NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2021

TECHNICAL SCIENCES: PAPER II

MARKING GUIDELINES

Time: 1,5 hours 75 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

QUESTION 1

1.1 D
1.2 B
1.3 A
1.4 D
1.5 D

QUESTION 2

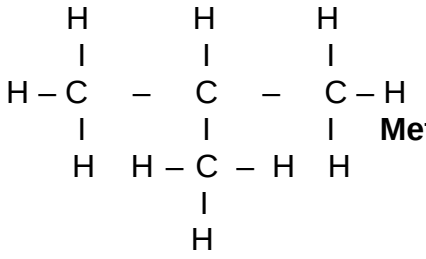
2.1 Unsaturated compounds contain covalent double or triple bonds between the carbon atoms.

2.2 D
E

2.3 Carboxylic acids

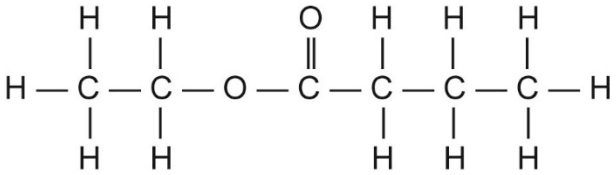
2.4 2.4.1 Propan-1-ol
2.4.2 Butanoic acid

2.5 2.5.1



Three carbons
Methyl group on second carbon

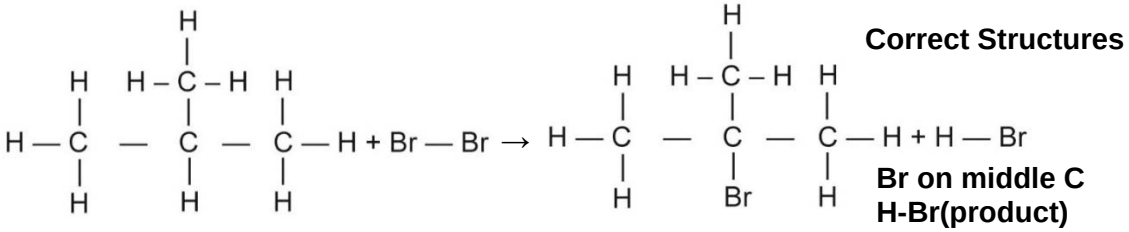
2.5.2



Functional group **Whole structure correct**

2.6 2.6.1 Substitution/Bromation/Halogenation

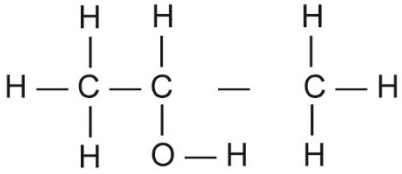
2.6.2



Correct Structures
Br on middle C
H-Br(product)

2.7 Positional isomers have the same molecular formula, but different positions of the side chains, substituents or functional groups on the parent chain.

2.8



O–H group must be on the middle C

Correct number of carbon atoms

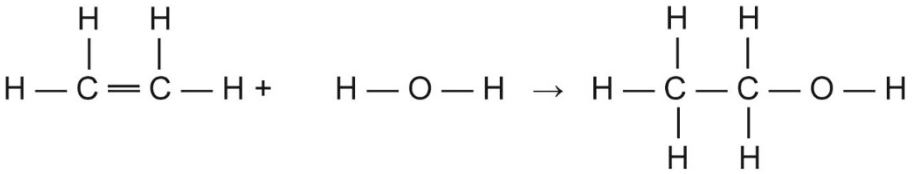
QUESTION 3

3.1 HCl ✓

3.2 There must be no water present.

3.3 Water or H_2O
Hydration

3.4



3.5 NaOH/KOH or sodium hydroxide/Potassium hydroxide

3.6 Substitution

QUESTION 4

4.1 The temperature at which the vapour pressure equals atmospheric pressure.

OR

The temperature at which the vapour pressure equals the atmospheric pressure of the liquid and the liquid is converted to vapour.

4.2 Butanol has longer chain length/larger contact surface than methanol. Intermolecular forces/London forces increase with chain length. Therefore, butanol needs more energy to overcome the intermolecular forces. Therefore, butanol will have a higher boiling point than methanol.

4.3 Butane has weak London forces between the molecules and butanol has strong hydrogen bonds between molecules. Stronger intermolecular forces need more energy to overcome the intermolecular forces. That is why butanol has a higher boiling point than butane.

OR

Butane has weak London forces between the molecules and butanol has strong hydrogen bonds between molecules. Weaker intermolecular forces need less energy to overcome the intermolecular forces. That is why butane has a lower boiling point than butanol.

4.4 Butanol will have the highest viscosity.
Butanal has dipole-dipole forces and butan-1-ol has hydrogen bonding, Hydrogen bonding is stronger than dipole-dipole. Substances with the strongest intermolecular forces will have the highest viscosity.

QUESTION 5

5.1 Small organic molecules that can be covalently bonded to each other in a repeating pattern.

5.2 Film wrap
Bread plastic bags
Shopping and dry-cleaning bags
Freezer bags
Squeeze bottles
Or any other correct use

QUESTION 6

6.1 Electrical energy → Chemical energy

6.2 Carbon.
Carbon does not react easily with other substances and it conducts electricity.

6.3 The loss of electrons./In terms of oxidation numbers: oxidation is an increase in the oxidation numbers.

6.4 6.4.1 Oxidation will take place at the positive electrode.

6.4.2 Small chlorine bubbles will form there.

6.4.3 $2Cl^- \rightarrow Cl_2 + 2e^-$

6.5 The copper chloride will lose its blue colour and become colourless.
The copper ions/Cu^{2+} in the solution are reduced to copper/Cu solid which forms a precipitate/plates on the electrode.

QUESTION 7

7.1 Galvanic cell /Voltaic cell

7.2 A salt bridge.
Completes the circuit.

OR

Provide a passage for ions to ensure electrical neutrality between the two half-cells.

7.3 Zinc – electrode.
Oxidation takes place.

7.4 $E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$
$= 0,34 - (-0,76)$
$= 1,1$ V

7.5 Spontaneous reaction.

7.6 $Zn_{(s)} / Zn^{2+}_{(aq)} // Cu^{2+}_{(aq)} / Cu_{(s)}$

7.7 Environmentally friendly
Renewable
Sustainable
Affordable

7.8 Biodiesel
Fuel cells
Photovoltaic cells
Wind turbines

Total: 75 marks