper atoms: $Cu^{2+} + 2e^- \rightarrow Cu$ ☒D Copper ions gain electrons (reduction) and do not lose electrons (oxidation)
28	B	58	☒A Lead is too reactive to made my heating lead oxide alone ☑B Mercury is an unreactive metal and can be made my heating mercury oxide ☒C Tin is too reactive to made my heating tin oxide alone ☒D Zinc is too reactive to made my heating zinc oxide alone
29	D	70	☒A Galvanising involves attaching zinc to steel not magnesium to steel ☒B magnesium is not electroplated onto steel ☒C Magnesium is too reactive to be a barrier protection as it will corrode too fast ☑D Magnesium is more reactive than steel and provides sacrificial protection
30	D	49	☒A Iron nail rusts to protect the copper by sacrificial protection ☒B Iron nail rusts to protect the tin by sacrificial protection ☒C Attaching the iron nail to the positive electrode increases the nail rusting ☑D Attaching the iron nail to the negative electrode gives cathodic protection

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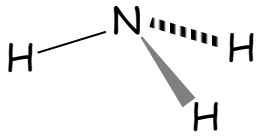
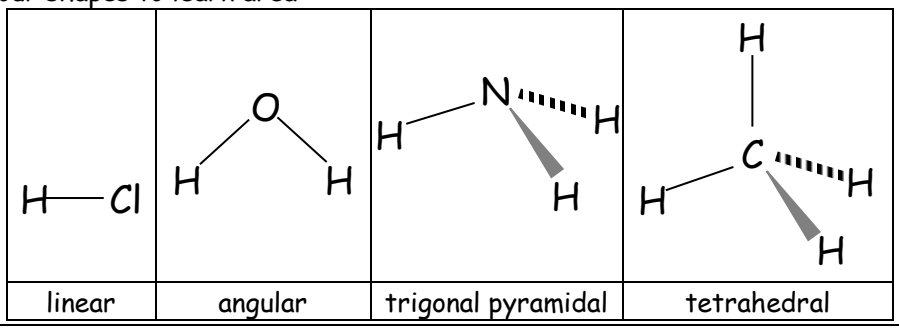
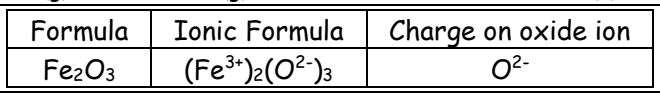
Long Qu	Answer	Reasoning
1a	Acid rain damages plant/marine life	Non-metals dissolve in water to form acids, e.g. CO_2 and NO_2 Acid rain formed in atmosphere damages marine and plant life and damages metal and carbonate rock structures
1b(i)	$2CH_3SH + H_2$ ↓ $C_2H_6 + 2H_2S$	$2CH_3SH + H_2 \longrightarrow C_2H_6 + 2H_2S$
1b(ii)	445°C	Data Booklet information gathering question
2a	Shared pair of electrons between 2 atoms	Covalent bonding usually takes place between two non-metal atoms. The 2 atoms share electrons to form pairs and each atom has a full outer shell.
2b	 Trigonal Pyramidal shape	Four shapes to learn area:  linear | angular | trigonal pyramidal | tetrahedral
2c(i)	X = blue Y = red	Ammonia dissolves in water on pH paper to form ammonium hydroxide ∴ pH paper at X turns blue Fumes of hydrogen chloride gas dissolve in water on pH paper to form acid ∴ pH paper at Y turns red
2c(ii)	Ammonium chloride	ammonia + hydrogen chloride ⟶ ammonium chloride $NH_3(g)$ + $HCl(g)$ ⟶ $NH_4Cl(s)$
3a	2-	 Formula: Fe_2O_3 | Ionic Formula: $(Fe^{3+})_2(O^{2-})_3$ | Charge on oxide ion: O^{2-}
3b	$Fe^{3+} + 3e^- \rightarrow Fe$	Fe^{3+} ions at start and Fe atoms at end of reaction. Three electrons must be gained by the Fe^{3+} ions to become Fe atoms
3c	26 30 23	Number of protons = atomic number = 26 Number of neutrons = mass – atomic number = 56 -26 = 30 Number of electrons = no of protons – charge = 26 – (+3) = 23
4a	Beaker contents go cloudy	PPA 1.2 Question The sulphur produced by the chemical reaction builds up in the beaker eventually making the mixture cloudy enough to stop the 'X' from remaining visible through the beaker.
4b	Line graph including:	½mark: labelling axes ½mark: correct scales ½mark: plotting points ½mark: drawing line
4c(i)	0.050 s^{-1}	Answer has ± half box error allowed
4c(ii)	8	Rate= $\frac{1}{\text{time}}$ Time = $\frac{1}{\text{rate}} = \frac{1}{0.125} = 8s$
4d	To keep depth of solution the same	PPA 1.2 Question It is important to keep all variables the same, except the one you are altering in the experiment, and using the same beaker keeps the depth of the solution the same in each experiment.
5a	Carboxyl group	Alcohols have the hydroxyl functional group of –OH Carboxylic acids have the carboxyl functional group of -COOH

5b — 30g

gfm of CH_3OH = (1x12) + (4x1) + (1x16) = 12 + 4 + 16 = 32g

$$\textbf{n}\text{o. of mol} = \frac{\textbf{m}\text{ass}}{\textbf{gfm}} = \frac{16}{32} = 0.5 \text{ mol}$$

$$CH_3OH + CO \longrightarrow CH_3COOH$$

1mol 1mol

0.5mol 0.5mol

gfm CH_3COOH = (2x12) + (4x1) + (2x16) = 24 + 4 + 32 = 60g

mass = **n**o. of mol x **gfm** = 0.5 x 60 = 3.18g

6a — Provide body with energy

Food Type	Importance to Diet
Carbohydrates	Provide body with energy
Fats	
Proteins	Needed for body growth and tissue repair

6b — Carbon, Hydrogen, Oxygen

Food Type	Carbon	Hydrogen	Oxygen	Nitrogen
Carbohydrates	✓	✓	✓	×
Fats	✓	✓	✓	×
Proteins	✓	✓	✓	✓

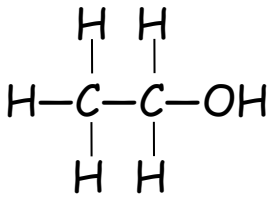
6c

starch
sucrose
glucose

Test for Starch: Iodine turns starch blue/black

Test for Glucose: warm Benedict's Solution turn brick red with glucose

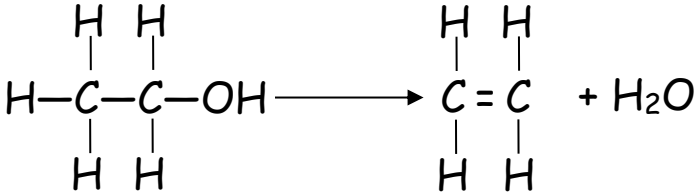
7a



*Eth*anol is a 2 carbon structure.

Ethan*ol* is an alcohol with a hydroxyl –OH functional group

7b(i) — Water



7b(ii) — To prevent suckback

At the end of the experiment, the hot air in the test tube starts to contract back to its original size. This reduction of volume sucks cold water up the delivery tube. If cold liquid comes into contact with the hot glass of the test tube, it could crack/shatter.

7b(iii) — Catalyst is in a different state to the reactants

Type of Catalyst	**Definition**
Homogeneous	Catalyst in same state as reactants
Heterogeneous	Catalyst in different state from reactants

7b(iv) — 1g

Catalyst is not used up during the experiment and full mass of catalyst is left over at the end of the experiment.

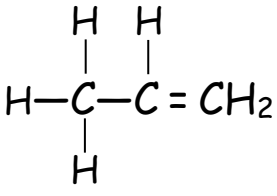
8a(i) — Methylpropane

2-methylpropane: -CH_3 methyl group on a 3 carbon main alkane chain.
As methyl group can only be located on carbon number 2, methyl group does not require to be numbered.

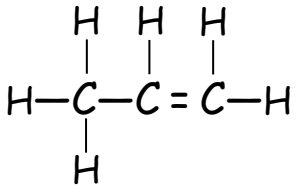
8a(ii) — Addition

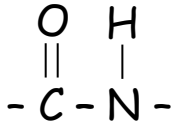
Alkane molecule adds across the double bond

8b



Propene is the alkene reactant in this reaction:



9a(i)	condensation	Condensation reactions have 2 smaller molecules join up to make a larger molecule with a small molecule like water remove at the join.
9a(ii)	Amide link	Amide links are found in polyamides e.g. nylon Peptide links are found in proteins 
9a(iii)	Both ends of monomer can react and large polymer is formed	If monomers only had one functional group, the molecule would not be able to extend to become a polymer with thousands/millions of monomers joined together.
9b	Strength or toughness	Kevlar is a very strong yet lightweight polymer used in bullet-proof vests.
10a	glows red or glows brightly	Zinc is more reactive than copper but not as reactive as magnesium. The description of zinc's reaction with oxygen would be somewhere between than of magnesium and copper.
10b	To place magnesium, copper and zinc in order of reactivity	PPA Question
10c	Do not look directly at the burning magnesium	Magnesium is used in flares because of the very bright light emitted.
11a	Precipitation	$Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \longrightarrow PbI_{2(s)} + 2KNO_{3(aq)}$ soluble soluble insoluble soluble
11b(i)	$Pb^{2+}+2I^- \rightarrow Pb^{2+}(I^-)_2$	$Pb^{2+} + 2NO_3^- + 2K^+ + 2I^- \rightarrow Pb^{2+}(I^-)_2 + 2K^+ + 2NO_3^-$ Cancel out any spectator ions which appear on both sides $Pb^{2+} + \cancel{2NO_3^-} + \cancel{2K^+} + 2I^- \rightarrow Pb^{2+}(I^-)_2 + \cancel{2K^+} + \cancel{2NO_3^-}$ Re-write equation omitting spectator ions $Pb^{2+} + 2I^- \rightarrow Pb^{2+}(I^-)_2$
11b(ii)	Spectator ions	Ions which appear on both sides of the equation are called spectator ions as they do not take part in the reaction.
12a	exothermic	Exothermic reactions: reaction which gives out (heat) energy Endothermic reaction: reaction which takes in heat from the surroundings
12b(i)	Hydrogen is flammable	The hydrogen gas could mix with oxygen from air and cause an explosive mixture to be formed.
12b(ii)	oxidation	Oxidation is loss of electrons (electrons after the arrow) Reduction is gain of electrons (electrons before the arrow)
12c	Magnesium is more reactive than iron and Mg loses electrons to the iron	Magnesium reacts quicker when in contact with iron. All reactions of magnesium will involve an oxidation of magnesium atoms to magnesium ions. The electrons can end up at the less reactive iron.
13a(i)	0.1	**n**o. of mol = **v**olume x **c**oncentration = 0.1 litres x 1 mol l^{-1} = 0.1 mol
13a(ii)	0.3	citric acid + sodium hydrogencarbonate $\longrightarrow$ products 1mol 3mol 0.1mol 0.3mol
13b(i)	Partial dissociation of H^+ ions in water	Strong acids have full dissociation of H^+ ions. Weak acids only have partial dissociation of H^+ ions from molecules
13b(ii)	Answer to include:	1 mark: Description of any method which shows difference • reaction with a metal or metal carbonate • conductivity • pH 1 mark: Indication of the result that would be expected for test selected