ANSWERS TO 2024 PRELIM 5105 SCCHEM

Paper 3:

1.	В
2.	D
3.	В
4.	В
5.	В
6.	A
7.	В
8.	В
9.	A
10.	С
11.	D
12.	С
13.	А
14.	А
15.	С

16.	Α
17.	С
18.	С
19.	С
20.	В

Paper 4:

Section A Answer all the questions in this section.

1 One of the isotopes of bromine has the symbol shown.

⁷⁹₃₅Br

(a) Complete the table to show the relative mass and relative charge of the particles found in this isotope.

particle	relative mass	relative charge
electron	1/1836 OR 1/1840	1-
proton	1	1+
neutron	1	0

1 mark for at least 2 correct; 2 marks for all correct;

[2]

(b) Determine the number of each of these particles in one atom of the isotope of bromine, ⁷⁹₃₅Br.

number of electrons =35.....

number of neutrons =44..... [2]

number of protons =35.....

1 mark for at least 2 correct; 2 marks for all correct;

2 The diagram shows how the components in petroleum (crude oil) can be separated into different fractions using fractional distillation.



(a)	a) Which of the fractions, A , B , C or D has the highest boiling point?					
	I	D OR BITUMEN	[1]			
(b)	Sugg	est one compound likely to be present in fraction A.				
	Meth	nane/CH ₄ /ethane/C ₂ H ₆ /propane/C ₃ H ₈ /butane/C ₄ H ₁₀	[1]			
(c)	(c) Some fractions like diesel oil, which contain larger molecules, can be broken up smaller molecules by a chemical reaction.					
	(i)	$C_{16}H_{34} \rightarrow substance E + C_2H_4 + C_3H_6$ Name the chemical reaction. cracking.	[1]			
	(ii)	Deduce the chemical formula of substance E . 	[1]			
Prelimina	ary Exam	nination 2024 Secondary Four Normal (Academic Page 2 Science (Chemistry) 5105 Paper 4) 4			

(iii) Name and draw the structural formula of C_3H_6 .

name propene......

structural formula



(iv) C₂H₄ can act as monomers to undergo polymerisation to form polyethene.

Complete the structure of polyethene.



[1]

(d) Bioethanol is produced from sugarcanes and is considered an alternative renewable energy source to fossil fuels like petroleum.

The following description for the use of bioethanol is in a student's notebook. Some words have been left out.

Complete the description by writing in the missing words.

The use of bioethanol is often described to be environmentally sustainable or even 'carbon neutral', as it does not <u>increase</u> the levels of carbon dioxide in our atmosphere.

Bioethanol fuel is obtained through fermentation of <u>sugar/glucose</u>, which is obtained during photosynthesis in sugarcane which absorbs atmospheric carbon dioxide.

This volume of carbon dioxide absorbed in the production of bioethanol offsets the volume of carbon dioxide produced in the <u>combustion/burning</u> of bioethanol.

[3]

3 The diagram shows two versions of the Periodic Table where hydrogen is either placed in Group 1 or not with any group.

version 1



version 2



- (a) With reference to version 1 of the Periodic Table, give a reason why hydrogen can be placed in the same group as the other elements in Group 1.
 Hydrogen has <u>one valence/outer shell/outermost shell</u> electron (in its atom) OR hydrogen can form an ion of 1+ charge (just like elements in Group 1). [1]
- (b) With reference to version 2 of the Periodic Table, state one difference between the physical properties of hydrogen and the other elements in Group 1. Any one:
 - 1. Hydrogen has a lower boiling point than elements in Group 1.
 - 2. Hydrogen exists as a gas at room temperature and pressure while elements in Group 1 exist as solids.
 - 3. Hydrogen is a poor conductor of heat (or electricity) while elements in Group 1 are good conductors of heat (or electricity).
 - 4. Hydrogen has a lower density than elements in Group 1. REJECT chemical properties comparison or no comparison at all.
- [1]
- (c) Margarine is manufactured by passing hydrogen through polyunsaturated vegetable oils to form a solid product.
 - (i) State the type of reaction involved in this process.addition.......[1]

(d) Hydrogen was reacted with oxygen to form water.

(i)	Calculate the number of moles of 225 g of water. [<i>A</i> _r : H, 1; O, 16] Show your working. No. of moles of water = 225 / 18	
	1 mark for working shown; 1 mark for final answer below; number of moles of water = 12.5	[2]
(ii)	Sodium from Group 1 can react with water to form sodium hydroxide and hydrogen gas.	
	Complete the equation for this reaction.	
	$2Na + 2H_2O \rightarrow 2NaOH + H_2$	
	1 st mark is for the 3 substances formula; only when 1 st mark is obtained, 2 nd mark is for balancing equation;	[2]

Section B

Answer one question from this section.

4 Pentadecane, C₁₅H₃₂, can under combustion under different conditions to give different products.

condition	supply of oxygen	products
1	excess	gas P and water vapour
2	limited	gas P , gas Q and gas R

(a) (i) Identify gas P and state the observation when gas P is bubbled through limewater. gas P carbon dioxide / CO₂..... [2] observation white precipitate formed in limewater..... (ii) Methane and gas **P** have similar effects on the environment. Describe the effect of an increased level of methane on the environment.cause (global warming) more extreme weather events (such as [1] flooding) OR melting of polar ice. (iii) Given that gas **P** is an acidic gas, state the colour change when gas **P** is bubbled into Universal indicator solution. colour changes fromgreen...... toyellow/orange/red...... [1] (b) Gas Q is a toxic gas and can be formed by the incomplete combustion of pentadecane. Identify gas **Q**. carbon monoxide / CO..... [1] (i) (ii) 210 cm³ of oxygen is required to completely combust a certain volume of pentadecane. Calculate the minimum volume of air needed at room temperature and pressure. Volume of air = $210/21 \times 100$ [1] volume of air = ...1000..... cm³

Preliminary Examination 2024

(c) Given that **R** has a boiling point of 100 °C, draw a 'dot and cross' diagram of the molecule of **R**. Show only the outer shell electrons.



1st mark for correct overlap of electrons with correct labelling of elements; If 1st mark is obtained, 2nd mark is for correct number of unbonded [2] electrons;

In experiment 1, a student investigated the temperature changes when zinc reacts with copper(II) sulfate. 5 g of zinc powder was added to 30 cm³ of aqueous copper(II) sulfate in a Styrofoam cup. The temperature of the solution was measured every 30 seconds.
 (a) Use the thermometer diagrams to record the temperatures in the table.

t/s	0	30	60	90	120	150	180	210
T / °C	27	27	27	57	79	79	77	75

1st mark for at least four correct; 2nd mark for all correct;

[2]

 (b) Plot the results on the grid below and draw a smooth line graph.
 All points plotted correctly;; (minus 1 mark for one wrong plot) Straight line drawn from point to point;



Preliminary Examination 2024

Page 6

Secondary Four Normal (Academic) Science (Chemistry) 5105 Paper 4

 (c) From your graph, deduce the temperature of the mixture after 75 seconds. Show clearly on the graph (with dotted lines) how you found our answer. Reading taken from the graph at 75 seconds, with dotted lines drawn on the graph. Accepted range: 41 ± 1 °C

[1]

(d) In experiment 2, the student repeated the experiment, but used a **metal** cup instead of a Styrofoam cup.

Describe how the temperature readings will differ in experiment 2 as compared to experiment 1.

Explain your answer.

<u>Temperature readings from student X will</u> generally be <u>less</u> than those of student W; this is because <u>metal is a good conductor of heat (loses heat);</u> while <u>styrofoam is an insulator (or poor conductor) of heat;</u> REJECT if answers include contradiction or 'metal cup absorbs heat'. [2]

END OF PAPER