MARKER CODE		Student Personal Identification Number

Solomon Islands National Form Six School Certificate

CHEMISTRY

2017

QUESTION AND ANSWER BOOKLET

Time Allowed: 3 Hours

INSTRUCTION

1. This Exam Paper consists of TWO sections. **ATTEMPT ALL QUESTIONS.**

		MARKS	TIME
SECTION A:	Multiple Choice Questions	40	36 minutes
SECTION B:	Q21: Atomic Structure and Bonding	24	20 minutes
	Q22: Quantitative Chemistry	32	23 minutes
	Q23: Organic Chemistry	44	18 minutes
	Q24: Inorganic Chemistry	16	23 minutes
	Q25: Principles of Physical Chemistry	28	18 minutes
	Q26: Oxidation and Reduction	16	20 minutes
	TOTAL:	**200**	**180 minutes**

2. Write your **Student Personal Identification Number (SPIN)** on the top right hand corner this page and at the top of the **fold-Out flap** on the last page.

3. Write all answers to the Multiple Choice Questions on the answer sheet on the **FOLD-OUT FLAP** on the last page.

4. In **SECTION B**, write the answers to the questions in the spaces provided in this booklet.
   NOTE: A copy of the **Periodic Table of the Elements – Sheet** should be provided.
   The symbol M is used for molar mass.
   For example, M (Mg) = 24 g/mol and M (NH_3) = 17 g/mol

5. Check that this booklet contains pages **1-29** in the correct order and that none of these pages is left blank. Page 28 has been left blank deliberately.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION

SECTION A: MULTIPLE CHOICE QUESTIONS (40 MARKS)

Answer all the questions in this section. Write your best answer in the boxes of the fold-out flap provided on the back of this booklet. Each question is worth 2 marks.

1. The electronic configuration of aluminum ion is

   A. $1s^2 2s^2 2p^6$

   B. $1s^2 2s^2 2p^6 3s^2 3p^1$

   C. $1s^2 2s^2 p^6 3s^2$

   D. $1s^2 2s^2 2p^6 3s^1$

2. Water is a polar molecule, this means that there is

   A. A partial negative charge near the hydrogen atom in the molecule.
   B. A partial positive charge near the oxygen atom in the molecule.
   C. An even distribution of electron density between oxygen and hydrogen in the molecule.
   D. An uneven distribution of electron density between the hydrogen and oxygen in the molecule.

3. What is the most important factor that influences the shapes of covalent molecules?

   A. Lone pair electrons of the central atom.
   B. Size and electronegativity of the bonding atoms.
   C. Electron distribution between the atoms.
   D. The electrostatic force between the bonding atoms.

4. How many chlorine atoms are in 10grams of Chlorine gas (Cl_2)?

   A. $0.28(6.23 \times 10^{23})$.
   B. $0.56(6.23 \times 10^{23})$.
   C. $10.0(6.23 \times 10^{23})$.
   D. $35.5(6.23 \times 10^{23})$.

Aluminum reacted with hydrogen chloride to form a salt of aluminum chloride and hydrogen gas.

5. What is the correct balance chemical equation for the above reaction?

   A. $Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$.
   B. $2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$.
   C. $Al + HCl \longrightarrow AlCl_3 + H_2$.
   D. $2Al + HCl_3 \longrightarrow AlCl_3 + 3H_2$.

In titration, volume of liquid is measured accurately for the neutralization reaction.

6. Name the long glass tube required to carry out a titration.

   A. Pipette.
   B. Burette.
   C. Clamp stand.
   D. Conical flask.

7. Which of the following hydrocarbons does not have isomers?

   A. C_6H_{14}.
   B. C_5H_{10}.
   C. C_4H_8.
   D. C_3H_8.

8. What is the IUPAC name of the isomer of cis-3-hexene?

   A. n-hexane.
   B. trans-3-hexene.
   C. trans-3-hexyne.
   D. trans-3-hexane.

9. Which of the following will undergo an addition reaction with chlorine?

   A. C_6H_6.
   B. $CH_3CH_2CH_3$.
   C. $CH_3CH_2CH=CHCH_3$.
   D. CH_3CH_2COOH.

10. What is the product formed when 2-butene reacted with chlorine?

    A. 1-chlorobutane.
    B. 3-chlorobutane.
    C. 2,3 dichlorobutane.
    D. 2,2 dichlorobutane.

11. Which of the following compounds below will react with ethyne to produce $CH_2BrCHBrCl$?

    A. HCl, then HBr.
    B. HCl, then Br_2.
    C. Cl_2, then HBr.
    D. Cl_2, then Br_2.

12. Dehydration of an alcohol leads to the formation of

    A. Alkene
    B. Alkyne
    C. Alkane
    D. Alkyl hylide.

13. A reaction in which a sulfuric acid reacts with a base to form a salt and water is

    A. Esterification.
    B. Hydrolysis.
    C. Saponification.
    D. Neutralization.

14. Which of the following alcohols forms a **ketone** when oxidized?

    A. 2-propanol.
    B. 1-propanol.
    C. Methanol.
    D. 2-methyl-2-propanol.

15. The monomer $CH_2CH_2CH_2CH_2$ represent polymer named

    A. Polybutylene.
    B. Polyhexene.
    C. Polypropylene.
    D. Polystyrene.

16. What is the correct pH of sodium oxide when dissolved in water?

    A. pH 2.
    B. pH 6.
    C. PH 7.
    D. pH 10.

Compare the following chlorides, NaCl, $MgCl_2$, $AlCl_3$ and PCl_3;

17. Which one of the chloride is the least conductor of electricity?

    A. NaCl.
    B. $MgCl_2$.
    C. $AlCl_3$.
    D. PCl_3.

18. Acids are

    A. Proton donor.
    B. Proton acceptor
    C. Electron donor
    D. Electron acceptor

19. When an atom undergoes oxidation it is

    A. gaining of electron(s)
    B. sharing of electron(s)
    C. losing of electron(s)
    D. losing of oxygen atom(s)

20. The oxidation number for sulfur in SO_4^{2-} is

    A. 0
    B. +4
    C. -6
    D. +6

SECTION B: LONG ANSWER QUESTIONS (160 MARKS)

Answer questions 21-26 in the space provided. All calculations must be showed as required by each question.

Question 21. Atomic Structure and bonding [24 marks]

A. Table below shows the number of protons and neutrons of elements **R, S, T** and **U**

Name of the elements	Protons	Neutrons
R	10	11
S	11	14
T	14	16
U	15	17

Use the information in the table to answer the questions i, ii, iii and iv.

i. Name the elements in the same period _____
1 mark

ii. What is the atomic number for element (T)? _____
1 mark

iii. What is the mass number for element (R)? _____
_____
1 mark

iv. How many electrons does element (S) has after it reacted with a halogen
_____ 1 mark

v. Describe the **bond type** and deduce the melting point of the compound produced when element (S) reacted with a halogen.
_____
_____
_____
_____
2 marks

vi. Explain the trend in atomic radii for elements S, T and U

_____

_____

2 marks

vii. Define the term ionization energy.

_____

1 mark

Q.21 A	
	9 marks

B. The table below shows physical properties of element **X** and Y.

Compound	**Melting point**	**Electrical conductivity**	**Solubility**
X	High	Conduct electricity	Soluble in water
Y	Low	Does not Conduct electricity	Not soluble in water

Study the information in the table and answer the following questions.

i. Which of the above compound is ionic compound? _____

1 mark

ii. Which of the above compound is a covalent compound? _____

1 mark

iii. State the difference in polarity of compounds X and Y.

_____

_____

1 mark

iv. Differentiate between intermolecular forces and intra-molecule forces?

_____

_____

_____

_____

2 marks

v. Explain why metals are said to have ductile property?

_____

_____

2 marks

Q.21 B	
	7 marks

C. Table shows list of covenant compounds and their formula.

Name	Ammonia	Carbon dioxide
Formula	NH_3	CO_2

i. Draw the Lewis structure of Ammonia and Carbon dioxide in the spaces provided below.

1. Ammonia	**2. Carbon dioxide**

4 marks

ii. What is the shape of Ammonia? _____

_____

1 mark

iii. What is the shape of Carbon-dioxide? _____

_____

1 mark

iv. Compare the Ammonia and Carbon dioxide molecule and explain their polarity.

_____

_____

_____

2 marks

Q. 21 C	
	8 marks

Question 22. Quantitative Chemistry [32 marks]

A. Magnesium oxide is a white powder.

$M(Mg) = 24\ gmol^{-1}$ $M(C) = 12\ gmol^{-1}$ $M(O) = 16\ gmol^{-1}$

Use the information above and answer the following questions.

i. What is the molar mass for Magnesium oxide?

_____

_____

_____

2 marks

ii. Calculate the mass of oxygen atom (O) in 12.044×10^{23} compound of Magnesium oxide?

_____

_____

_____

3 marks

900g of the Magnesium ore (MgO) was decomposed to produce pure magnesium metal and oxygen gas according to the word equation

Magnesium oxide -----> magnesium + oxygen gas

iii. Write a balance equation for the reaction above

_____

2 marks

iv. What is the amount [in grams] of magnesium metal produced in the above reaction?

_____

_____

_____

_____

2 marks

Q. 22 A	
	9 marks

B. A substance used as perfumes by the Chinese has been analyzed to have contained **76% lead, 13% chlorine**, **2.2% carbon 8.8 % oxygen**.

M(Pb) = 106gmol^{-1}; M(Cl) = 35gmol^{-1}; [M(C) = 12g mol^{-1}; M(O) = 16gmol^{-1}
molar mass is 868gmol^{-1}

i. What is the empirical for the Chinese perfume?

5 marks

ii. Calculate the molecular formula for the Chinese perfume

3 marks

Suppose 6.0g of blue hydrated Copper (II) sulphate, $CuSO_4.xH_2O$, (x unknown) was gently heated in a crucible until the mass remaining was 4.0g.

M(Cu) = 58.9gmol^{-1}; M(S) = 32.0gmol^{-1}; M(O) = 16gmol^{-1}; M(H) = 1gmol^{-1}

iii. What is the percentage (%) of water crystallization?

2 marks

iv. What is the formula for the $CuSO_4.xH_2O$? Show all working

5 marks

Q. 22 B	
	15 marks

C. Titration is a process of finding the concentration of unknown solution using known concentration of primary standard solution.

i. What is a primary standard solution?

_____

_____

1 mark

25.0 cm^3 of a potassium hydroxide solution was pipetted into a conical flask and titrated with a standard solution of 0.2M hydrochloric acid.
Using phenolphthalein indicator for the titration it was found that 15.0 cm^3 of the acid was required to neutralize the alkali.

M (K) = 39gmol^{-1}; M(O) = 16gmol^{-1}; H (M) = 1gmol^{-1}; M(Cl) = 35gmol^{-1}

ii. Write a balanced chemical equation for the reaction?

_____

2 marks

iii. What is the name of the glassware used to determine the volume of acid?

_____

1 mark

iv. What is the concentration of Potassium hydroxide? 4 marks

Q. 22. C.	
	8 marks

Question 23. Organic Chemistry [44 marks]

Hydrocarbons are compounds made of hydrogen and carbon, such as alkanes, alkenes and alkynes.

A. Use the general formula for of alkanes is $C_nH_{(2n+2),}$ alkenes C_nH_{2n} and Alkynes C_nH_{2n-2}

i. Draw the **structural formula** of given hydrocarbons in the table below.

General formula	**IUPAC Name**	**Structural formula**
$C_nH_{(2n+2),}$	1. Propane	
C_nH_{2n}	2. butene	
C_nH_{2n-2}	3. ethyne	

6 marks

ii. Which of the molecules above is a saturated molecule?

_____

1 mark

iii. Explain the term isomer.

_____

_____

2 marks

iv. In the space below draw the structure of the 2 isomers of but-2-ene and give their correct names.

Structure of Isomer 1	**Structure of Isomer 2**
Name:	**Name:**

6 marks

v. Write a balance chemical equation for the TWO (2) possible products, when methane (CH_4) reacted with chlorine gas. Give the correct IUPAC names of the product formed.

Reaction 1: Products

_____

Reaction 2: Products

_____

4 marks

vi. What is this type of reaction called?

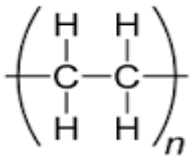
_____

1 mark

Q. 23 A	**20 Marks**

B. Polymers are large hydrocarbon molecules.

i. Draw and name the structure of the monomer used to make the polymer in the table.

Part of the a polymer	Monomer
	Name:

3 marks

ii. Below is table showing structural formula for the 3 different types of alcohol. They are Primary, secondary and tertiary.

Types of alcohol	OH I CH_3CHCH_3	CH_3CH_2OH	CH3 I CH_3CCH_3 I OH
Identify which is **Primary, secondary** and **Tertiary alcohol**	1.	2.	3.

3 marks

iii. Write the formula of the products formed in the oxidation of the following alcohols;

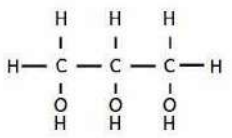
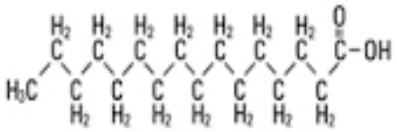
1. CH_3CH_2OH + **[O]** ----> _____ + **[O]** ---->_____

2 marks

2. $CH_3CHOHCH_3$ + **[O]** ----->_____

1 mark

Table below shows names and formula of different compounds

Names	Formula
Ethanoic acid	CH_3COOH
Methanol	CH_3OH
Glycerol	
Palmeotic acid	
Sodium Hydroxide	NaOH

Use the information in the table to answer the following questions.

iv. What are the names of the compounds used to produce an ester?

Compound 1. _____ compound 2. _____

2 marks

v. Draw the structure and give the IUPAC name for the ester produced from the compounds 1 and 2 in question (iv) above.

Structure

Name

3 marks

Given the fatty acid (Palmeotic acid) and glycerol in the table on page 16.

vi. Draw the structure of fat formed from the reaction of glycerol and fatty acid.

Structure of fat

3 marks

vii. What is the common name of the product formed when the fat you have drawn above in question (vi) is reacted with Sodium chloride?

_____

1 mark

viii. Describe how the chemical nature of soap promotes its role as a cleaning agent.

_____
_____
_____
_____
_____
_____
_____

2 marks

ix. Explain hydrogenation of the fatty acids and its effect on the melting point?

_____

_____

_____

_____

2 marks

x. Describe the test used to differentiate glucose open structure from glucose close structure.

_____

_____

_____

_____

2 marks

Q.23 B	
	24 marks

Question 24. Inorganic Chemistry [16 marks]

A. The table below shows the oxides and Chlorides of period III elements.

Element	**Sodium**	**Magnesium**	**Aluminum**	**Silicon**	**Sulfur**
Oxide	Sodium oxide	Magnesium oxide	Aluminum oxide	Silicon dioxide	Sulfur dioxide
Chlorides	Sodium chlorides	Magnesium chloride	Aluminum chloride	Silicon chloride	Sulfur chloride

i. What is the molecular formula for Silicon dioxide and Aluminum chloride?

1. Silicon dioxide _____
2. Aluminum chloride _____

2 marks

ii. Identify at least TWO basic oxides from the table above?

_____

2 marks

iii. Explain the trend in oxides' melting points, as you go from Sodium oxide to Sulfur dioxide.

_____

_____

2 marks

iv. What is an amphoteric oxide? _____

_____

1 mark

v. Give an example of amphoteric oxide _____

_____

1 mark

vi. Write a balance chemical equation to show basicity of Al_2O_3 2 marks

_____

Q 24 A	**10 marks**

B. Anion and cation reacted differently with aqueous solutions

i. Describe result for solutions containing Al^{3+}, Fe^{2+} and Fe^{3+} in Sodium hydroxide

1. Al^{3+}

_____

_____

2 marks

2. Result with Fe^{2+}

_____

_____

2 marks

3. Result with Fe^{3+}

_____

_____

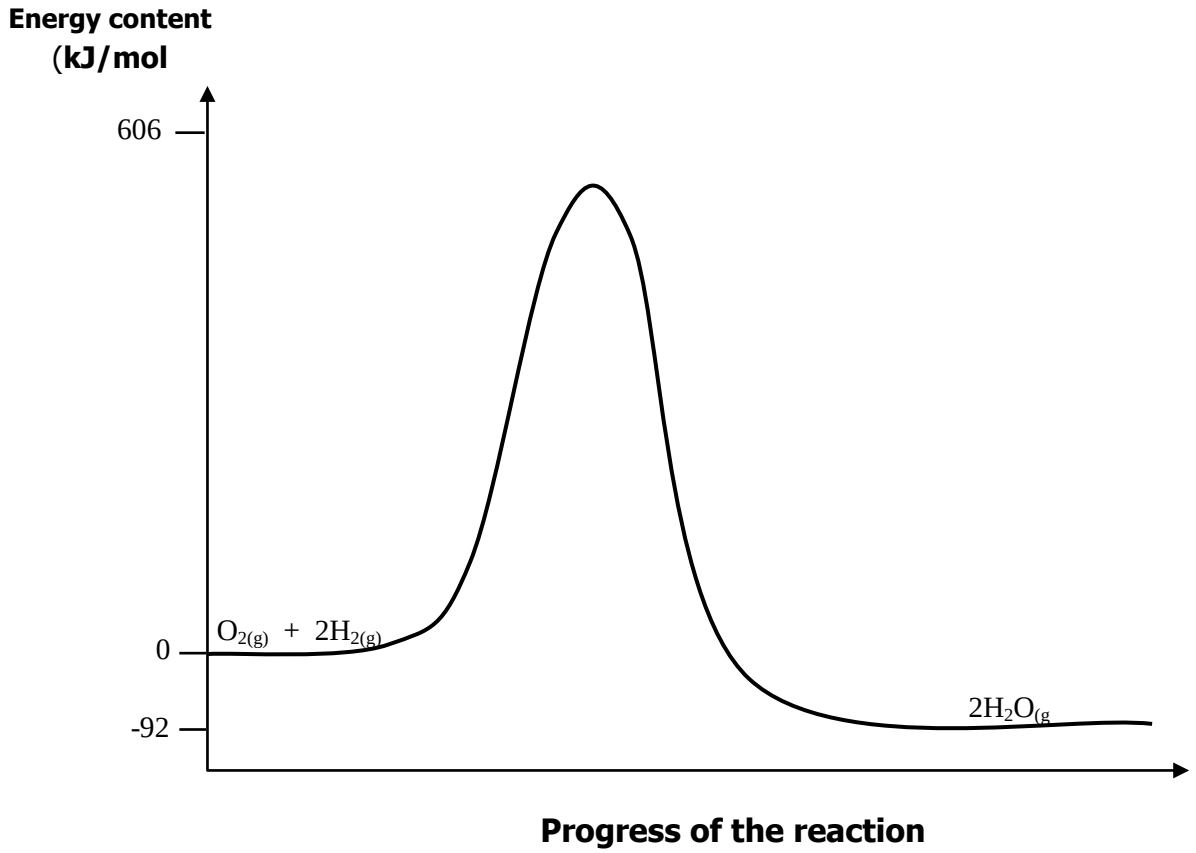
2 marks

Q. 24 B	
	6 marks

Question 25. Principles of Physical Chemistry [28 marks]

A. Diagram below represents the energy profile for the reaction of oxygen and hydrogen to form water.

$$O_{2(g)} + 2H_{2(g)} \rightleftharpoons 2H_2O_{(g)}$$



i. State whether the reaction is endothermic or exothermic?

_____

1 mark

ii. What is the enthalpy change (Δ**H**) for the reaction?

_____

1 mark

iii. What is the **activation energy** for the reaction above?

_____

1 mark

iv. Make a sketch on the energy profile diagram on **page 21** to show what will happen to the **activation energy** for the reaction if a catalyst is added.

2 marks

Q.25 A	**5 marks**

Refer to **question 25 (A)** on **page 21**, and answer the following questions.

B. Consider the reaction of oxygen and hydrogen to form water in [part A].

i. What will happen to the **equilibrium** if the temperature deceases?

_____

2 marks

ii. What will happen to the equilibrium if the pressure increases?

_____

2 marks

iii. What will happen to the equilibrium if water is removed?

_____

2 marks

iv. Using collision theory;

1. Explain how increase temperature affects rate of reaction.

_____

_____

_____

2 marks

2. Explain how decrease concentration of the reactants affects the rate of reaction

_____

_____

_____

2 marks

3. Explain how decreased particle size affects the rate of reaction.

_____

_____

_____

2 marks

Q. 25 B	
	9 marks

C. Given are the following equations and their enthalpy change (ΔH) values to form compound quione ($C_6H_4O_2$).

$C_6H_4(OH)_{2(aq)}$ --------> $C_6H_4O_{2(aq)} + H_{2(g)}$ ΔH = +177 KJ mol-1

$H_{2(g)} + O_{2(g)}$ --------> H_2O_2 $_{(aq)}$ ΔH = -191 Kj mol-1

$H_{2(g)} + {}^1/_2\ O_2$ $_{(g)}$ -------> H_2O $_{(g)}$ ΔH = -241 kJ mol-1

H_2O $_{(g)}$ -------> H_2O $_{(l)}$ ΔH = -43 kJ mol-1

Use the above equations; calculate the ΔH for the formation of compound quione ($C_6H_4O_2$).

i. $C_6H_4(OH)_2$ $_{(aq)} + H_2O_{2(aq)}$ ---------> $C_6H_4O_2$ $_{(aq)} + {}_2H_2O$ $_{(l)}$

4 marks

D. Acid and base reactions are called neutralization reaction;

i. Identify **base** and **conjugate acid** for the reaction below?

$OCl^{-1} + H_2O$ -----> $HOCl + OH^{-1}$

1. Base _____

2. Conjugate acid _____

2 marks

Hydrochloric acid is a strong and acetic acid is a weak acid.

ii. Explain the difference between strong and weak acids, when dissolving in water.

_____
_____
_____

2 marks

iii. What is the pH of hydronium concentration in 4.82×10^{-2}M solution?

_____
_____
_____
_____

3 marks

Q. 25 C & D	
	11 marks

Question 26. Oxidation and Reduction [16 marks]

A. Redox reaction

i. What is the oxidation number for N in the compound [$\mathbf{H_2NO_2}$]

1. Oxidation number for N: _____

2 marks

2. $MnO_4^-(aq) + 5\ H_2C_2O_4(aq) + 6\ H^+(aq) \longrightarrow 10\ CO_2(g) + 2\ Mn^{2+}(aq) + 8\ H_2O(l)$

ii. For the equation above identify which of the reactant is a

1. Reducing agent: _____

2. Oxidizing agent: _____

2 marks

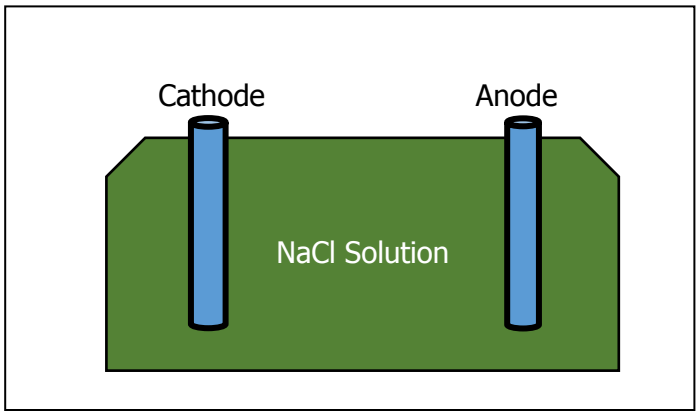
iii. Write the balance half reactions of this unbalance reactions:

$$\mathbf{H_2C_2O_4 + MnO_4^- \text{------>} CO_2 + Mn^{2+}}$$

6 marks

Q. 26 A	**10 marks**

B. Diagram below shows the electrolysis of aqueous **Sodium Chloride solution**



Write a balance equation for the reaction at the following electrodes.

i. Cathode _____

2 marks

ii. Anode _____

2 marks

iii. What is the solution during the electrolysis? _____

_____

1 mark

In the electrolysis of **molten sodium chloride**

iv. What is the product at the Cathode?

_____ 1 mark

Q. 26 B	
	6 marks

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SINF6 - CHEMISTRY 2017

Student Personal Identification Number					

SECTION A:

ANSWER SHEET

1.		11.	
2.		12.	
3.		13.	
4.		14.	
5.		15.	
6.		16.	
7.		17.	
8.		18.	
9.		19.	
10.		20.	

SECTION B
(Markers Only)

Q21.		24
Q22.		32
Q23.		44
Q24.		16
Q25.		28
Q26.		16

SECTION A		SECTION B		TOTAL
40	+	160	=	200