NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2020

# TECHNICAL SCIENCES: PAPER II

## MARKING GUIDELINES

Time: 3 hours 150 marks

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**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.**

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## 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 ✓✓

**[20]**

## QUESTION 2

2.1 2.1.1 Ethanoic acid ✓✓ (2)

2.1.2 But-1-anol/1-Buthanol ✓✓ (2)

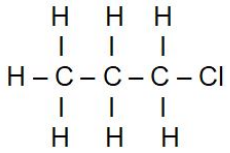
2.2 2.2.1 Functional isomers have the same molecular formula, but different functional groups. ✓✓ (2)

2.2.2 A ✓
E ✓ (2)

2.2.3 Ketone and ✓
Aldehyde ✓ (2)

2.3 Hydration ✓ (1)

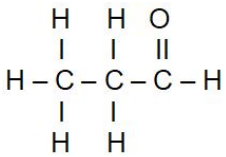
2.4 2.4.1



√ Cl- ion
√ 3 C atoms

(2)

2.4.2



O
II
√ -C – H
√ 3 C atoms

(2)

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)

2.6 C ✓ (1)

2.7 Ethyl ✓ propanoate ✓ (2)

**[20]**

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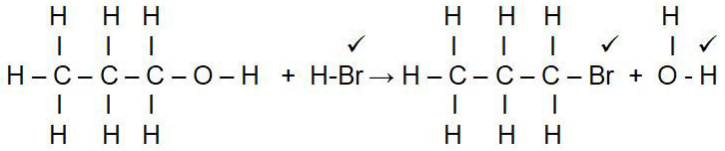
## QUESTION 3

3.1 Addition ✓
A double bond was broken to form a bond with a new substance. ✓ (2)

3.2 HBr ✓ (1)

3.3 NaOH ✓ (1)

3.4




(3)

3.5 Hydro halogenation ✓ (1)

3.6 Water must be in excess. ✓
OR
An acid catalyst is needed for the reaction to take place. ✓ (1)
**[9]**

## QUESTION 4

4.1 The temperature at which a solid changes to a liquid at an atmospheric pressure. ✓✓ (2)

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. (3)

4.3 The pressure exerted by the gas in equilibrium with a solid or liquid in a closed container at a given temperature. ✓✓ (2)

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. (3)

4.5 The chain length ✓ and the number of branches. ✓ The longer the chain and the more the branches, the higher the boiling point. ✓ (3)
**[13]**

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## 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. ✓ (2)

5.2 High-density polythene ✓ (1)

5.3 (Complete) combustion ✓ (1)

5.4 $2C_4H_{10} + 13O_2$ ✓ $\rightarrow 8CO_2 + 10H_2O$ ✓ (2)
**[6]**

## 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. ✓✓ (2)

6.1.2 Light must travel from dense to less dense medium. ✓
The angle of incidence must be bigger than the critical angle. ✓ (2)

6.1.3 Telescope ✓
Binoculars
Periscope or Endoscope (1)

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. (2)

6.3 6.3.1 45° ✓ (1)

6.3.2 Normal ✓✓ (2)

6.4 6.4.1 Refraction of light ✓✓ (2)

6.4.2 Dense to less-dense medium. ✓✓ (2)

6.4.3 Speed of light ✓✓ (2)
**[16]**

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## QUESTION 7

7.1 Dispersion of white light. ✓✓ (2)

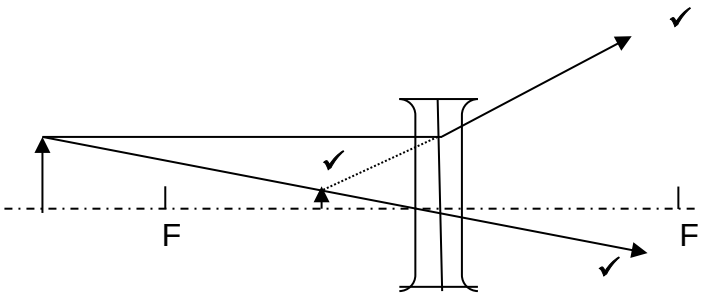
7.2 Red
Orange
Yellow ✓
Green
Blue ✓
Indigo
Violet ✓ (**IF COLOURS NOT IN SEQUENCE NO MARKS ARE TO BE SUBTRACTED)** (3)

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

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. ✓ (3)

7.5 Concave lens ✓✓ (2)

7.6




(3)
**[16]**

## 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. ✓✓ (2)

8.2 8.2.1 Sunburn ✓
8.2.2 Treatment of cancer ✓
8.2.3 Night vision devices ✓
8.2.4 Satellite communications ✓ (4)

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 ✓ (3)

8.3.2 Gamma rays have a very high level of energy ✓ and can penetrate almost any substance. ✓ (2)
**[11]**

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## QUESTION 9

9.1 A reaction where a transfer of $e^-$ takes place. ✓✓ (2)

9.2 Anode ✓
$Cl^-$ donates $e^-$ at that pole, ✓ oxidation takes place. ✓ (3)

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

9.4 Electrical energy ✓ → Chemical energy ✓ (must indicate a change) (2)

9.5 $Mg^{2+}(aq) + 2Cl^-(aq)$ ✓ → $Mg(s) + Cl_2(g)$ ✓✓ balancing (3)
**[12]**

## QUESTION 10

10.1 An electrochemical cell that converts chemical energy to electrical energy. ✓✓ (2)

10.2 10.2.1 $KNO_3$ ✓
$NO_3^-$ ions do not form precipitates ✓ (2)

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. (2)

10.3 10.3.1 25 °C ✓ (1)

10.3.2 Zn ✓ → $Zn^{2+} + 2e^-$ ✓ (2)

10.3.3 Oxidation half reaction ✓ (1)

10.3.4 $E^\circ_{cell} = E^\circ_{reduction} - E^\circ_{oxidation}$ ✓
$= (-0,44) - (-0,76)$ ✓
$= 0,32$ V ✓
It will be spontaneous ✓ (4)

10.3.5 The electrode potential is positive ✓ which indicates that the reaction will take place spontaneously. ✓ (2)

10.4 10.4.1 Mg ✓ (1)

10.4.2 $Ag^+$ ✓ (1)

10.4.3 $Mg(s)/Mg^{2+}(aq) // Ag^+(aq)/Ag(s)$ ✓ ✓ ✓ (3)
**[21]**

## QUESTION 11

11.1 Energy that can be used again. ✓✓ (2)

11.2 It is a cell that converts energy from the sun ✓ into electrical energy. ✓ (2)

11.3 No pollution ✓
Renewable energy✓ (2)
**[6]**

**Total: 150 marks**

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