Education and Sport Development

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NORTH WEST PROVINCE

NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL SCIENCES P2

JUNE 2019

MARKS: 150

TIME: 3 hours

This question paper consists of 13 pages.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of EIGHT questions. Answer ALL the questions in the ANSWER BOOK.

2. Start EACH question on a NEW page in the ANSWER BOOK.

3. Number the answers correctly according to the numbering system used in this question paper.

4. Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.

5. You may use a non-programmable calculator.

6. You are advised to use the attached DATA SHEETS.

7. Round off your FINAL numerical answers to a minimum of TWO decimal places.

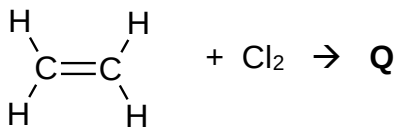
8. Give brief motivations, discussions etc. where required.

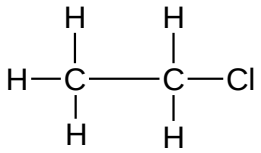
9. Write neatly and legibly.

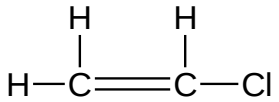
QUESTION 1: MULTIPLE-CHOICE QUESTIONS

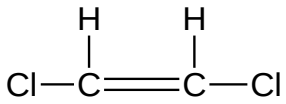
Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK, e.g. 1.7 D.

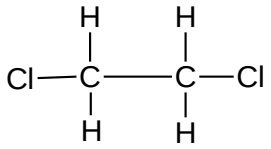
1.1 In the flow diagram below **Q** is the organic compound?



A. 

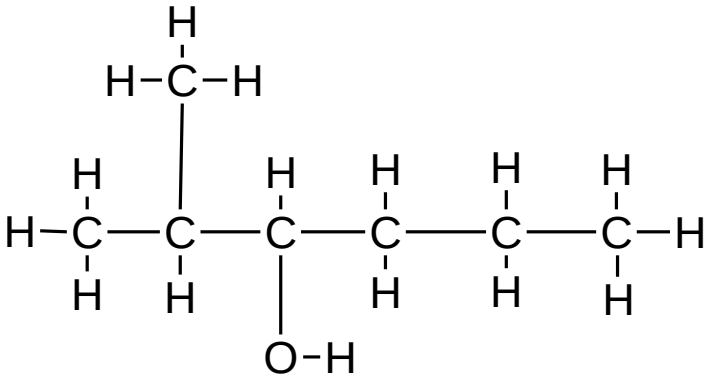
B. 

C. 

D. 

(2)

1.2 Which ONE of the IUPAC names below is CORRECT for the given structure?



A. 4-methalhexanal

B. 3-methyl hexan-2-one

C. 2-methylhexan-3-ol

D. 5-methylhexan-4-ol (2)

1.3 When the group —C≡C— is present in a compound, it could probably have the following IUPAC name:

A. Propyne

B. Butane

C. Ethanol

D. Hexene (2)

1.4 Which monomer is used to produce polyethene?

A. Chloroethene

B. Ethane

C. Chloroethane

D. Ethene (2)

1.5 The boiling points of branched alkanes are lower than that of the straight chain alkane with the same number of carbon atoms, since branched chains have:

A. greater molecular masses

B. shorter chain lengths

C. more electrons

D. smaller effective contact areas (2)

1.6 When a ray of light moves from an optically less dense medium to an optically more dense medium, then the…

A. wavelength and the speed of the light will decrease.

B. wavelength of the light will increase, but the speed of the light will decrease.

C. frequency and speed of the light will increase.

D. wavelength, frequency and speed of the light will decrease. (2)

1.7 A refracted ray of light hits the surface between water and air, as light travels from water to air. Which ONE of the following statements is correct?

A. The angle of incidence is 90˚

B. Total internal reflection occurs

C. The angle of incidence is smaller than the angle of refraction.

D. The angle of incidence is equal to the critical angle (2)

1.8 Which ONE of the following uses best fit with the type of electromagnetic wave?

A. Gamma rays - CT scans

B. Micro wave - Cell phone connections

C. Infrared - Television broadcasts

D. Ultraviolet light - Medical images (2)

1.9 Which ONE of the following is correct regarding the dispersion of white light?

A. Each colour has the same velocity

B. Violet light has the lowest frequency

C. The spectrum starts with red light

D. Red light is refracted last (2)

1.10 Consider the following statements regarding ultraviolet radiation:

(i) It cannot be reflected
(ii) It has a lower frequency than gamma rays
(iii) It is radiated from the sun and may be harmful to humans

Which ONE of the following combinations is correct?

A. (i) and (ii)

B. (ii) and (iii)

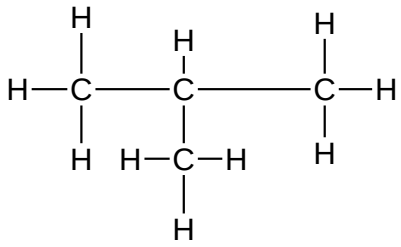
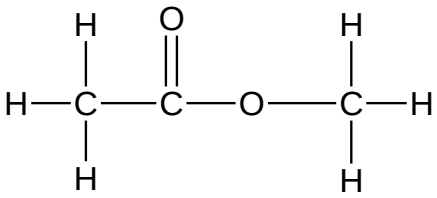
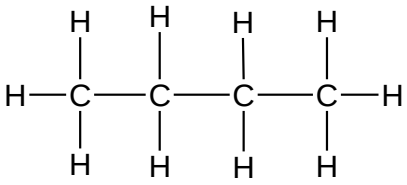
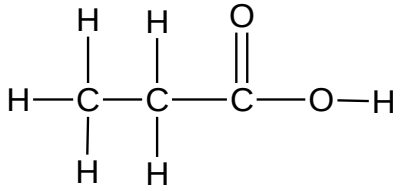
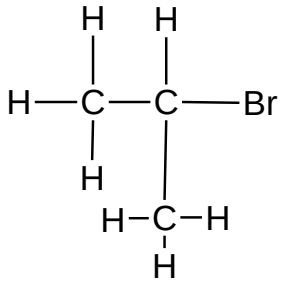
C. (i) and (iii)

D. (i), (ii) and (iii) (2)

[20]

QUESTION 2 (start on a new page)

Consider the representation of organic molecules A to H below.

A		B	
C	Propan-2-one	D	
E		F	Butan-2-ol
G		H	Pent-2-ene

2.1 Define a homologous series. (2)

2.2 Write down the NAME of the homologous series to which EACH of the following compounds belong:

2.2.1 B (1)

2.2.2 C (1)

2.2.3 D (1)

2.2.4 E (1)

2.2.5 F (1)

2.2.6 G (1)

2.2.7 H (1)

2.3 Write down the letter that represents a compound that:

2.3.1 Is a unsaturated hydrocarbon (1)

2.3.2 Has a general formula $C_nH_{2n+1}OH$ (1)

2.4 Write down the:

2.4.1 Molecular formula of the next compound in the same homologous series as compound D (2)

2.4.2 Structural formula of compound F (3)

2.4.3 IUPAC name of compound B (2)

2.4.4 IUPAC name of compound E (2)

2.4.5 Structural formula of the functional group of compound C (2)

2.4.6 Letters of the compounds which are chain isomers (2)

2.4.7 Letters of the compounds which are functional isomers (2)

2.5 Classify compound G as Primary, Secondary or Tertiary. (1)

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QUESTION 3 (start on a new page)

3.1 Ethene, made from natural gas or crude oil, is taken into the manufacturing plant and compressed. The gas is cooled and then passed to a reaction vessel where an initiator starts the polymerisation to form polythene. Unreacted Ethene is separated and recycled to the compressor. The polymer is extruded and cut into pellets.

3.1.1 Define a monomer. (2)

3.1.2 Write down the structural formula of Ethene. (2)

Polythene is the most common plastic. The annual global production is around 80 million tonnes.

3.1.3 Name TWO properties of polythene which makes it useful. (2)

3.1.4 Name TWO uses of polythene. (2)

3.2 Consider the table below and answer the questions that follow.

Systemic name	Formula	Boiling point (˚C)
Fluoromethane	CH_3F	-78,4
Chloromethane	CH_3Cl	-24,1
Bromomethane	CH_3Br	3,6
Iodomethane	CH_3I	42,4

3.2.1 Name the intermolecular forces in alkyl halides (1)

3.2.2 Identify the tendency in boiling points in the table.

Give an explanation for the tendency. (3)

3.2.3 Write down the formula of two alkyl halides that can pose a safety hazard at room temperature (25˚C). (2)

3.2.4 Provide a reason for your answer in QUESTION 3.2.3. (2)

3.2.5 Which compound has the highest viscosity? (1)

3.2.6 Does the viscosity of Fluoromethane INCREASE, DECREASE or REMAIN THE SAME if temperature increase? (1)

3.2.7 Explain your answer in QUESTION 3.2.6 (2)

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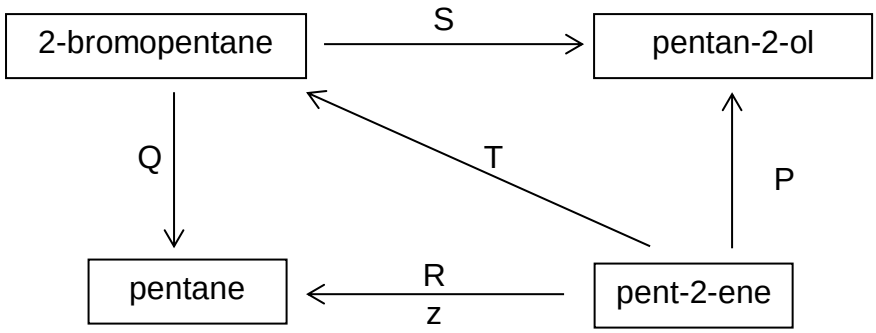
QUESTION 4 (start on a new page)

4.1 Whether we have a street car or a full-on dragster, we want the air and fuel in the chamber to burn at an equal rate and to burn completely. Engines running high octane fuel produce massive amounts of horsepower. Local gas companies are continuously working on developing fuel containing more octane (C_8H_{18}) for new higher class vehicles.

Write a balanced equation to show the complete combustion reaction of octane in excess oxygen. (4)

4.2 Pent-2-ene can be converted to other compounds by means of different organic reactions represented by P, Q, R, S and T, as shown below.



Write down the TYPE of the reaction represented by:

4.2.1 P (2)

4.2.2 Q (2)

4.2.3 R (2)

Observe reaction T;

4.2.4 Give the FORMULA of a suitable hydrogen halide needed for this reaction. (1)

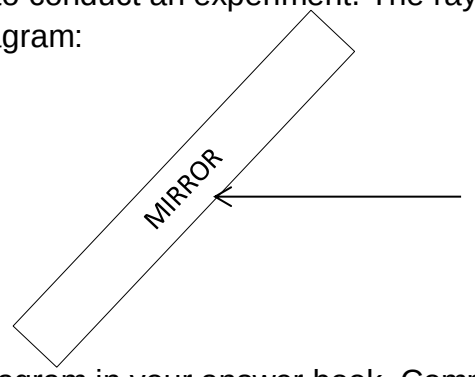
4.2.5 Name TWO reaction conditions required. (2)

4.3 Give the formula of the substance represented by "z" necessary to complete reaction R. (2)

[15]

QUESTION 5 (start on a new page)

5.1 A ray box is used to conduct an experiment. The ray falls on a mirror as displayed in the following diagram:



5.1.1 Copy the diagram in your answer book. Complete the diagram and provide labels. (4)

5.1.2 Write down the laws of reflection. (2)

5.2 When white light falls onto a triangular prism, dispersion is observed.

5.2.1 Define dispersion. (2)

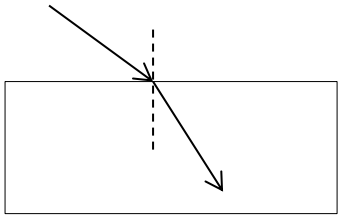
5.2.2 Which colour of light is refracted the most? (2)

5.2.3 Explain the answer to QUESTION 5.2.2 in terms of the wavelength. (2)

[12]

QUESTION 6/*VRAAG 6*

6.1 Copy the following diagram onto your answer book. Clearly indicate the normal, incident ray, angle of incidence, refracted ray, angle of refraction.

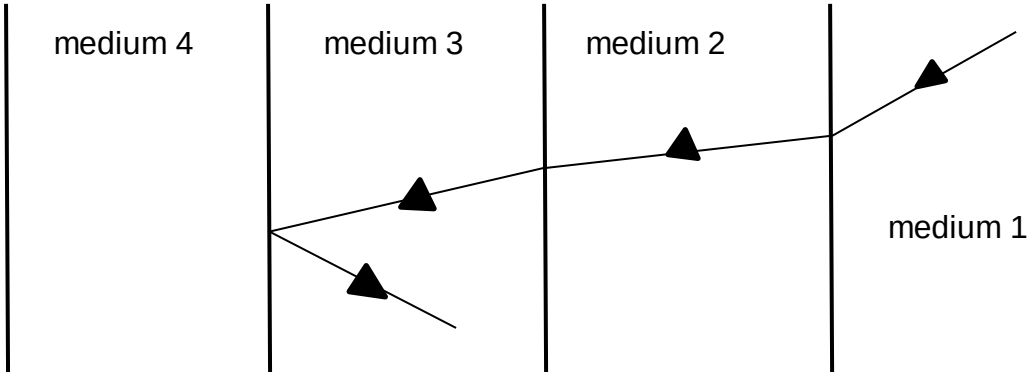


(5)

6.2 Define the term refraction. (2)

6.3 Name three things that can happen to a light ray when it hits an object. (3)

Light moves from medium 1 to medium 2 to medium 3 to medium 4. The following diagram illustrates the path of a ray of light through the different media:



6.4 Identify the phenomenon taking place between medium 3 and medium 4. (1)

6.5 The media in the diagram above have different optical densities.

6.5.1 Which medium is optically denser: medium 1 or medium 2? (1)

6.5.2 Explain the answer to QUESTION 6.5.1. (2)

6.5.3 In which medium, 1, 2 or 3, is the angle of incidence larger than the critical angle? (1)

6.5.4 Justify the answer to QUESTION 6.5.3. (2)

6.6 How does the optical density between medium 3 and medium 4 compare? (1)

6.7 Name TWO:

6.7.1 Conditions for total internal reflection (2)

6.7.2 Applications of total internal reflection (2)

[22]

QUESTION 7/*VRAAG 7* (start on a new page)

There are two types of lenses primarily used in everyday life, convex and concave.

7.1 Give the name of the lens also known as a converging lens. (1)

7.2 Converging lenses are used to rectify sight problems in humans by using them in glasses.

7.2.1 What is the problem with the sight of people who uses converging lenses inside their glasses? (2)

7.2.2 Draw and label a diagram to show the light rays as it moves through a converging lens. Your diagram should include the lens, focal point and the focal length. (3)

7.2.3 Give three uses of converging lenses. (3)

[9]

QUESTION 8/*VRAAG 8* (start on a new page)

In physics, electromagnetic radiation refers to the waves of the electromagnetic field, propagating through space-time, carrying electromagnetic radiant energy.

8.1 Define an electromagnetic wave. (2)

8.2 The table below represents some radiations of the electromagnetic spectrum.

Gamma rays	Micro waves	x-rays	Ultraviolet light	Infrared

8.2.1 Arrange the spectrum in order of increasing wavelength. (5)

8.2.2 In which radiation will a photon have the highest energy? (1)

8.2.3 Explain the answer to QUESTION 8.2.2. (2)

8.3 Briefly explain how electromagnetic waves propagate. (3)

8.4 Give two uses of x-rays. (2)

8.5 Give two disadvantages of x-rays. (2)

8.6 Calculate the energy of a photon of an electromagnetic wave with a wavelength of 800 pm. (5)

8.7 How will the energy of a photon with a wavelength of 850 pm compare with that calculated in QUESTION 8.6? (Write only GREATER THAN, SMALLER THAN or EQUAL TO). (1)

8.8 Identify the electromagnetic radiation best suitable for use in the following:

8.8.1 Keeping food warm (1)

8.8.2 Sterilisation of food and appliances (1)

[25]

Grand total: [150]

DATA FOR TECHNICAL SCIENCES GRADE 12
PAPER 2

GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 12
VRAESTEL 2

TABLE 1/*TABEL 1*

PHYSICAL CONSTANTS/*FISIESE KONSTANTES*		
CONSTANT/*KONSTANTE*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J.s
Speed of light *Spoed van lig*	c	3×10^{8} m.s^{-1}

TABLE 2/*TABEL 2*

WAVES, SOUND AND LIGHT/*GOLWE, KLANK EN LIG*	
Speed/*Spoed*	$c = f\lambda$
Energy/*Energie*	$E = hf$ or/*of* $E = \frac{hc}{\lambda}$

TABLE 3/*TABEL 3*

ELECTROCHEMISTRY/*ELEKTROCHEMIE*	
Emf/*Emk*	$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{oxidising\,agent} - E^{\theta}_{reducing\,agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{reduseermiddel}$