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.
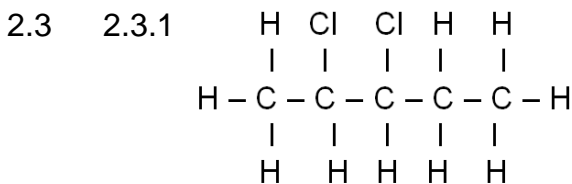

QUESTION 1

1.1   C
1.2   C
1.3   D
1.4   C
1.5   C
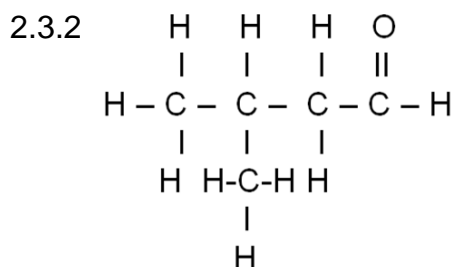1.6   A
1.7   B
1.8   B
1.9   C
1.10 C

[20]

QUESTION 2

2.1   A series of organic compounds that can be described by the same general formula where the one member is separated from the following by a CH_2-group.

2.2   B and F

2.3   2.3.1

5 carbons
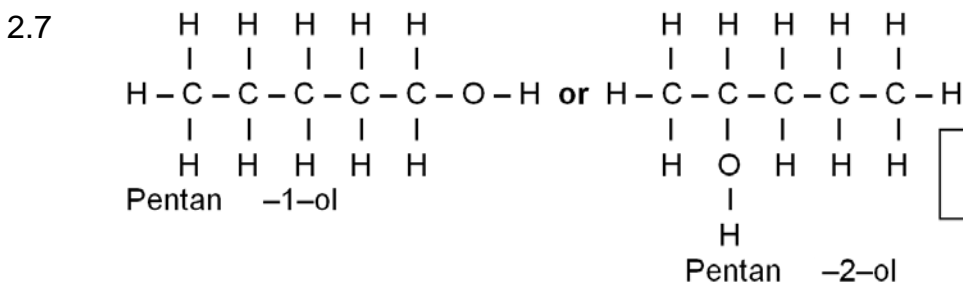2 chlorides

2.3.2

Aldehyde group
Methyl group

2.4   2.4.1   Butanoic acid

2.4.2   Propene

2.5   E

2.6   Positional isomers have the same molecular formula, but different positions of the side chain, substitutions or functional groups.

2.7

Pentan –1–ol   Pentan –2–ol

5 carbons
OH group

QUESTION 3

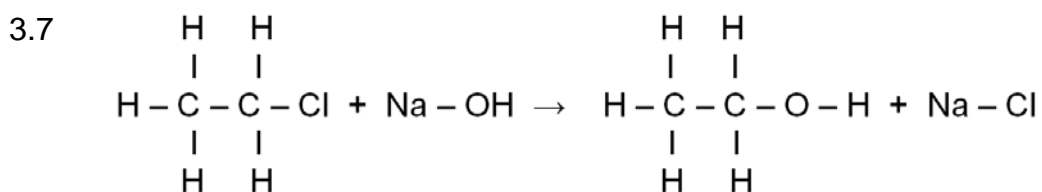3.1   Unsaturated

3.2   Hydrochloric acid

3.3   Hidro-halogenation

3.4   Acid catalyst must be used
       Excess of water (H_2O)

3.5   Sodium hydroxide (NaOH)

3.6   Substitution/Hydrolysis

3.7

QUESTION 4

4.1   Monomer is the basic structural unit (a small molecule) from which a polymer (macro molecule) is made. /Small organic molecule that can be covalently bonded to each other in a repeating pattern.

4.2   Polymerisation

4.3   Electrical insulation
       Milk and fruit juice bottles, butter and margarine containers
       Detergent containers
       Re-usable bottles
       Recycling bins
       Stadium seats
       Traffic barrier cones
       Water & drain pipes
       Toys
       (Any two)

QUESTION 5

5.1   The temperature at which the vapour pressure of the liquid is equal to the atmospheric pressure of the liquid.

5.2   Butanol has a longer chain length than propanol, therefore it has a larger contact surface area and it has stronger London forces than propanol. More (heat) energy is needed for higher kinetic energy to overcome the intermolecular forces and therefore it has higher boiling point.

5.3   5.3.1   London forces

       5.3.2   Dipole-dipole forces

       5.3.3   Hydrogen forces

5.4   The temperature at which the solid and liquid phases of a substance are at equilibrium.

5.5   Butanol

5.6   Butanone has dipole-dipole forces between the molecules. Butanol has strong hydrogen forces between the molecules. Butanol needs more energy to break the hydrogen bonds between the molecules and therefore the melting point will be higher.

5.7   Butene
       It has the weakest intermolecular forces which gives it the lowest viscosity as the layers can move over each other easily.

QUESTION 6

6.1   It is an electrochemical cell where electrical energy is converted into chemical energy.

6.2   A silver layer forms.

6.3   Electrical energy → Chemical energy

6.4   6.4.1   B

       6.4.2   A

6.5 $Ag^+(aq) + 1e^- \rightarrow Ag(s)$

6.6   Instead of using a carbon electrode, the object that is to be silver plated can be connected to the negative pole of the cell and placed in a $AgNO_3$ solution and silver will be deposited on the object.

QUESTION 7

7.1   7.1.1   No, there is no salt bridge to connect the two containers OR The circuit is not completed.

        7.1.2   Chemical energy → Electrical energy

        7.1.3   Zn to Cu

        7.1.4   Cu-electrode

        7.1.5 $Cu^{2+} + 2e^- \to Cu$

        7.1.6 $Zn + Cu^{2+} \to Zn^{2+} + Cu$ + Bal

        7.1.7 $Zn(s)/Zn^{2+}$ (aq)(1mol.dm^{-3}) //Cu^{2+}(aq)(1mol.dm^{-3})/Cu(s)

7.2   7.2.1   Loss of electrons

        7.2.2 $Emf_A = E^{o(reduction)} - E^{o(oxidation)}$
                         $= 0,8 - (-0,44)$
                         $= 1,24V$

                  $Emf_B = E^{o(reduction)} - E^{(oxidation)}$
                         $= -2,36 - (0,85)$
                         $= -3,21$ V

        7.2.3   Reaction A will be spontaneous as the EMF has a positive value.

7.3   7.3.1   PV systems do not emit any harmful air or water pollution.
                  Photovoltaic cells are quiet and no visual disturbance.
                  Small solar plants can be put on roofs of existing buildings.
                  PV cells operate for a long time with little maintenance.
                  Solar energy is a local renewable source of energy.
                  A PV system can be made to any energy requirements.
                  A PV system can be enlarged or moved as the energy requirements change.
                  (Correct answer)

        7.3.2   It can be used in isolated areas or in the middle of cities and towns to generate electricity which is used for, for example, pumping water, lights, activating switches, charging batteries, supplying the electric grid.

QUESTION 8

8.1   8.1.1   Refraction

        8.1.2   The light ray is moving from a dense to a less dense medium. The speed of the wave changes in a different medium and the wave is refracted.

        8.1.3   Critical angle

8.2   8.2.1   Total internal reflection

        8.2.2   Angle of incidence must be bigger than the critical angle.
                    The light wave must move from a dense to a less dense medium.

        8.2.3   Telescope
                    Binoculars

8.3   8.3.1   Normal is a line which is perpendicular to the surface of the reflective object.

        8.3.2   Line of incidence
                    Reflected ray

        8.3.3   40°

        8.3.4   (a)   7 cm

                    (b)   27 cm

                    (c)   Yes

QUESTION 9

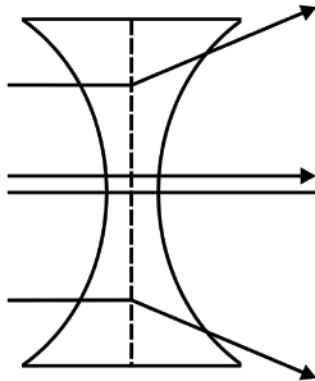9.1   9.1.1   Convex

       9.1.2   Real
                Inverted
                Same size

       9.1.3   When an exact copy of an object is needed.

9.2   9.2.1

       9.2.2   Upright, virtual, smaller than object.

9.3   9.3.1   Dispersion

       9.3.2   The phenomena whereby white light breaks up into its component
                colours.

       9.3.3   Violet

       9.3.4   Violet has the shortest wavelength and is therefore refracted most.

QUESTION 10

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

10.2   Sound waves need a medium for propagation and electromagnetic waves do not.

10.3   Gamma, X-rays, Ultraviolet, Visible light, Infrared, Microwaves, Radio waves.

10.4   10.4.1   X-rays

        10.4.2   Ultra violet rays

10.5 $E = \dfrac{hc}{\lambda}$

$= \dfrac{6{,}63 \times 10^{-34} \times 3 \times 10^{8}}{456 \times 10^{-9}}$

$= 4{,}36 \times 10^{-19}\, J$

Total: 150 marks