



WILLETTON SENIOR HIGH SCHOOL

Year 11 Semester One Examination, 2017

Question/Answer Booklet

CHEMISTRY

Student Name: _____

Teacher's Name: _____

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: 2 ½ hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Question booklet
Chemistry Data Sheet

Section	Marks
1	/20
	/30
2	/55
3	/65
total	/150
	%

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils, sharpener, correction tape/fluid, eraser, ruler, highlighters

Special items: up to three non-programmable calculators approved for use in the ATAR examinations

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One: Multiple-choice	20	20	30	30	17
Section Two: Short answer	8	8	55	55	40
Section Three: Extended answer	4	4	65	65	43
Total					100

Instructions to candidates

1. Answer the questions according to the following instructions.

Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Sections Two and Three: Write answers in this Question/Answer Booklet.

3. When calculating numerical answers, show your working or reasoning clearly. Express numerical answers to the appropriate number of significant figures and include appropriate units where applicable
4. You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
5. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, **indicate in the original answer space where the answer is continued**, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Section One: Multiple-choice**17% (30 Marks)**

This section has **20** questions. Answer **all** questions on the separate Multiple-choice Answer Sheet provided. For each question **shade the box** to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. Marks will not be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Suggested working time: 30 minutes.

INSTRUCTIONS

For each question shade the box to indicate the answer.

Use only a blue or black pen to shade the boxes.

For example, if b is your answer

1. a ☐ b ☒ c ☐ d ☐

If you make a mistake, place a cross through that square, do not erase or use correction fluid. Shade your new answer.

For example, if b is a mistake and d is your correct answer:

1. a ☐ b ☒ c ☐ d ☒

In the event that you then change your mind back to your original answer, you then cross out the second selection and then circle the first choice.

For example, if b was the first choice and d your second, but you change your mind back and b is your answer:

1. a ☐ b ☒ c ☐ d ☒

Marks will not be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

1. a ☐ b ☐ c ☐ d ☐
2. a ☐ b ☐ c ☐ d ☐
3. a ☐ b ☐ c ☐ d ☐
4. a ☐ b ☐ c ☐ d ☐
5. a ☐ b ☐ c ☐ d ☐
6. a ☐ b ☐ c ☐ d ☐
7. a ☐ b ☐ c ☐ d ☐
8. a ☐ b ☐ c ☐ d ☐
9. a ☐ b ☐ c ☐ d ☐
10. a ☐ b ☐ c ☐ d ☐

11. a ☐ b ☐ c ☐ d ☐
12. a ☐ b ☐ c ☐ d ☐
13. a ☐ b ☐ c ☐ d ☐
14. a ☐ b ☐ c ☐ d ☐
15. a ☐ b ☐ c ☐ d ☐
16. a ☐ b ☐ c ☐ d ☐
17. a ☐ b ☐ c ☐ d ☐
18. a ☐ b ☐ c ☐ d ☐
19. a ☐ b ☐ c ☐ d ☐
20. a ☐ b ☐ c ☐ d ☐

/20

/30

Section Two: Short answer**37% (55 Marks)**

This section has **8** questions. Answer **all** questions. Write your answers in the spaces provided.

When calculating numerical answers, show your working or reasoning clearly. Express numerical answers to the appropriate number of significant figures and include appropriate units where applicable.

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Suggested working time: 55 minutes.

Question 21**(8 marks)**

- (a) Write the formula of each of the following compounds. (4)

Name	Formula
sodium sulfide	
copper (II) sulfate	
aluminium carbonate	
nitrogen dioxide	

- (b) Write the names of each of the following species. (4)

Formula	Name
$\text{Zn}(\text{NO}_3)_2$	
NH_4^+	
SO_3	
FeCl_2	

Question 22

(11 marks)

- (a) **Draw** a full structural formula and **name** the straight chain isomer of a saturated hydrocarbon containing five carbon atoms. (3)

Name: _____

- (b) Give the **molecular formula** and **draw** a full structural formula for 1,2-dibromo-2-methylbutane. (3)

Molecular Formula: _____

- (c) **Draw** a full structural formula and **name** a branched chain isomer of C_5H_{10} that could be used to create the compound in part (b). (3)

Name: _____

- (d) Name the type of chemical reaction and any chemical(s) required to carry out this conversion from chemical (c) to chemical (b). (2)

Name of reaction type: _____

Chemical/s required: _____

Question 23**(6 marks)**

Draw and **name** the geometric isomers of but-2-ene and use them to explain this type of isomerism. (2)

Name: _____ (2)

Explanation: (2)

Question 24**(5 marks)**

(a) Draw a full structural formula of benzene. (2)

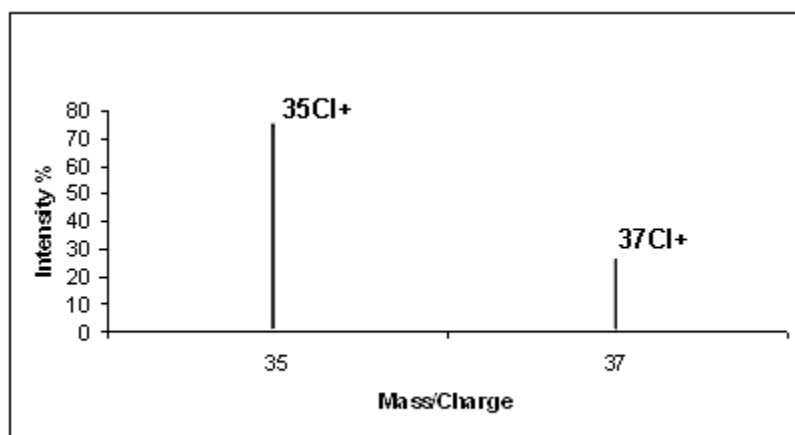
(b) Write a molecular equation and name the main organic product when benzene undergoes single substitution with chlorine gas (Cl_2) in the presence of UV light.

Equation: (2)

Main organic product. _____ (1)

Question 25**(7 marks)**

- (a) What analytical technique was used to produce the graph below? (1)



- (b) Use the information in the graph above to calculate the approximate relative atomic mass of chlorine. (2)

- (c) Draw and label a diagram of a Cl-35 atom showing the location of the nucleus; the number and type of particles in the nucleus and the electron levels. (4)

Question 26**(5 marks)**

Consider the information about some pure substances.

Substance	Melting point (°C)	Boiling point (°C)	Electrical conductivity in solid state	Electrical conductivity in liquid state	Solubility in water
1	1535	2750	good	good	insoluble
2	800	1410	non	good	soluble
3	-259	-253	non	non	insoluble
4	1710	2590	non	non	insoluble
5	50	265	non	non	insoluble

Choose **one** of the substances above that is most likely

(a) a **gas** at room temperature? (1)

(b) to be a **covalent molecular solid**? (1)

(c) to be a **metal**? (1)

(d) a **covalent network** substance? (1)

(e) an **ionic** substance? (1)

Question 27**(10 marks)**

Consider the following chemical reaction in which methane gas (CH₄) reacts in excess oxygen gas.



- (a) How many **moles** of methane are in 10.0 g of methane gas? (1)

- (b) How many **moles** of oxygen gas are required to completely react with 1.85 mol of methane gas? (1)

- (c) What **mass** of carbon dioxide gas is produced from the complete combustion of 25.0 g of methane? (3)

- (d) What is the **mass** of 3.60 moles of methane? (1)

Question 27 contd.

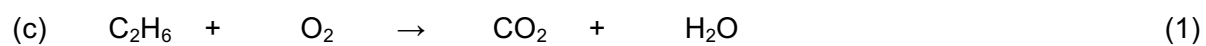
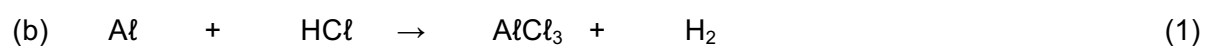
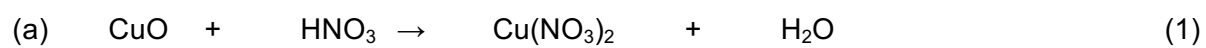
- (e) What **mass** of water vapour is produced by complete combustion of 2.50 mol of methane? (2)

- (f) Determine the percentage composition of methane. (2)

Question 28

(3 marks)

Balance the following equations.



End of Section Two

Section Three: Extended answer

43% (65 Marks)

This section contains **4** questions. You must answer **all** questions. Write your answers in the spaces provided.

Where questions require an explanation and/or description, marks are awarded for the relevant chemical content and also for coherence and clarity of expression. Lists or dot points are unlikely to gain full marks.

Final answers to calculations should be expressed to the appropriate number of significant figures.

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Suggested working time: 65 minutes.

Question 29

(16 marks)

Diamond and graphite are two allotropes of carbon with distinctly different covalent network structures and physical properties. Compare them in terms of the following points.

(a) Covalent network structure.

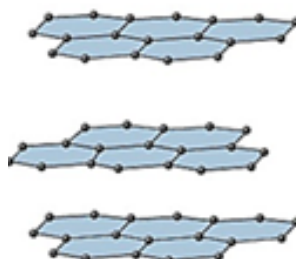
(i) Label the following **once** on the appropriate diagram. (4)

Diamond

Graphite

covalent bond

carbon atom



Source: <http://scienceline.ucsb.edu/getkey.php?key=4545>

Question 29 contd.

- (ii) Compare the covalent network structures of both diamond and graphite. (4)

- (b) Electrical conductivity.

- (i) Explain why diamond does not conduct electricity. (2)

- (ii) Explain why graphite does conduct electricity. (2)

- (c) Hardness of the solid.

- (i) Give two reasons why diamond is so hard. (2)

Reason 1:

Reason 2:

(ii) Give two reasons why graphite is soft. (2)

Reason 1

Reason 2

Question 30

(16 marks)

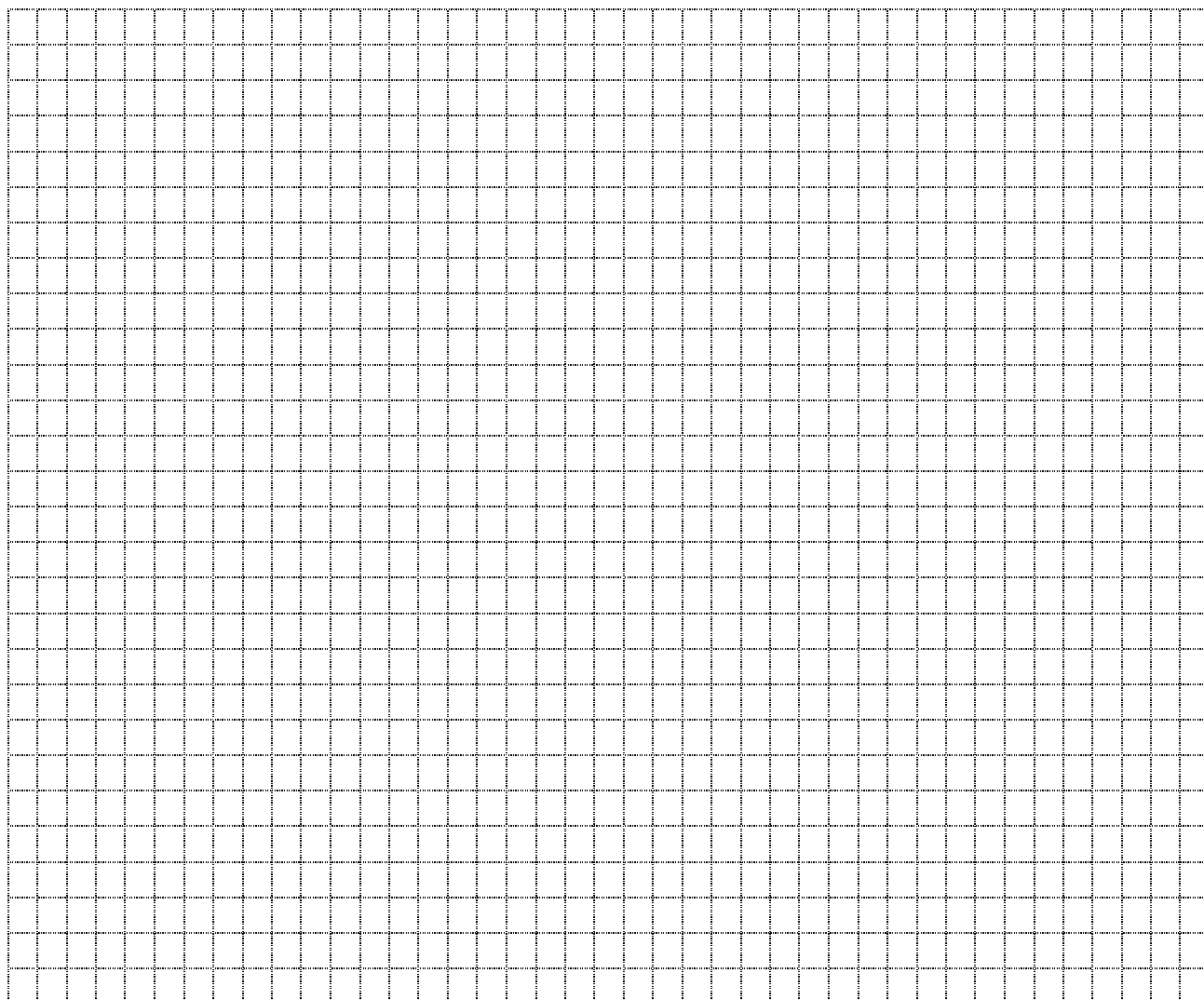
(a) What was Neils Bohr's contribution to the understanding of atomic structure? (2)

(b) How does his contribution explain analytical techniques such as Flame tests and Atomic Absorption Spectroscopy? (3)

Question 30 contd.

- (c) A drinking water sample was thought to be contaminated with lead (II) ions. The absorbance readings, on an Atomic Absorption Spectrometer, of some **known** samples of lead (II) ions are shown below. Draw a **graph** showing the relationship between lead (II) ion concentration and the absorbance level. (5)

Concentration of lead (II) ion (mg L^{-1})	Absorbance
0.0010	10
0.0030	35
0.0070	70
0.010	95
0.013	125
0.016	160
0.020	195



Note: A spare grid is provided at the end of the examination if required

Question 30 contd.

- (d) The suspect drinking water sample was then tested on the same Atomic Absorption Spectrometer and the absorbance measured at 105. Determine if the water is safe to drink and give your reasoning in the space below.

(The maximum acceptable level of lead in drinking water has been established by the National Health and Medical Research Centre at 0.01 mg L^{-1}) (2)

Source: <https://www.nhmrc.gov.au/guidelines-publications/eh52>

- (e) The water sample was retested using a different atomic absorption spectrometer and the lead (II) ions level was found to be below the guideline (below 0.01 mg L^{-1}). Describe an error that could account for this difference in results. (2)

- (f) Describe how the scientist/s conducting this test could improve the reliability of their results. (2)

Question 31**(15 marks)**

Refer to the properties of elements A,B and C in the same period of the Periodic Table to answer the following questions.

Element	Relative atomic radius	Relative electronegativity	Number of valence electrons
A	small	medium	4
B	medium	low	2
C	large	low	1

- (a) Explain the trend in atomic radius and number of valence electrons. (3)

- (b) Explain the trend in the number of valence electrons and electronegativity. (3)

Question 31 contd.

Sodium and chlorine are reactive elements with distinctly different physical and chemical properties. The chemically stable compound formed from these two elements has completely different properties to either element. The reactivity or stability of these three substances is related to their valence electrons.

- (c) Explain these statements, **in terms of their valence electrons**, by completing the following table. (9)

Statement	Explanation	Electron dot diagram (Lewis structure)	Marks
Sodium is a reactive element		Sodium atom	3
Chlorine is a reactive element		Chlorine gas	3
The chemically stable compound formed from these elements has completely different properties to either element		Sodium chloride	3

Question 32**(18 marks)**

Biodiesel can be made from something as simple as used vegetable oil or on a larger scale from crops such as soybeans. Biodiesels are likely to be increasingly used as an alternative to fossil fuels and are considered to have several benefits in comparison to fossil fuels. They can be made from the waste material of food crops such as soybean and produce less carbon dioxide emissions. Other studies suggest that large scale production of biofuels may use land otherwise needed for food crops and that the entire process of producing and transporting biofuels can generate more carbon dioxide than is saved.

Adapted from <http://www.explainthatstuff.com/biofuels.html>

- (a) (i) What is a fossil fuel? (1)

- (ii) Give one example of a fossil fuel (0.5)

- (b) (i) What is a biofuel? (1)

- (ii) Give one example of a biofuel other than biodiesel (0.5)

A typical equation for the complete combustion of biodiesel is shown below.



Source: <http://biofuel.org.uk/how-do-biofuels-burn.html>

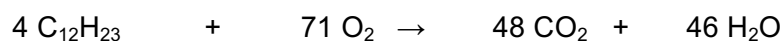
- (c) Determine the mass of CO₂ emissions produced from 1.00 kg of biodiesel. (3)

Question 32 contd.

- (d) Given that 1.00 kg of biodiesel has a volume of about 1.14 L; determine the mass of carbon dioxide emissions from burning 1.00 L of biofuel. (2)

Petrodiesel (normal diesel) is a mixture of hydrocarbons and as such a single chemical equation does not exist for the combustion of diesel.

- (e) The equation below is the accepted “average” equation for the complete combustion of diesel. If 1.00 L of diesel has a mass of 0.832 kg determine the mass of CO₂ gas produced from 1.00 L of diesel. (4)



Source: <https://chembloggreen1.wordpress.com/>

Question 32 contd.

Carbon emissions, i.e. $\text{CO}_{2(g)}$, from the combustion of fuels is an important issue as $\text{CO}_{2(g)}$ is a known Greenhouse gas. However other social, economic and political issues may determine what fuel is actually used.

- (f) Briefly describe a social issue which may influence the fuel used in a particular community. (2)

- (g) Briefly describe an economic issue which may influence the fuel used in a particular community. (2)

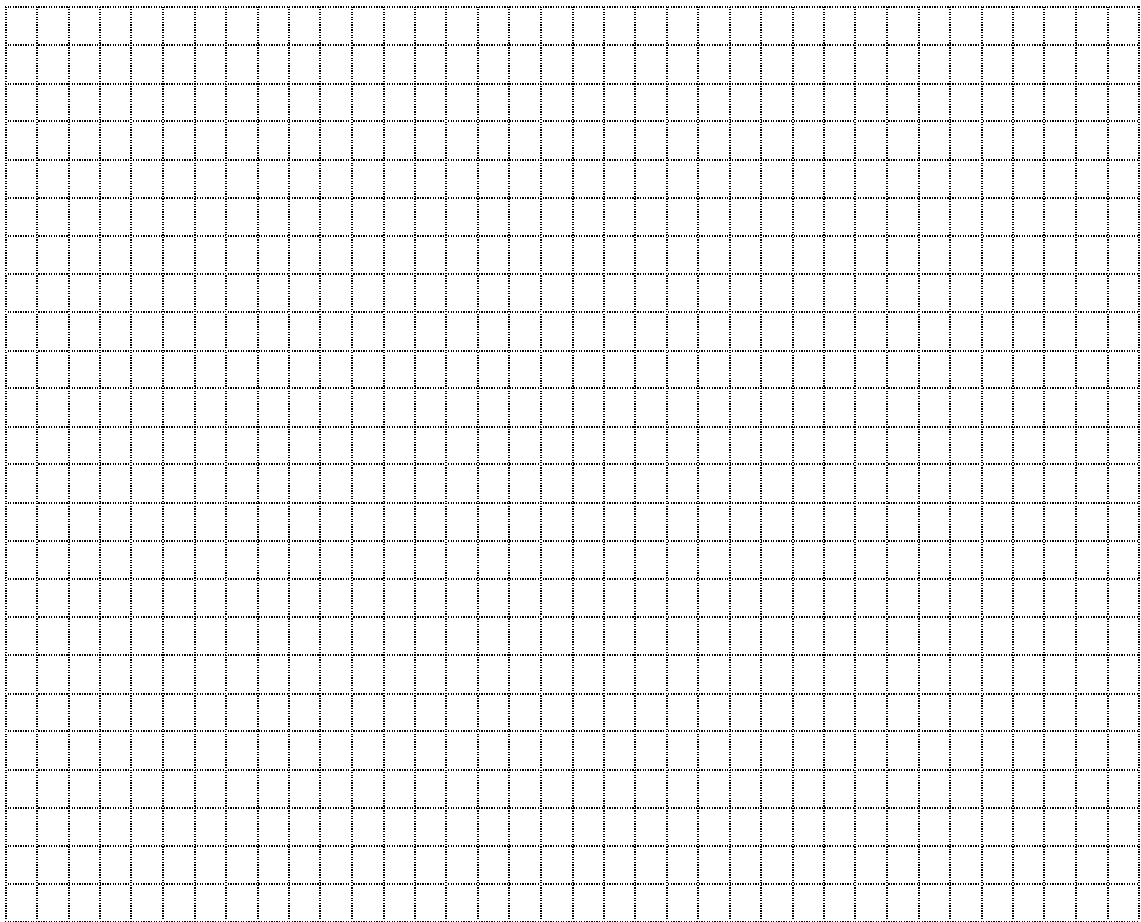
- (h) Briefly describe a political issue which may influence the fuel used in a particular community. (2)

End of questions

Additional Working Space

[illegible]

Spare grid for Question 30



Question Number:

Question Number:

[illegible]