NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020

TECHNICAL SCIENCES: PAPER II

MARKING GUIDELINES

Time: 3 hours 150 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 B
1.2 D
1.3 B
1.4 A
1.5 D
1.6 B
1.7 B
1.8 B
1.9 C
1.10 C

QUESTION 2

2.1 2.1.1 Ethanoic acid

2.1.2 But-1-anol/1-Buthanol

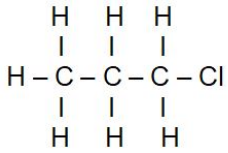
2.2 2.2.1 Functional isomers have the same molecular formula, but different functional groups.

2.2.2 A
E

2.2.3 Ketone and
Aldehyde

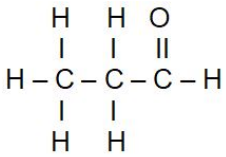
2.3 Hydration

2.4 2.4.1



√ Cl- ion
√ 3 C atoms

2.4.2



O
II
√ -C – H
√ 3 C atoms

2.5 A chemical compound that contains carbon-carbon double or triple bonds.
OR
Unsaturated compounds contain covalent double or triple bonds between carbon atoms.

2.6 C

2.7 Ethyl propanoate

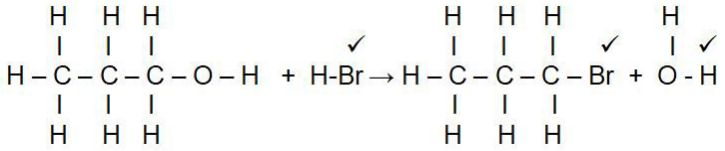
QUESTION 3

3.1 Addition
A double bond was broken to form a bond with a new substance.

3.2 HBr

3.3 NaOH

3.4



3.5 Hydro halogenation

3.6 Water must be in excess.
OR
An acid catalyst is needed for the reaction to take place.

QUESTION 4

4.1 The temperature at which a solid changes to a liquid at an atmospheric pressure.

4.2 Pentane.
Pentane is an alkane that has very weak London forces between the molecules and therefore little energy is needed to overcome the intermolecular forces when it changes phase and therefore it has a low melting point.

4.3 The pressure exerted by the gas in equilibrium with a solid or liquid in a closed container at a given temperature.

4.4 Pentanol.
Pentanol has strong hydrogen bonds that need a lot of energy to break. So molecules do not evaporate easily and there is a low vapour pressure.
OR
It has the higher melting point and melting point is inversely proportional to vapour pressure.

4.5 The chain length and the number of branches. The longer the chain and the more the branches, the higher the boiling point.

QUESTION 5

5.1 A monomer is a single unit and a polymer is a large number of single units joined by the same type of linkage.

5.2 High-density polythene

5.3 (Complete) combustion

5.4 $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

QUESTION 6

6.1 6.1.1 When the angle of incidence is greater than the critical angle, the ray of light reflects into the original medium.

6.1.2 Light must travel from dense to less dense medium.
The angle of incidence must be bigger than the critical angle.

6.1.3 Telescope
Binoculars
Periscope or Endoscope

6.2 Same size of object.
Distance from object to mirror is the same as mirror to image.
Image is virtual.
Images are also parity inverted – left-right inversion.
Image is upright.

6.3 6.3.1 45°

6.3.2 Normal

6.4 6.4.1 Refraction of light

6.4.2 Dense to less-dense medium.

6.4.3 Speed of light

QUESTION 7

7.1 Dispersion of white light.

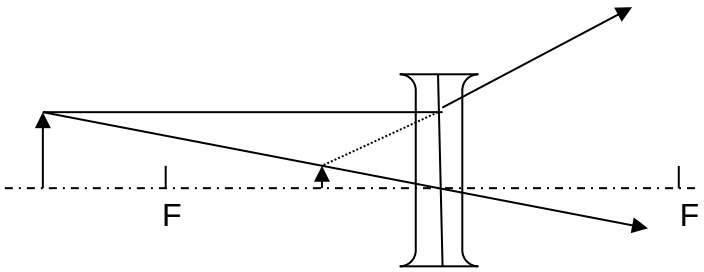
7.2 Red
Orange
Yellow
Green
Blue
Indigo
Violet (**IF COLOURS NOT IN SEQUENCE NO MARKS ARE TO BE SUBTRACTED)**

7.3 $c = f\lambda$
$3 \times 10^{8} = f(700 \times 10^{-9})$
$4{,}29 \times 10^{14}$ Hz $= f$

7.4 Violet light has the shortest wave length and will be refracted most. Red light has the longest wavelength and will be refracted least.

7.5 Concave lens

7.6



QUESTION 8

8.1 Self propagating, changing magnetic and electric fields that are mutually perpendicular to each other and perpendicular to the direction of propagation of the wave.

8.2 8.2.1 Sunburn
8.2.2 Treatment of cancer
8.2.3 Night vision devices
8.2.4 Satellite communications

8.3 8.3.1 $E = \frac{hc}{\lambda}$

$$= \frac{6{,}63 \times 10^{-34} \times 3 \times 10^{8}}{1{,}2 \times 10^{-12}}$$

$= 1{,}66 \times 10^{-13}$ J

8.3.2 Gamma rays have a very high level of energy and can penetrate almost any substance.

QUESTION 9

9.1 A reaction where a transfer of e^- takes place.

9.2 Anode
Cl^- donates e^- at that pole, oxidation takes place.

9.3 Magnesium forms on the electrode.
Mg^{2+} -ions receive $2e^-$ and form magnesium atoms which form a magnesium precipitate.

9.4 Electrical energy → Chemical energy (must indicate a change)

9.5 $Mg^{2+}(aq) + 2Cl^-(aq) \rightarrow Mg(s) + Cl_2(g)$ balancing

QUESTION 10

10.1 An electrochemical cell that converts chemical energy to electrical energy.

10.2 10.2.1 KNO_3
NO_3^- ions do not form precipitates

10.2.2 It allows the ions to move from one half-cell to the other./ It acts as a switch. / Ensures electrical neutrality./Completes circuit.

10.3 10.3.1 25 °C

10.3.2 $Zn \rightarrow Zn^{2+} + 2e^-$

10.3.3 Oxidation half reaction

10.3.4 $E^\circ_{cell} = E^\circ_{reduction} - E^\circ_{oxidation}$
$= (-0,44) - (-0,76)$
$= 0,32$ V
It will be spontaneous

10.3.5 The electrode potential is positive which indicates that the reaction will take place spontaneously.

10.4 10.4.1 Mg

10.4.2 Ag^+

10.4.3 $Mg(s)/Mg^{2+}(aq) // Ag^+(aq)/Ag(s)$

QUESTION 11

11.1 Energy that can be used again.

11.2 It is a cell that converts energy from the sun into electrical energy.

11.3 No pollution
Renewable energy

Total: 150 marks