



Assessment Schedule 2018

**South Pacific
Form
Seven
Certificate**



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YR13 CHEMISTRY EXAM PAPER ASSESSMENT CRITERIA

L O	QN	S L	EVIDENCE	STUDENT RESPONSE LEVEL			
				Extended Abstract 4	Relational 3	Multistructural 2	Unistructural 1
STRAND 1: ATOMIC STRUCTURE AND BONDING AND RELATED PROPERTIES							
13CHE1.1.1.1	1.1a	1	This is the overall location of negative (and positive) charge on a molecule.				Mention separate positive & negative components in a molecule or Mention location of electrons, and/or, creating the overall negative charge on a molecule. Accept answers that mention difference in electronegativity values of atoms concerned.
13CHE1.1.1.3	1.1b	1	Tetrahedral shape				Tetrahedral shape only.
13CHE1.1.1.4	1.1c	1	Van der Waal forces/ London forces or induced dipole – induced dipole/ dispersion forces, or instantaneous induced dipole. Also temporary dipole-dipole.				Van der Waal forces/ London forces or induced dipole – induced dipole/ dispersion forces, or instantaneous induced dipole. Also temporary dipole-dipole.

13CHE1.1.3.7	1.1d	3	The presence of the Cl atom in the place of hydrogen (in CH ₄) introduces a highly polar bond due to the electronegativity difference between C and Cl. This results in a net dipole moment / and therefore a dipole attraction between the molecules of CH ₃ Cl. This increases the boiling point. from CH ₄ (entirely non-polar) drastically.	CH ₄ intermolecular force v. weak. Cl presence initiates negative charge/changes polarity of CH ₄ / resulting in strong polar intermolecular forces and high boiling points. (Student able to link the ideas & able to differentiate between CH ₄ & CH ₃ Cl). CH ₄ completely non-polar.	Only two of the ideas are mentioned with some connection between them or presence of Cl results in polar molecule & strong intermolecular bonds thus high b.pt.	Only one idea discussed with no connection made between the concepts. Cl presence has affected the polarity and the resulting intermolecular force produced. (Do not accept increasing molar mass)
13CHE1.1.2.2	1.2	2	The increasing number of positive protons causes stronger attraction with the valence electrons therefore ionic sizes decrease across the period (from Na⁺¹ to Mg⁺² to Al⁺³) .	.	Must state the correct trend i.e decreasing ionic radii across the period. The increasing nuclear attraction may or may not be included in answer.	Recognition of increasing number of protons but unable to relate it to increasing attraction and thus decreasing size. Also accept increasing attraction.
13CHE1.2.1.1	1.3a	1	Nuclear fission is when a heavy nucleus divides to form 2 smaller ones releasing a large amount of energy.			Division of a nucleus to form 2 smaller ones, and release of energy. (Student must be able to define correctly)
13CHE1.2.1.2	1.3b	1	A neutron or 1_0n	.		A neutron or 1_0n . Accept neutrons or neutron.(Student must have correct knowledge)
13CHE1.2.1.3	1.3c	1	Highly dangerous, destroys living cells, causes changes in living cells, causes mutation, causes cancer. Also accept have/produce high energy, have penetrating ability, high radioactivity or have high ionising ability.			Accept anyone: Highly dangerous, destroys living cells, causes changes in living cells, causes mutation, causes cancer. . Also accept have/produce high energy, have penetrating ability, high radioactivity or high ionising ability.

13CHE1.2.4.1	1.3d	<p>4</p> <p>USE in everyday application. a.generate electric power b.produce internal organ images in medicine (X-rays, Geiger counter, luminous paint, scanners, radioactive tracers in the body). Radiotherapy (kills cancer cells) and sterilisation of medical equipment c. Forensic science –radioactive isotopes to detect trace elements in blood, bones, tissue etc.</p> <p>Relating the properties of nuclear particles to how it is being used. Nuclear radiation (from fission or fusion) in the form of alpha, beta particles & gamma rays are produced releasing high energy. R,elements travel through film to show black spots (X-rays), ionise molecules of surrounding air (Geiger counters, smoke detectors, C-dating), produce fluorescence with certain compounds (paint), intensity of radiation in the body provide information on the status of organs (locate brain tumours,thyroid infection etc.)</p> <p>Comparison of advantages to disadvantages. Some radiation is dangerous to living tissue & cause tumors e.g gamma rays because they are ionising. Advantages outway disadvantages when they are used under control.</p> <p>Influence or impact of the application on human life. Accurate dating, increase life span due to improved medical services as diseases are detected early, improve investigation into crimes, increase safety in work places & construction sites etc.</p> <p>(Do not accept 'kills humans')</p>	<p>All four parts are present in the answer, (Student must have</p> <ul style="list-style-type: none"> • correct knowledge of use of nuclear radiation; • is able to relate the use to its properties; • can make comparison between adv & disadv) • can evaluate how nuclear reactions affect human life. 	<p>Only three skills are present.</p>	<p>Only two skills present.</p>	<p>Only one skill is present.</p>
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13CHE1.3.2.1	1.4a	2	They have variable oxidation states, they form coloured compounds and they form complex ions.			They have variable oxidation states, they form coloured compounds and they form complex ions. Also partially filled d-orbitals. (Prescription based answers. All 3 or just 2 must be present for the full score)	Less than 3 properties. If students mention the other two (they are paramagnetic and used as catalysts) or other properties generally true of metals in general (metals, high m.pts & b.pts, conductors of electricity) as these are also true of transition elements. 1 score if only one property is given.
13CHE1.1.1.2	1.4b	1	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$				Only one correct answer. $1s^2 2s^2 2p^6 3s^2 3p^6 3d^9$. Anything else is wrong.
13CHE1.3.1.2	1.4c	1	Green				Accept any variation of green; blue-green or yellow-green, lime green, light green
13CHE1.3.1.4	1.4d	1	Tetrahydroxyzincate (II) ion				Tetrahydroxyzincate (II) ion. Accept any of the following: tetrahydrozinc (II) ion, or tetrahydroxozincate(II) or tetrahydroxidezincate (II).
13CHE1.3.1.1	1.4e	1	Copper metal				Copper metal

13CHE1.3.2.3	1.4f	2	$\text{Ag}^{+1}_{(\text{aq})} + 2\text{NH}_3_{(\text{aq})} \rightarrow [\text{Ag}(\text{NH}_3)_2]^{1+}_{(\text{aq})}$			Accept any source of Ag^{1+} ions (AgNO_3 , $\text{Ag}(\text{OH})$, AgO soln etc), and $\text{NH}_3/\text{NH}_4\text{OH}$. Equation must be balanced.	Main spps are present in the equation given, but equation is not balanced, or equation is balanced for wrong species of reactants / product..
13CHE1.3.2.6	1.4g	2	Brown/black ppt forms then dissolves to form a colourless solution.			Brown/black ppt forms then dissolves to form a colourless solution.	Brown/black ppt forms then dissolves or formation of a colourless solution.
STRAND 2: ENERGY CHANGES IN CHEMICAL AND PHYSICAL PROCESSES							
13CHE2.1.1.2	2.1	1	Ionisation energy.				Ionisation energy/Enthalpy of ionisation/Ionisation enthalpy.
13CHE2.1.2.4	2.2a	2	$\text{C}_3\text{H}_{8(\text{g})} + 5\text{O}_{2(\text{g})} \rightarrow 3\text{CO}_{2(\text{g})} + 4\text{H}_2\text{O}_{(\text{g})}$			Student recognises that combustion involves addition of oxygen & produces $\text{CO}_{2(\text{g})}$ & $\text{H}_2\text{O}_{(\text{g})}$. Correct equation, balanced with states.	Correct products but incorrect balancing/states or correct balancing of incorrect equation. Or correct use of O_2 .
13CHE2.1.1.3	2.2b	1	$\Delta_{\text{combustion}}\text{H}^\circ$ or $\Delta_{\text{c}}\text{H}^\circ$				All 4 symbols must be present and in the correct order for the score. Also accept $\Delta_{\text{r}}\text{H}^\circ$ and even if the degree sign is missing.
13CHE2.1.2.1	2.2c	2	Propane gas produces heat when used in cooking and the production of heat is an exothermic reaction.			Knowing that exothermic means heat is given out. Understanding that to cook means to be subject to heat.	Exothermic only or correct understanding of cooking only.

13CHE.2.1.3.3	2.3	<p>3</p> $\Delta_r H^\circ = \sum \Delta H_{\text{Bonds broken}} - \sum \Delta H_{\text{Bonds formed}}$ <p>B/ broken = $347 + (5 \times 414) + 352 + 464$ $= 347 + 2070 + 352 + 464$ $= 3233 \text{ kJmol}^{-1}$</p> <p>B/formed = $598 + (4 \times 414) + (2 \times 464)$ $= 598 + 1656 + 928$ $= 3182 \text{ kJmol}^{-1}$</p> <p>$\Delta_r H^\circ = 3233 - 3182$ $= +51 \text{ kJmol}^{-1}$ + sign must be present</p>		<p>All THREE below :</p> <p>Equation for $\Delta_r H^\circ$ to be present. (How to get $\Delta_r H^\circ$)</p> <p>Correct calculation for b/broken & b/formed. (Ability to calculate)</p> <p>Correct final answer with + sign. (Know importance of + sign)</p>	<p>Any TWO below :</p> <p>Equation for $\Delta_r H^\circ$ to be present. Correct calculation for b/broken & b/formed. Correct final answer with + sign.</p>	<p>Equation for $\Delta_r H^\circ$ to be present. OR Correct calculation for b/broken & b/formed. OR Correct final answer with + sign.</p>
13CHE2.1.2.2	2.4	<p>2</p> <p>Energy is needed or absorbed to break bonds (endothermic), while energy is removed or given out when bonds are formed (exothermic).</p>			<p>Both are given: Breaking bonds is an endothermic process while forming bonds is an exothermic process. Or energy increases for bond breaking, and energy decreases for bond formation.</p>	<p>Only ONE is given: Breaking bonds is an endothermic process or forming bonds is an exothermic process.</p>

STRAND 3: Aqueous Equilibrium Systems						
13CHE3.1.3.3	3.1a	3	$\text{CH}_3\text{COOH} + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COO}^{-1} + \text{H}_3\text{O}^{+1}$ $K_a = \frac{[\text{CH}_3\text{COO}^{-1}][\text{H}_3\text{O}^{+1}]}{[\text{CH}_3\text{COOH}]}$ $1.74 \times 10^{-5} = \frac{[\text{H}_3\text{O}^{+1}]^2}{[\text{CH}_3\text{COOH}]}$ $[\text{H}_3\text{O}^{+1}] = \sqrt{1.74 \times 10^{-5} \times 0.017}$ $= 5.44 \times 10^{-4}$ $\text{pH} = -\log [\text{H}_3\text{O}^{+1}]$ $= -\log (5.44 \times 10^{-4})$ $= -(-3.26)$ $= \underline{3.26}$		<p>Correct linking between K_a of CH_3COOH and $[\text{H}_3\text{O}^{+1}]$ via an equation.</p> <p>Able to determine $[\text{H}_3\text{O}^{+1}]$</p> <p>Able to carry out calculations.</p> <p>Able to determine pH value.</p> <p>Not necessary that any or all of the 3 equations are shown prior to the calculation working.</p>	<p>Any two of the skills demonstrated.</p> <p>Any one of the skills demonstrated.</p>
13CHE3.2.1.1	3.1b	1	<p>The addition of a common ion to a saturated solution at equilibrium, results in precipitation. A In this case the addition of sodium acetate, introduced a common ion (acetate/$\text{CH}_3\text{COO}^{-1}$) where the common ion reacted with the hydronium ion, H_3O^{+1} causing a shift to the left, changing the pH.</p>			<p>Definition of common ion effect, is 'the addition of a common ion to a saturated solution at equilibrium, results in precipitation. The addition of a common ion on the products side of the equilibrium, increased the conc. of reactants.</p>
13CHE3.1.1.1	3.2a	1	$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$			<p>Accept K only instead of K_c</p> $K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$
13CHE3.2.1.2	3.2b	1	<p>Since the reaction is exothermic, an increase in temperature would favour the production of reactants thus lowering the value of the equilibrium constant, K_c.</p>			<p>Lowering or decreasing of K_c value must be in the answer. Explanation is not necessary. Also if $[\text{N}_2]$ and $[\text{H}_2]$ increases.</p>

3.3

4

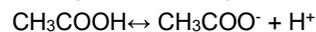
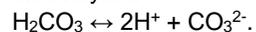
Nature of species and how it relates to conductivity include ionisation of water.

Compounds in solution are mostly ionic in nature, and dissolve in water by dissociation forming ions. The ions may remain unreactive or react with water (hydrolyse) to change the nature of the solution. In either case, the solution is an electrolyte and conducts electricity because of the ions present.

Water in solution also ionises and conducts electricity;



Some covalent compounds dissolve in water because they are polar e.g glucose however they are non-electrolytes, except covalent acids (e.g. H_2CO_3 and CH_3COOH) which are electrolytes.

**Concentration of species and how they affect alkalinity (s.c.b of w.a hydrolyse)**

Certain ionic compounds form ions on dissociation that hydrolyse in water eg. $\text{Na}_2\text{CO}_3 \rightarrow 2\text{Na}^+ + \text{CO}_3^{2-}$. CO_3^{2-} is a strong conjugate base of the weak acid H_2CO_3 and hydrolyses in water to form H_2CO_3 and OH^- ions. The excess OH^- ions cause the overall solution to be basic ($\text{pH} > 7$).

Concentration of species and how they affect acidity. (s.c.a of w.b. hydrolyse)

$\text{CaCl}_2 \rightarrow \text{Ca}^{2+} + 2\text{Cl}^-$. Ca^{2+} is a strong conjugate acid of the weak base $\text{Ca}(\text{OH})_2$, thus it hydrolyses in water to form $\text{Ca}(\text{OH})_2 + \text{H}^+$ (or H_3O^+). The excess H_3O^+ ions causes the solution to be slightly acidic ($\text{pH} < 7$).

Examples in relevant chemical equations as illustrations must be correctly used.

Student must show all of the following skills;

- Knowledge of how components would have come to be present in a solution.
- Connect components to conductivity, basicity & acidity.
- Able to justify a process with an example or equation.
- Link the ideas logically & correctly.

Student must show three of the skills outlined.

Student must show two of the skills outlined.

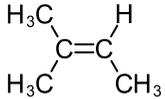
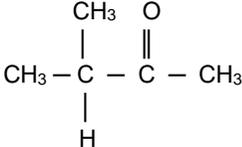
Student only shows one of the skills outlined.

STRAND 4: OXIDATION-REDUCTION REACTIONS

13CHE4.1.1.1	4.1a	1	A device that uses a spontaneous redox reaction to produce an electric current.				A device that uses a spontaneous redox reaction to produce an electric current. OR a device that uses a reaction to produce an electric current. OR it is an electrochemical cell that is spontaneous OR it is rechargeable and is referred to as a battery. (Also score of one if the answer describes the set up in the diagram given in the question paper).
13CHE4.1.1.2	4.1b	1	Presence of salt bridge, two half-cells linked by salt bridge				Student must identify any one correct feature on the diagram. Either presence of salt bridge, two half-cells linked by salt bridge or no external power source).
13CHE4.1.2.4	4.1c	2	This has 2 containers with an electrode in each, while an electrolytic cell has 2 electrodes in the same container. This has a voltmeter while an electrolytic cell has a power source. This has a salt bridge while a galvanic cell does not have a salt bridge. This set up uses chemical energy to produce electrical energy, while an electrolytic cell uses electrical energy to produce chemical energy.			Two differences given OR the difference is not given and two things written about one of the types of cells.	Only one difference given OR the difference is not given and only one thing written about one of the types of cells.

13CHE4.1.2.2.	4.1d	2	Al(s) / Al ³⁺ (aq, 0.1 mol L ⁻¹) // Cu ²⁺ (aq, 0.1 mol L ⁻¹) / Cu(s)			Al(s) / Al ³⁺ (aq, 0.1 mol L ⁻¹) // Cu ²⁺ (aq, 0.1 mol L ⁻¹) / Cu(s) OR Al(s) / Al ³⁺ (aq) // Cu ²⁺ (aq) / Cu(s) (Knowledge of IUPAC system for cell notation. Correct process on the correct side and presence of //).	Al / Al ³⁺ // Cu ²⁺ / Cu OR (Knowledge of IUPAC system for cell notation. Correct process on the correct side or presence of //).
13CHE4.1.3.3	4.1e	3	$E^{\circ}_{\text{cell}} = \text{SRP}_{\text{reduction}} - \text{SRP}_{\text{oxidation}}$ $= 0.34 \text{ V} - (-1.66) \text{ V}$ $= 0.34 + 1.66 \text{ V}$ $= + 2.00 \text{ V}$ <p>The reaction is spontaneous. This is due to the + value, although the explanation is not required.</p>		$E^{\circ}_{\text{cell}} = \text{SRP}_{\text{red}} - \text{SRP}_{\text{ox}}$ $= 0.34 \text{ V} - (-1.66)$ $= 0.34 + 1.66$ $= + 2.00 \text{ V}$ <p>The reaction is spontaneous</p> <p>Calculation, answer with + sign & conclusion all correct.</p> <p>Student must</p> <ul style="list-style-type: none"> • Know how to calculate E°_{cell} • Demonstrate correct calculation • Relate sign to spontaneity of reaction. 	$E^{\circ}_{\text{cell}} = \text{SRP}_{\text{red}} - \text{SRP}_{\text{ox}}$ $= 0.34 \text{ V} - (-1.66)$ $= 0.34 + 1.66$ $= + 2.00 \text{ V}$ <p>Student shows two of the following skills.</p> <ul style="list-style-type: none"> • Know how to calculate E°_{cell} • Demonstrate correct calculation • Relate sign to spontaneity of reaction. 	$E^{\circ}_{\text{cell}} = \text{SRP}_{\text{red}} - \text{SRP}_{\text{ox}}$ $= 0.34 \text{ V} - (-1.66)$ $= 0.34 + 1.66$ $= + 2.00 \text{ V}$ <p>Student shows at least one of the following skills.</p> <ul style="list-style-type: none"> • Know how to calculate E°_{cell} • Demonstrate correct calculation • Relate sign to spontaneity of reaction.

STRAND 5: ORGANIC CHEMISTRY

13CHE5.1.1.1	5.1a	1	<p>Organic isomers with the same molecular formula whose atoms are arranged differently in space, are mirror images of each other and are non-superimposable.</p> <p>Optical isomers have a chiral carbon; a carbon atom with 4 different groups of atoms attached to it.</p>				<p>Same molecular formula but arranged differently in space.</p> <p>And are mirror images of each other but are not superimposable.</p> <p>Molecule that have a chiral Carbon atom.</p> <p>Molecule that has a Carbon atom with 4 different groups of atoms attached to it.</p>
13CHE5.2.2.5	5.1b	2	 <p>2-methylbut-2-ene</p>			<p>Correct structure and name</p> <p>(Student is able to draw correct structure and is able to name)</p>	<p>Only one given; either correct structure or correct name. Also even if the structure drawn is incorrect but the name given for the incorrect structure is correct.</p>
13CHE5.2.1.2	5.1c	1	<p>Rxn Y = Elimination reaction.</p>				<p>Elimination reaction.</p>
13CHE5.2.2.1	5.1d	2	<p>Rxn X = Oxidation reaction</p> 			<p>Correct structure of Compound E and correct name of reaction.</p> <p>Accept condensed formulae.</p>	<p>Either structure or name present.</p> <p>Accept condensed formulae.</p>

13CHE5.1.3.11	5.1e	3	1,2 - dimethylpropanamine		<p>1,2 – dimethylpropanamine OR 1-methyl-2-methylpropanamine. Students must</p> <ul style="list-style-type: none"> Recognize longest continuous chain as an amine. Recognise the substituents and correctly name them. Correct numbers and dash inserted into name. 	<p>Comma and/or dash missing in correct name Or comma & dash present but name is not continuous. 1 2 dimethylpropanamine 1,2 – dimethyl propanamine</p>	<p>Comma & dash absent and name not continuous but numbers & components of name are present, even if it is in the wrong order. e.g. 1 2 dimethyl propane amine</p> <p>Propane 1 methyl 2 methyl amine. Numbers and dashes must be correct or substituents numbered correctly longest continuous or, longest continuation chain is propanamine.</p>
13CHE5.2.2.6	5.1f	2	<p>KMnO₄ colour change from purple to pale brown/pink, then to colourless, Vinegar-like odour Or smell of acetic acid.</p>			<p>KMnO₄ colour change from purple to pale brown/pink, then to colourless, AND Vinegar-like odour.</p> <p>(Accept a slight variation to the above)</p>	<p>KMnO₄ colour change from purple to pale brown/pink, then to colourless, OR Vinegar-like odour.</p> <p>Also accept ‘test with blue litmus paper turns red/pink’. (Accept a slight variation to the above)</p>

13CHE5.2.4.1	5.2	4	<p>Type of reaction of alcohols e.g. esterification, saponification, alcoholic drinks, combustion, oxidation, substitution with PCl₅, elimination rxn. with conc. sulphuric acid</p> <p>Product formed eg. alcohols to make esters, soap and cosmetics, alcoholic beverages, alcohols react with esters to make another ester (Dacron), c,acids, energy, alkyl halides to make polymers, alkenes.</p> <p>How the product formed is used in industry, eg esters in cosmetics and artificial flavour in food industry, medicinal products, beverages in hotel industry, textile industry etc.</p> <p>Named examples/ formulae/ correct balanced equations to support information given.</p>	<p>All four areas covered and ideas well connected.</p> <p>Named reaction of alcohol</p> <p>Equations for formation of products</p> <p>Examples of everyday use of the product with</p> <p>Reactions of the products indicating wide use.</p> <p>NB Need to mention both reaction of alcohol and reaction of their product.</p>	Only three areas covered.	Two areas covered.	One area only covered.
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