ANSWERS: **Identifying organic substances (Level 2)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2021** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **1. (i)**  **(ii)**  **2.** | Add acidified potassium permanganate. Propan-1-ol will react to form  propanoic acid, turning the purple permanganate colourless.  CH3CH2CH2OH + MnO4– / H+ 🡪 CH3CH2COOH  3-chloropentane will not react.  Add bromine water. Pent-1-ene will react to form 1,2-dibromopentane, turning the orange / brown bromine water colourless.  CH2CH(CH2)2CH3 + Br2(*aq*) 🡪 CH2BrCHBrCH2CH2CH3  Propan-1-ol will not react (or will only slowly react in the presence of UV light).  Add water to all samples. The one that forms two layers is pent-1-ene. The other two compounds are miscible in water.  Slowly heat both remaining samples until you reach their boiling points. This will be when the liquid samples turn into gases. The one with the lower boiling point is ethanol / the higher boiling point is propan-1-ol.  *No penalty for correctly using boiling / melting points to identify all 3*  *substances. Pent-1- ene < ethanol< propan-1-ol.* | Identifies correct observation for BOTH reagents.  OR  Identifies ONE correct product.  Identifies pent-1-ene using solubility.  OR  Identifies a difference in boiling point between ethanol and propan-1-ol. | Correctly distinguishes ONE pair of compounds with correct reagents, observations and structural formulae of the products.  OR  Correctly distinguishes TWO pairs of compounds with correct reagents, observations and names products only.  Correctly links physical properties to all 3 substances. | Correctly distinguishes  BOTH pairs of  compounds with correct reagents, observations and  structural formulae of the products.  Devises a method which allows for the correct identification of the 3 compounds. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2020** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **1.**  **2.** | When sodium hydrogen carbonate solution is added to each of the three liquids:  Ethanol and hexene can be distinguished, as ethanol will be soluble/mix in the aqueous solution no layers seen and hexene will be insoluble and will form two layers.  Propanoic acid can be identified, as bubbles of CO2 will be seen (and there will be one layer) due to it being an acid-base reaction / neutralisation /acid carbonate reaction.    **Bromine water**  The bromine water with propanoic acid will remain red-brown / orange / brown / yellow colour OR react slowly in presence of UV light with the red-brown / orange / brown / yellow colour fading to colourless..  Bromine water with hexene will have a colour change from red-brown / orange / brown / yellow colour to colourless. This is an addition reaction.  OR  **Acidified Potassium permanganate**  The potassium permanganate with propanoic acid will remain purple. There will be no reaction.  Potassium permanganate will have a colour change from purple to colourless in the hexene. This can be considered an addition and / or an oxidation reaction.  OR  **Non Acidified Potassium Permanganate**  The potassium permanganate with propanoic acid will remain purple. There will be no reaction.  Potassium permanganate will have a colour change from purple to brown in the hexene. This can be considered an addition and / or an oxidation reaction.  **Valid test (not Litmus)**  E.g. a reactive metal will identify propanoic acid, as bubbles of gas will be observed. This is a metal acid reactions. E.g. magnesium metal  Diagram  Description automatically generated  Hexene with magnesium no reaction as no bubbles will be observed. | • ONE correct  observation. (Do not  accept observation with water and ethanol /hexene)  OR  One correct organic product (name or formula).  • Correct reagent identified.  • Correct observation. | Links observations to  chemical or physical property for ONE organic molecule.  Links reagent to a correct observation OR  reaction type. | Outlines a valid procedure that correctly identifies and justifies each liquid with correct chemical equation.  Explains the reagent,  observations, and reaction type to distinguish the molecules. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2019** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **1.**  **2.** | Potassium permanganate will turn from purple to colourless / pale pink / brown when mixed with compound **A**, whereas there would be no observable change with compound **B**. This is an oxidation reaction.    Sodium carbonate, Na2CO3, solid or solution can be used as it will fizz with **C**, which is a carboxylic acid in an **acid-base reaction** /neutralisation. The amine functional group of **B** would not react, as it is a base like the sodium carbonate.  Any carbonate or hydrogen carbonate is acceptable.  OR add a strip of Mg metal to both **B** and **C**. **C** will fizz, producing gas as it is an **acid-metal reaction** because **C** is a carboxylic acid.  The amine (**B**) functional group would not react with the Mg metal. | • Identifies the type of reaction.  OR  States the colour change.  • Identifies TWO functional  groups.  • Identifies TWO correct  observations for two tests.  • Chooses a valid reagent. | • Links the observation to the reaction type.  • Links TWO functional groups to correct reagent and observations.  • Links correct reagent to correct observations. | • Accurate table with  explanation of a reaction, and observations that  distinguish the functional groups. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2018** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| **(a)**  **(b)**  **(c)** | Ethanoic acid is an acid so will react with the solid sodium hydrogen carbonate to produce carbon dioxide gas as this is an acid-base reaction. Therefore fizzing will be observed. The propan-1-amine is a base and will not react with the NaHCO3.  When bromine water is added to hex-1-ene, it will quickly decolourise from a red-brown colour. This is an addition reaction forming dibromohexane. There will be no colour change with hexane or ethanol. When water is added to hexane and ethanol, two layers will form with hexane. Hexane is a non-polar molecule so there will not be any attraction to the water. Ethanol is a polar molecule so it will be miscible with water.  *There is no penalty for using only bromine water to distinguish all three liquids.*  The OH group on the alcohol can be identified by a reaction with warm, acidified potassium dichromate, H+ / Cr2O72–. The colour change observed will be orange to green as the alcohol oxidises to a ketone *(Level 3 Chemistry)* in a redox / oxidation reaction.  The double bond of propene can be identified using bromine water, which turns colourless from orange-brown rapidly as a dibromoalkane is formed in an addition reaction.  KMnO4(*aq*) cannot be used because both an alcohol and an alkene will react with it. The alcohol would be oxidised to a ketone *(Level 3)* and the alkene would form a diol. Colour change purple to colourless/brown or pale pink.  *(No products from identification reactions needed)* | Identifies that the acid will react  with the NaHCO3.  States that bromine water will react with hex-1-ene.  Recognises that alcohol is water soluble  States a reagent that can be used to identify ONE product.  Matches ONE correct  reagent with the correct  reaction type OR  observation | Links the acid-base reaction  to **observations** to identify  the liquids  Links an identification method to an explanation to distinguish two of the molecules with observations  Links appropriate chemical test and the reaction type to ONE functional group, with observations.  e.g Bromine, addition, alkene, orange to colourless  Dichromate, oxidation, alcohol,  orange to green  Links KMnO4(*aq*) to reacting with both organic products, both oxidation, and either oxidation products(diol, ketone carboxylic acid) OR colour change | Identifies **all three** molecules linking to properties of the  molecules with observations.  Links correct chemical tests and reactions to both organic products  AND explains why  KMnO4(*aq*) can’t be  used. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2015** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  | Three liquids will be identified and the fourth will be the ‘last one’. The tests used to identify the liquids include:  Cr2O72– / H+ which will turn from orange to green when the ethanol is oxidised to ethanoic acid.  Ethanoic acid can be identified by an acid-base reaction with sodium carbonate. Bubbles of gas will be produced. Sodium ethanoate / ethanoate ion is formed.  Hex-2-ene can be identified by an addition reaction with bromine water, which turns from red / brown to colourless straightaway when added to the alkene. It will form 2,3-dibromohexane  Hexan-1-amine will be the chemical left over that will not react with any of the given reagents. | Identifies TWO types of  reactions occurring.  OR  States TWO correct observations.  OR  Identifies TWO organic products correctly. | Links appropriate  provided reagents to  observations correctly  for TWO liquids.  OR  Links appropriate provided reagents to the correct type of reaction for TWO liquids. | Outlines a valid  procedure which  correctly identifies  each liquid using  appropriate provided  reagents  AND  Identifies the type of reaction and products of each reaction. |

<https://www.chemical-minds.com>

NCEA questions and answers reproduced with permission from NZQA