# 2019 SINGAPORE-CAMBRIDGE A LEVEL H2 CHEMISTRY P1 SUGGESTED ANSWER KEY (9729)
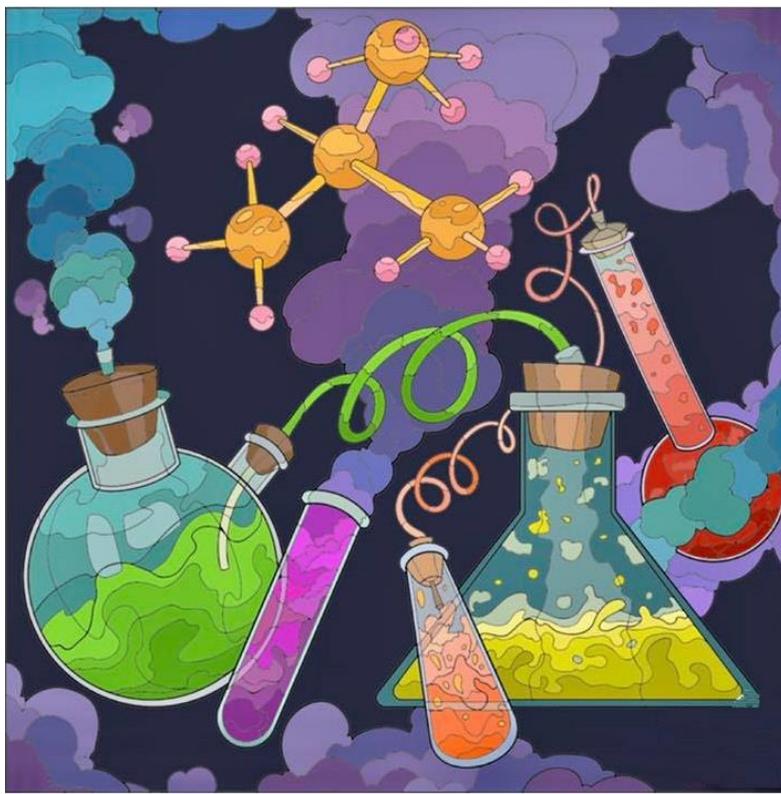
Written and Prepared by Mr Mitch Peh

**2019 A Level H2 Chemistry P1 Suggested Answer Key (9729)**

30 marks, 15% weightage

| 1 | **B** | 6 | **A** | 11 | **A** | 16 | **A** | 21 | **D** | 26 | **B** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | **C** | 7 | **D** | 12 | **B** | 17 | **B** | 22 | **C** | 27 | **C** |
| 3 | **B** | 8 | **B** | 13 | **D** | 18 | **A** | 23 | **A** | 28 | **C** |
| 4 | **C** | 9 | **D** | 14 | **D** | 19 | **A** | 24 | **C** | 29 | **B** |
| 5 | **C** | 10 | **D** | 15 | **D** | 20 | **D** | 25 | **B** | 30 | **B** |

Analysis of 2019 A Level Chemistry Paper 1 (9729)

Overall, I would say that this paper requires quite a significant amount of thinking and data interpretation skills, besides the need to have very strong content knowledge, in order to do well. This is because A Level Chemistry examiners can be rather creative with their design of questions in this paper. Take a simple topic like Atomic Structure, they can ask in a novel manner as seen in question 1 and 3, where students have to digest the information provided first, then apply a few different Topics to solve them. Also, there is a strong emphasis of questions testing content knowledge such as pi bond, sp hybridisation, melting point and electrical conductivity of silicon, factor affecting angle of deflection is charge to mass ratio, products of free radical substitution reaction, intermediate compounds of electrophilic substitution reaction where students either know or do not know the answer to these questions.

For question 6, I think there may be a chance that the answer ends up to be option B because the molecular mass and thus electron cloud size of $CH_3Cl$ and $HCO_2H$ are rather similar but there is presence of strong hydrogen bonding between $HCO_2H$ molecules (2 hydrogen bonds per molecule), which may then cause the pressure to become lower. I suspect that the very fact Cambridge included this option may mean they want students to take this factor into account.

I also have an interesting observation for this year's Paper 1. There were some notable Topics which were frequently tested in other years but glaringly missing in this year's Paper 1. However, these Topics have already been tested in Paper 2 or Paper 3. This may mean that there is some collaboration and efforts made between the Paper 1, 2 and 3 exam setters not to repeat testing the same Topic.

Take the topic of acid-base equilibria for example, the definitions of Bronsted Lowry acids & bases and Lewis acid & base have already been tested in P3/Q1(c), the calculation of pH of weak acid/base has already been tested in P3/Q2(e). These Topics were not tested in this year's Paper 1 again.

A topic that has not been heavily tested in this year's A Level Chemistry paper is Electrochemistry and Electrolysis. Only 3 marks were allocated in Paper 3 and 2 marks allocated in Paper 1, one was a repeat question somemore. Students who studied this topic extensively were certainly left disappointed. Personally, I suspect that there will be a stronger emphasis on this topic in next year's exam.

There are 4 difficult and tricky questions in this year's paper. Apart from these questions, most other questions require strong content knowledge to be able to answer correctly.

**Difficult Questions**
Q28: Students need to realise which of the amide linkages will hydrolyse and identify the types of products formed.
Q30: Students should draw a diagram of the two square pieces of copper to visualise the number of copper atoms required, before applying It=nF formula to solve for the time required.

**Tricky Questions**
Q12: For the definitions of the various standard enthalpy changes, students usually focus a lot on the stoichiometric coefficients and may miss out the importance of state symbols as well. Thus they may

decide to choose the wrong option of A instead. Furthermore, they may not have seen the standard state of carbon before, which can be either graphite or diamond.

Q13: The first statement of Gibbs free energy change for the reaction being positive may seem correct at surface, to explain non-spontaneity of reaction. However, upon deeper analysis with the data on enthalpy change of reaction and entropy change provided, students will realise the Gibbs free energy change value is actually negative.

**Hybrid Skills Questions**

Q6: Have to apply pV=nRT formula, find Mr and realise that p is inversely proportional to Mr.

**Questions which require data interpretation skills**

Q1: Need data interpretation skills and strong content knowledge of isotopes and relationship between protons, neutrons, electrons.

Q3: Need data interpretation skills, making reference to periodic table, and applying Topic of IE down the group and across period.

Q14: Interpretation of the gradient of initial rate against concentration of substrate graph

**Questions which require mathematical manipulation skills**

Q7: Mole calculation and applying pV=nRT

Q11: Mole calculation to find molar ratio

- **Definition and Topic Based Questions (Supposed to be easy questions)**

Q2: Angle of deflection depends on charge to mass ratio

Q4: Dot cross diagram of barium peroxide, where students have to know peroxide ion is $O_2^{2-}$.

Q5: Definition of pi bond

Q8: Melting point and electrical conductivity of Silicon

Q9: Periodicity, reaction between cation and NaOH, reaction between oxides with acids and bases

Q10: Explain reactivity of Group 2 elements

Q15: Students need to be familiar with the factors affecting rate constant and proportion of particles having energy greater than activation energy

Q16: Simple understanding of sp hybridization

Q17: Topic of enantiomer

Q18: Products of free radical substitution

Q20: To form a racemic mixture, we need $S_N1$ nucleophilic substitution reaction (2 step mechanism)

Q21: Neutralisation of phenol and carboxylic acid with the use of NaOH

Q22: Oxidation of the different types of alcohol

Q23: Reaction between acyl chloride and amine

Q24: Neutralisation reaction between amine and HCl

Q25: Protonation and deprotonation of amino acids, strength of acid

Q26: Electronic configuration of anion

Q27: Complex anion of chromium after reacting with excess NaOH

**Repeat Questions**

Q29: 2015 A level P1/Q10: Standard conditions require the concentration of all the solutions and $H^+$ ions to be 1moldm$^{-3}$.

Detailed Solutions

| Qn | Ans | Detailed Explanations |
|---|---|---|
| 1 | B | • Topic:  Atomic Structure on finding number of protons, neutrons and electrons<br>• From Data Booklet, the number of neutrons that the isotope of strontium has is 84-38=46 since the number of protons for strontium is 38 (fixed regardless of the type of isotope).<br>• Thus, the number of electrons that the ion of the isotope, $Sr^{2+}$ has is 36.<br>• Similarly, W, $X^-$ and $Y^{2-}$ all have 36 electrons.<br>• Hence, the number of protons that W, X and Y have are 36, 35 and 34 respectively.<br>• Then, we deduce that the nucleon number for W, X and Y is 82, 81 and 80 respectively. |
| 2 | C | • Topic: Atomic Structure on deflection of protons and electrons between electric plates<br>• Option A and B are incorrect as electrons should be deflected to the positive plate while protons should be deflected to the negative plate.<br>• Angle of deflection is proportional to $\dfrac{q}{m}$ ratio. Hence, protons should deflect less compared to electrons. |
| 3 | B | • Topic:  Atomic Structure on ionisation energies down the group and across the period<br>• Tellurium is in Group 16 with electronic configuration $ns^2np^4$.<br>• Tellurium should have lower IEs than arsenic and selenium since it has an additional electron shell. Hence, the answer can only be option A or B.<br>• Its second and third IE should be higher than that of antimony (in same period and Group 15) due to stronger electrostatic forces of attraction between the nucleus and the electrons since the nuclear charge in Tellurium is higher.<br>• However, its fourth IE should be lower than that of antimony due to increased shielding effect provided by the s electron shell. |
| 4 | C | • Topic: Chemical Bonding on dot-and-cross diagram<br>• From Data Booklet, Barium is in Group 2 so it should have a charge of 2+, not 1+. Hence, answer can only be option C or D.<br>• We should also recall that the oxidation state of O in hydrogen peroxide is -1. Hence, the formula of barium peroxide should be $BaO_2$ so the answer should be option C. |
| 5 | C | • Topic: Chemical Bonding on pi bonds<br>• 1 is incorrect as $Al_2Cl_6$ has 2 dative bonds which are sigma bonds.<br>• 2 is correct as $CO_2$ has 2 double bonds. Hence it has 2 π bonds.<br>• 3 is incorrect as $CH_3CHO$ has an aldehyde functional group which causes it to only have 1 π bond.<br>• 4 is incorrect as $CH_2CHCH_3$ only has 1 double bond so it only has 1 π bond. |
| 6 | A | • Topic: Ideal Gas, relationship between pressure and $M_r$<br>• Given $pV=nRT$, when temperature and volume are adjusted to be the same, we have $p \propto n$ and since $n = \dfrac{m}{M_r}$, we have $p \propto \dfrac{1}{M_r}$ as m=0.433g (constant).<br><br>Mr of $CH_4$ =16<br>Mr of HCHO =30<br>Mr of $CH_3Cl$ =50.5<br>Mr of $HCO_2H$ =46 |

| Qn | Ans | Detailed Explanations |
|---|---|---|
| | | • Hence, the lowest pressure is for $CH_3Cl$, followed by $HCO_2H$, HCHO and the highest pressure is for $CH_4$. <br><br> Alternative Answer <br> • However, the answer could be option B if we take into account $HCO_2H$ molecules are able to form an average of 2 hydrogen bonds per molecule, causing the intermolecular forces of attraction between molecules to be stronger compared to $CH_3Cl$ molecules which are only able to form pd-pd interactions between molecules. <br> • With stronger intermolecular forces of attraction, the pressure exerted by $HCO_2H$ molecules could be lower compared to the pressure exerted by $CH_3Cl$ molecules. |
| 7 | D | • Topics: Mole calculations, ideal gas equation <br> Balancing the decomposition equation, we have: <br> $2NaN_3 \rightarrow 2Na + 3N_2$ <br> Number of moles of $NaN_3 = \dfrac{5.00}{23.0 + 3(14.0)} = \dfrac{1}{13} mol$ <br><br> Number of moles of $N_2 = \dfrac{1}{13} \times \dfrac{3}{2} = \dfrac{3}{26} mol$ <br> Applying pV=nRT, volume of nitrogen gas = <br> $\dfrac{nRT}{p} = \dfrac{3 \times 8.31 \times (273 + 30)}{26 \times 9.85 \times 10^4} = 0.00295 m^3 = 2.95 dm^3$ <br><br> Comments <br> • We have to write out and balance the chemical equation in order to know the stoichiometric coefficients for all the reactants and products, then we can perform the calculation for volume of nitrogen gas. |
| 8 | B | • Topic: Periodicity on melting point and electrical conductivity <br> • Based on the statement "s- and p-block elements in Period 4 show a similar pattern of properties to the elements in Period 3", Germanium, a group 4 element, will take on similar properties as Silicon, meaning that it will have a giant molecular structure, contributing to strong covalent bonds which need to be broken for melting to take place. Thus, Germanium will have high melting point. <br> • Germanium will also be a semiconductor, just like silicon. |
| 9 | D | • Topic: Periodicity on identifying the elements present, qualitative analysis of cation reacting with NaOH(aq), reaction between oxide and acid/alkali <br> • From the Qualitative Analysis section of the Data Booklet, the cation which gives a white ppt insoluble in excess NaOH(aq) is $Mg^{2+}$ and not $Al^{3+}$. <br> • We also need to recall that $SiO_2$ only reacts with hot and concentrated strong base NaOH to give $Na_2SiO_3$ while both $P_4O_6$ and $P_4O_{10}$ can react with strong bases readily. Hence, the other element present in X should be Si and not P. <br><br> Comments <br> • The following knowledge are not required to answer the question but good for understanding. X is magnesium silicide, $Mg_2Si$. <br> • Magnesium silicide reacts with HCl to form $MgCl_2$ and $SiH_4$. Hence, solution Y is magnesium chloride, $MgCl_2$ and gas Z is silicon hydride, $SiH_4$. <br> $Mg_2Si + 4HCl \rightarrow 2MgCl_2 + SiH_4$ <br> • Gas Z, silicon hydride, $SiH_4$, burst in flame to form water and silicon dioxide, $SiO_2$. <br> $SiH_4 + O_2 \rightarrow SiO_2 + H_2O$ |

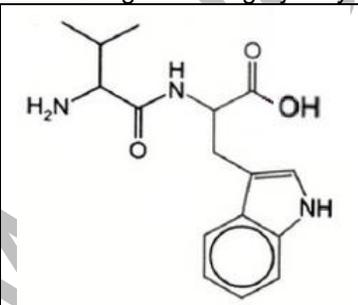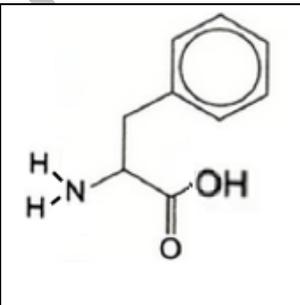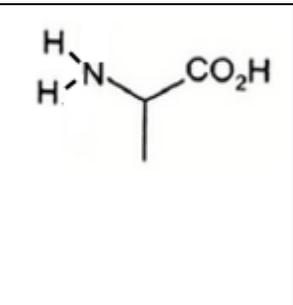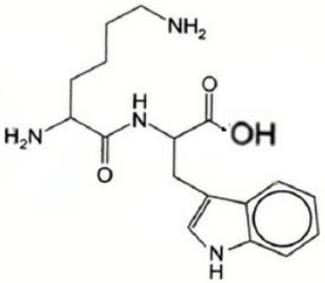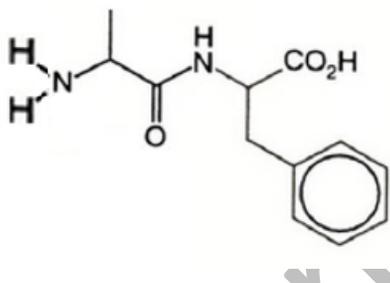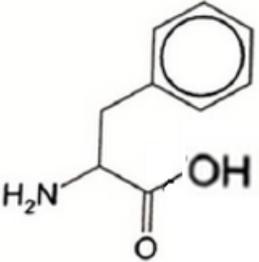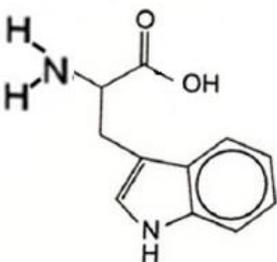| Qn | Ans | Detailed Explanations |
|----|-----|----------------------|
| 10 | D | • Topic: Group 2 Element on increasing chemical reactivity down the group<br>• Option A is incorrect as electron affinity is associated with non-metals instead.<br>• Option B is incorrect as electronegativity decreases down the group instead.<br>• Option C is incorrect as nuclear charges increases down the Group but Group 2 metals form ionic compounds which is associated with the ease of losing electrons and effective nuclear charge falling instead.<br>• Option D is correct as the increase in the number of electron shells down the group make it easier for the metal to lose valence electrons, forming ions and thus ionic compounds. Hence, this explains the increasing chemical reactivity down group 2. |
| 11 | A | • Topic: Mole Concept<br>• Mr of B, O and Pb: 10.8, 16, 207.2<br>• Suppose that we have 1g of solder glass.<br>• Number of moles of $B_2O_3$ = $\dfrac{0.16}{2(10.8)+3(16.0)} = 0.0022988\,mol$<br>• Number of moles of PbO= $\dfrac{0.84}{207.2+16.0} = 0.0037634\,mol$<br>• Pb/B molar ratio = $\dfrac{0.0037634}{0.0022988 \times 2} = 0.82$<br><br>Comments<br>• Note that the question is asking for Pb/B molar ratio and not Pb/B mass ratio. |
| 12 | B | • Topic: Chemical Energetics on definition of the different types of standard enthalpy change<br>• For this question, we need to observe which part of the reaction violates the definition of each of the enthalpy change.<br>• Option A is incorrect. For $\Delta H^{\theta}_{combustion}$ of $C_6H_{12}(l)$, we need $H_2O(l)$ to be formed in the reaction and not $H_2O(g)$. Hence, the state symbol for $H_2O$ is incorrect.<br>• Option B is correct. For $\Delta H^{\theta}_{formation}$ of $C_6H_{12}(l)$, $C_6H_{12}(l)$ should be formed from the element in its standard state, and graphite can be considered a standard state.<br>• Option C is incorrect as $\Delta H_3$ should be $12 \times \Delta H^{\theta}_{atomisation}$ of $H_2$ instead since we are forming 12 moles of .<br>• Option D is incorrect. For $\Delta H^{\theta}_{formation}$ of $H_2O(g)$, $H_2O(g)$ should be formed from $H_2$ (g) and $O_2(g)$, not H atoms.<br><br>Comments<br>• For the definition of the different types of standard enthalpy change, it is important to not just check the stoichiometric coefficients, but also check the state symbols of each reactant and product. |

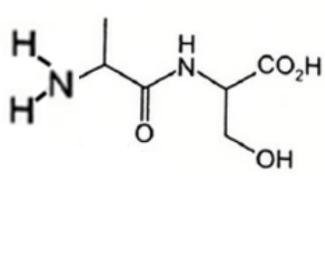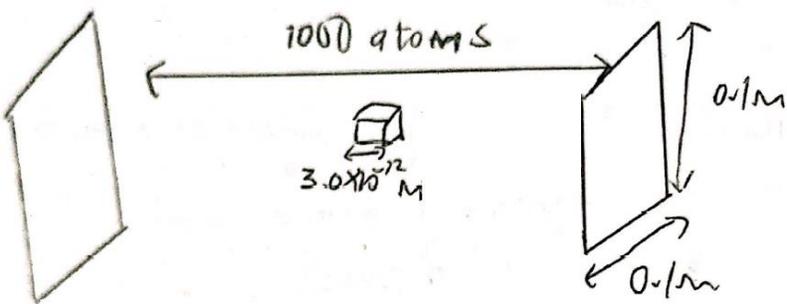| Qn | Ans | Detailed Explanations |
|----|-----|----------------------|
| 13 | D | • Topic: Chemical Energetics on factors resulting in non-spontaneous reactions<br>• 1 is incorrect. 1 may seem correct because when Gibbs free energy change for the reaction is positive, the decomposition reaction is non-spontaneous, allowing hydrogen peroxide to be stored without decomposition. However, we need to check the value to see whether it is indeed a valid reason.<br>• Given $\Delta G = \Delta H - T\Delta S$, $\Delta H$ being negative and $\Delta S$ being positive, $\Delta G$ will always be a negative value which means that the reaction is spontaneous. Hence, statement 1 is wrong.<br>• 2 is correct. When the reaction has a very high activation energy, little decomposition will take place as the reactants are unlikely to have sufficient energy to overcome the activation energy required.<br>• 3 is incorrect as the entropy change should be positive instead since there is greater number of mole of gaseous products than gaseous reactants, leading to an increase in disorderliness. |
| 14 | D | • Topic: Reaction Kinetics on enzyme-substrate reaction<br>• When [substrate]=$x$, the concentration of the substrate is too high such that there is insufficient enzyme active sites available to bind to the substrate.<br>• Hence, option 1 is incorrect as the initial rate of reaction does not increase anymore.<br>• Option 2 is incorrect as the order of reaction with respect to substrate should be 0, not 1.<br>• Option 3 is correct. There are no more enzyme active sites available. |
| 15 | D | • Topic: Reaction Kinetics, factors affecting rate constant value, effect of increasing temperature<br>• 1 is incorrect. The rate constant is independent of the concentration of the reactants.<br>• 2 is incorrect. Increasing the concentration has no effect on the proportion of particles having energy greater than the activation energy.<br>• 3 is correct. In fact, it is good to know that if the forward reaction is endothermic, the forward rate constant will increase at a faster rate than the backward rate constant.<br>• 4 is correct. Kinetic energy of particles is proportional to the thernomdynamic temperature. Hence, when temperature increases, the proportion of particles having kinetic energy greater than the activation energy increases.<br>• For those taking H2 Physics, you should be familiar with this equation:<br>$$\frac{1}{2}m\langle c^2 \rangle = \frac{3}{2}kT$$ |
| 16 | A | • Topic: Chemical Bonding, hybridisation of orbitals<br>• Option A is correct. The 2 carbon atoms in $C \equiv C$ bond are sp hybridised.<br>• Option B is incorrect as none of the carbon atoms in $H_2C=CH_2$ is sp hybridised. Instead, they are all $sp^2$ hybridised.<br>• Option C is incorrect as there are 4 carbon atoms in $HC \equiv C-C \equiv CH$ which are sp hybridised.<br>Option D is incorrect as none of the carbon atoms in $H_2C=CH-CH=CH_2$ is sp hybridised. Instead, they are all $sp^2$ hybridised. |

| Qn | Ans | Detailed Explanations |
|---|---|---|
| 17 | B | • Topic Isomers<br>• The structure of ether with the lowest number of carbon atoms and has a chiral carbon atom.<br><br>$H-\underset{\underset{H}{\mid}}{\overset{\overset{H}{\mid}}{C}}-O-\underset{\underset{H}{\mid}}{\overset{\overset{CH_3}{\mid}}{C^*}}-C_2H_5$ |
| 18 | A | • Topic: Alkane, free radical substitution<br>• Compound 1 is possible when propane undergoes monosubstitution<br>• Compound 2 is possible when propane undergoes disubstitution<br>• Compound 3 is possible when 2 of $\bullet CH_2CH_2CH_3$ combine together to form an alkane with a carbon chain of 6 carbon atoms.<br>• Compound 4 is not possible to be formed from free radical substitution of propane as there are 5 carbon atoms present in the compound instead of 3 or 6 carbon atoms. |
| 19 | A | • Topic: Arene, intermediates of electrophilic substitution<br>• Option C and D are incorrect as the partial rings should be facing the carbon atom which is $sp^3$ hybridised.<br>• The electrophile required should be positively charged. Hence, it should be $[CH_3CO]^+$. |
| 20 | D | • Topic: Halogenoalkane and $S_N1$ nucleophilic substitution<br>• To form a racemic mixture, there should be a chiral carbon with Cl attached to it.<br>• Then, the substance will undergo $S_N1$ nucleophilic substitution i.e. 2 step mechanism, with a carbocation as the intermediate.<br>• The nucleophile $OH^-$ will attack the trigonal planar $sp^2$ hybridised carbocation from top and bottom of the plane, resulting in equal proportion of the enantiomers formed, thus creating a racemic mixture.<br>• Only the compound in option D will satisfy these criteria.<br>• Structural formula of compound in option D<br><br>$H_3C-\underset{\underset{CH_3}{\mid}}{\overset{\overset{H}{\mid}}{C}}-\underset{\underset{CH_2CH_3}{\mid}}{\overset{\overset{CH_3}{\mid}}{C^*}}-Cl$ |

| Qn | Ans | Detailed Explanations |
|---|---|---|
| 21 | D | • Topics: The multiple roles that NaOH can partake in, including neutralisation of phenol and carboxylic acid, nucleophilic substitution with RX <br> • The C-I bond is too strong due to the presence of partial double bond character so no reaction will occur with NaOH(aq). <br> • Both phenol and carboxylic acid functional groups can react with NaOH(aq). <br> • It is also good to refresh your memory on the reactivity between organic compounds, Na, NaOH and $Na_2CO_3$. <br><br> <table><tr><td></td><td>Na</td><td>NaOH</td><td>$Na_2CO_3$</td></tr><tr><td>ROH</td><td>✓</td><td>✗</td><td>✗</td></tr><tr><td>HO—⬡</td><td>✓</td><td>✓</td><td>✗</td></tr><tr><td>RCOOH</td><td>✓</td><td>✓</td><td>✓</td></tr></table> |
| 22 | C | • Topics: Oxidation of the different types of alcohols <br> • The primary alcohol group will be oxidised to carboxylic acid, secondary alcohol group will be oxidised to ketone and tertiary alcohol group will remain unoxidised. |
| 23 | A | • Topics: Reaction between acyl chloride and amine to form amide linkage. <br> • Option B and D are incorrect as molecules of W need to be chiral. However, the carboxylic acids required to generate the compounds in options B and D will not be able to fulfil this criterion. <br> • Options C and D are incorrect as the nitrogen atom should still be part of the cyclic ring after the reaction between acyl chloride and amine. <br> • Analysis of how compound Y is formed: <br><br>  |
| 24 | C | • Topics: Amines, neutralisation involving HCl and amine <br> • Cold hydrochloric acid can react with phenylamine in an acid-base reaction to form a salt that is the crystalline solid after evaporation. <br> • Answer cannot be option B because for hydrolysis of amide linkage to take place, reflux condition will be required. |
| 25 | B | • Topic: Amino acids, protonation and deprotonation at various pH levels <br> • Since pH 7 is higher than $pK_a$ values of 2.1 and 4.1 but lower than $pK_a$ value of 9.5, the 2 $CO_2H$ groups of glutamic acid should be deprotonated while the $^+NH_3$ group should remain protonated. |
| 26 | B | • Topics: Atomic Structure on electronic configuration and transition elements <br> • The $M_r$ of Mo is 42 which means that the electronic configuration of its atom is $[Kr]\ 4d^45s^2$. <br> • Since we always remove electron from the higher energy shell first, the electronic configuration of the molybdenum ion, $Mo^{4+}$, should be $[Kr]\ 4d^25s^0$. |

| Qn | Ans | Detailed Explanations |
|---|---|---|
| 27 | C | • Topic: Transition Elements on ligands<br>• In a solution of chromium(III) chloride, we will have $[Cr(H_2O)_6]^{3+}$ complex ions where 6 $H_2O$ molecules will donate their lone pair of electrons to form dative bonds with $Cr^{3+}$.<br>• When limited amount of aqueous sodium hydroxide is added, we will obtain grey green precipitate of $[Cr(OH)_3(H_2O)_3]$.<br>• When excess amount of aqueous sodium hydroxide is added, the precipitate dissolves to form complex ion of $[Cr(OH)_6]^{3-}$.This is similar to the reaction between $Al(OH)_3$ and excess NaOH to form $Na(Al(OH)_4)$. |
| 28 | C | • Topic: Amides, Hydrolysis of amide linkage<br>• From the first diagram, even though there are 4 amide linkages, we can only break the 2 amide linkages which have the carboxyl groups that contains the benzene ring.<br>• Recall that dipeptide means a peptide that is formed by 2 amino acid residues i.e. only 1 amide bond present.<br>• Option A is incorrect as we will obtain a tripeptide (Left compound has 2 amide linkages) and an amino acid after hydrolysis.<br><br><br>Tripeptide      Amino Acid<br><br>• Option B is incorrect as we will obtain a dipeptide and 2 amino acids after hydrolysis, with 2 regions being hydrolysed.<br><br><br>Dipeptide     Amino Acid 1     Amino Acid 2 |

| Qn | Ans | Detailed Explanations |
|----|-----|----------------------|
| | | • Option C is correct as we will obtain 2 dipeptides after hydrolysis, with only 1 region being hydrolysed. <br><br>  <br> Dipeptide 1 · Dipeptide 2 <br><br> • Option D is incorrect as we will obtain a dipeptide and 2 amino acids after hydrolysis, with 2 regions being hydrolysed. <br><br>  <br> Amino Acid 1 · Amino Acid 2 · Dipeptide |
| 29 | B | • Topic: Electrochemical cell, standard electrode potential <br> • All the concentrations should be $1 \, mol \, dm^{-3}$ when measuring electrode potential under standard conditions. <br> • Exact same question as 2015 A Level Q10. |
| 30 | B | • Topic: Electrolysis, It=nF formula <br> • The challenge to this question is in terms of visualizing the information provided. <br><br>  <br><br> • First we want to find out the amount of copper atoms which need to be formed. <br> ○ To cover the length of the plate, we need $\dfrac{0.1}{3.0\times10^{-12}} = 3.3333\times10^{10}$ atoms <br> Hence, the amount of copper atoms required is <br> $$\dfrac{\left(3.3333\times10^{10}\right)^{2}(1000)}{6.02\times10^{23}} = 1.8456 \, mol$$ |

| Qn | Ans | Detailed Explanations |
|----|-----|----------------------|
|    |     | • Second, we need to know the half equation for the formation of copper atoms <br> $$Cu^{2+} + 2e^- \rightarrow Cu$$ <br> Hence the amount of electrons involved in the reaction is <br> $$(1.8456)(2) = 3.6913 mol$$ <br> • Third, we can find the time required by applying the equation It=nF <br> $$4t = (3.6913)(96500) \Rightarrow t = 89055s = 24.7h$$ |