

STUDENT:

TEACHER:

CSE TEST – MAY 2009

YEAR 11 CHEMISTRY

Written test 1

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

QUESTION AND ANSWER BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks	Suggested times (minutes)
A	20	20	20	23
B	7	7	60	67
			Total 80	90

- Students are permitted to bring into the test room: pens, pencils, highlighters, erasers, sharpeners, rulers and a scientific calculator.
- Students are **NOT** permitted to bring into the test room: blank sheets of paper and/or white out liquid/tape.

Materials

- Question and answer book of 15 pages and a copy of the Periodic Table.
- Answer sheet for multiple choice questions.

Instructions

- Write your **name** in the space provided above **and** on the multiple choice answer sheet.
- All written responses must be in English.

At the end of the test

- Place the answer sheet for multiple choice questions inside the front cover of this book.

Students are NOT permitted to bring mobile phones and/or other electronic communication devices into the test room.

SECTION A – Multiple choice questions**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0. Marks will **not** be deducted for incorrect answers.

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

Question 1

The ${}_{16}^{32}\text{S}^{2-}$ and ${}_{13}^{27}\text{Al}^{3+}$ ions **both** have

- A. the same number of electrons.
- B. the same number of electron shells.
- C. the electron configuration of an inert gas.
- D. the same electron configuration as an atom of argon.

Question 2

The electron configuration $1s^2 2s^2 2p^4 3s^2 3p^6 3d^5 4s^2$ is **most likely** to be that of

- A. an atom of the element vanadium in the ground state.
- B. a negative ion of titanium in an excited state.
- C. a positive ion of chromium in the ground state.
- D. an atom of the element vanadium in an excited state.

Question 3

Which one of the following elements is most likely to have been discovered first?

- A. Sodium
- B. Iron
- C. Gold
- D. Fluorine

Question 4

The most likely formula for the compound formed from an element X in Group 2 and an element Y in Group 5 is

- A. X_2Y_3 .
- B. X_2Y_5 .
- C. X_5Y_2 .
- D. X_3Y_2 .

Question 7

Methanol, CH_3OH , and ethanol, $\text{CH}_3\text{CH}_2\text{OH}$, are the first two members of the alkanol homologous series.

- a. What is the relationship between successive members of a homologous series?

1 mark

- b. Predict the name and semi-structural formula of the third member of this homologous series

2 marks

Total 3 marks**END OF SECTION B****END OF QUESTION BOOK**

b. Suggest a formula for the reagent X.

1 mark

d. Give the name of compound Y and draw its structural formula.

2 marks

e. Give the name of compound Z and draw its structural formula.

2 marks

e. When but-2-ene burns in excess air the products are carbon dioxide and water. Write a balanced equation for this reaction.

2 marks

f. For each of the four compounds mentioned above, Y, Z, but-2-ene and 2-bromobutane, state whether they are saturated or unsaturated and explain what is meant by these two terms.

Y:

Z:

But-2-ene:

2-bromobutane:

Saturated / unsaturated:

3 marks

Total 11 marks

Question 5

The number of nitrogen atoms in 0.25 mol of ammonium nitrate (NH_4NO_3) is

- A. 1.5×10^{23}
- B. 3.0×10^{23}
- C. 4.5×10^{23}
- D. 6.0×10^{23}

Question 6

Which one of the following compounds is likely to have the **lowest** solubility in water?

- A. Ethane, C_2H_6
- B. Sodium Chloride, NaCl
- C. Ethanol, $\text{C}_2\text{H}_5\text{OH}$
- D. Hydrogen Chloride, HCl

Question 7

Which of the following pairs of compounds are **not** isomers?

- A. $\text{CH}_3\text{OC}_2\text{H}_5$ and $\text{C}_3\text{H}_7\text{OH}$
- B. $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- C. $\text{CH}_2=\text{CHCH}_2\text{CH}_3$ and $\text{CH}_2=\text{C}(\text{CH}_3)_2$
- D. $\text{CH}_2\text{Cl}(\text{CH}_2)_4\text{CH}_3$ and $\text{CH}_3\text{CHCl}(\text{CH}_2)_2\text{CH}_3$

Question 8

What mass of oxygen gas, O_2 , has the same number of atoms as 12.0 g of carbon?

- A. 8.0 g.
- B. 12.0 g.
- C. 16.0 g.
- D. 32.0 g.

Question 9

3.00 mol of phosphorus molecules, P_4 , has a mass of

- A. 31.0 g.
- B. 93.0 g.
- C. 124 g.
- D. 372 g.

Question 10

Which one of the following contains the smallest number of mole of hydrogen atoms?

- A. 3.0 g of C₂H₆
 B. 2.0 g of C₃H₈
 C. 0.4 g of H₂
 D. 1.6 g of CH₄

Question 11

Galactose has the empirical formula CH₂O and a molar mass of 180 g mol⁻¹. The molecular formula of galactose is

- A. CH₂O
 B. C₂H₄O₂
 C. C₄H₈O₄
 D. C₆H₁₂O₆

Question 12

Which one of the following alternatives contains species that are isotopes?

- A. ¹²₆C, ¹³₆C, ¹⁴₆C
 B. ⁴⁰₁₈Ar, ⁴⁰₁₉K, ⁴⁰₂₀Ca
 C. ²³₁₁Na⁺, ²⁴₁₂Mg²⁺, ²⁷₁₃Al³⁺
 D. CH₃CH₂CH₂CH₂Cl, CH₃CH(Cl)CH₂CH₃, (CH₃)₂CHCH₂Cl

Question 13

Metal Q forms a positive ion. In which of the following compounds is Q present as the Q³⁺ ion?

- A. Q(NO₃)₂
 B. Q₂(SO₄)₃
 C. QCO₃
 D. Q₃N₂

Question 14

Many compounds can be formed from two different elements. Which one of the following pairs of elements reacts to form a compound with ionic bonding?

- A. Magnesium and sulfur
 B. Fluorine and iodine
 C. Iron and chromium
 D. Hydrogen and oxygen

- b. State **two** properties of diamond and **two** properties of graphite, and explain how these properties are determined by their chemical bonding.

Diamond

Property 1

Property 2

Explanation

2 marks

Graphite

Property 1

Property 2

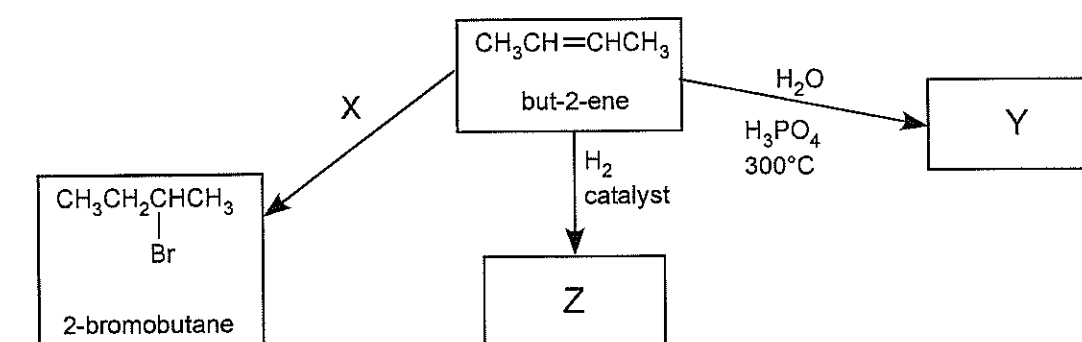
Explanation

2 marks

Total 8 marks

Question 6

Some reactions of the alkene, but-2-ene, are shown in the flow chart below.



- a. What name is given to the type of reactions shown by but-2-ene?

1 mark

- e. If the student had not washed the remaining zinc how would this have affected the ratio $n(I) : n(Zn)$?

2 marks

Total 8 marks

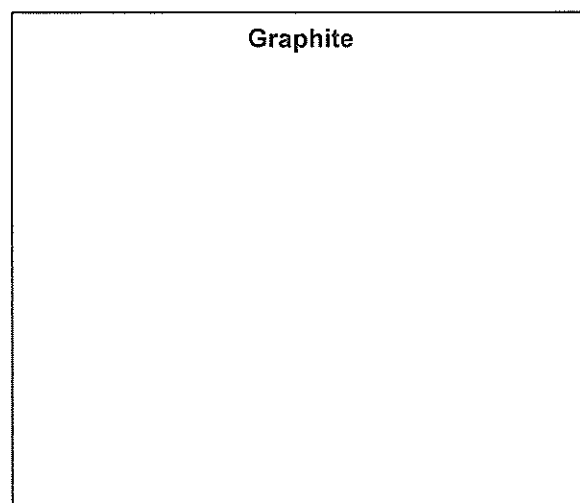
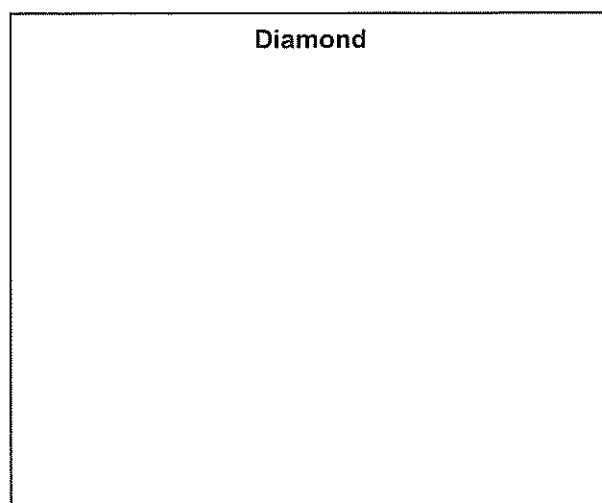
Question 5

Diamond and graphite are allotropes of carbon and some of their properties are summarised in the table below.

Substance	State at SLC	Electrical conductor
Diamond	Very hard, high melting point solid	No
Graphite	Soft, high melting point solid used as lubricant	Yes

- a. Draw labelled diagrams of the diamond and graphite structures which show the arrangement of carbon atoms in the covalent lattice and the types of chemical bonds present.

Include 12 carbon atoms in each diagram.



4 marks

Question 15

Which one of the following processes causes iron to become malleable rather than brittle?

- Rapid cooling of the hot metal.
- Slow cooling of the hot metal.
- Work hardening by hammering or bending.
- Adding a large percentage of carbon when producing the alloy, steel.

Question 16

In which one of the following alternatives are all the compounds alkenes?

- C_2H_4 , C_3H_6 , C_4H_8
- C_2H_6 , C_3H_8 , C_4H_{10}
- C_2H_2 , C_2H_4 , C_2H_6
- C_3H_6 , C_4H_{10} , C_6H_{12}

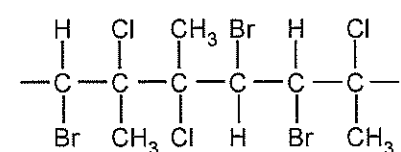
Question 17

The most appropriate name for the compound $\begin{array}{ccccccc} & CH_3 & -CH- & CH_2- & CH- & CH_3 & \\ & & | & & | & & \\ & & CH_2-CH_3 & & CH_3 & & \end{array}$ is

- 2-ethyl-4-methylpentane.
- 2,4-dimethylhexane.
- 3,5-dimethylhexane.
- 2,4-dimethylhexene.

Question 18

A section of a polymer is shown below



The monomer used to make this polymer is

- $\begin{array}{cc} Br & CH_3 \\ & \diagdown \quad / \\ & C=C \\ & / \quad \diagdown \\ H & Cl \end{array}$
- $\begin{array}{cc} Br & CH_3 \\ & \diagdown \quad / \\ & C=C \\ & / \quad \diagdown \\ Cl & H \end{array}$
- $\begin{array}{cc} CH_3 & Cl \\ & \diagdown \quad / \\ & C=C \\ & / \quad \diagdown \\ H & Br \end{array}$
- $\begin{array}{cc} Br & Cl \\ & \diagdown \quad / \\ & C=C \\ & / \quad \diagdown \\ CH_3 & H \end{array}$

Question 19

Which of the following liquids would be expected to have the **highest** surface energy?

- A. Mercury, Hg
- B. Octane, C₈H₁₈
- C. Water, H₂O
- D. Dichloromethane, CH₂Cl₂

Question 20

Which of the following is **not** a common property of nanoparticles?

- A. A high surface area to volume ratio.
- B. The ability to act as catalysts.
- C. Particle size of about 10³ nm.
- D. Behaviour which differs from that of large particles of the same substance.

END OF SECTION A

- c. Give one more property for each of calcium, bromine and calcium bromide that is consistent with the bonding you have described.

Calcium:

Bromine:

Calcium bromide:

3 marks

Total 9 marks

Question 4

A student determines the empirical formula of zinc iodide by the following method. 3.694 g of iodine, I₂, and 2.573 g of zinc were placed in a flask with a small amount of ethanol. The mixture was gently heated until the reaction commenced. When all the iodine colour had disappeared the flask was cooled. The ethanol was carefully poured from the remaining zinc which was then washed with water and dried. 1.628 g of zinc remained.

- a. Calculate the amount, in moles, of iodine atoms reacted

1 mark

- b. Calculate the mass of zinc reacted

1 mark

- c. Determine the empirical formula of zinc iodide.

3 marks

- d. Why was the remaining zinc washed with water before being dried?

1 mark

Question 3

The element calcium is a solid at room temperature. In comparison the element bromine has a higher relative atomic mass than calcium but at room temperature it is a liquid, with a low boiling temperature. Some information about calcium and bromine is given below. When calcium reacts with bromine, calcium bromide, CaBr_2 , is formed. This compound is a solid at room temperature which has high melting and boiling temperatures.

	Relative atomic mass	Melting temperature ($^{\circ}\text{C}$)	Boiling temperature ($^{\circ}\text{C}$)
Calcium	40.1	838	1490
Bromine	79.9	-7.0	58

- a. Describe the bonding that is present in these two elements to account for the differences in their melting and boiling temperatures.

Calcium:

2 marks

Bromine:

2 marks

- b. Describe how the electron arrangements of calcium and bromine have changed when calcium bromide is formed.

2 marks

SECTION B – Short answer questions**Instructions for Section B**

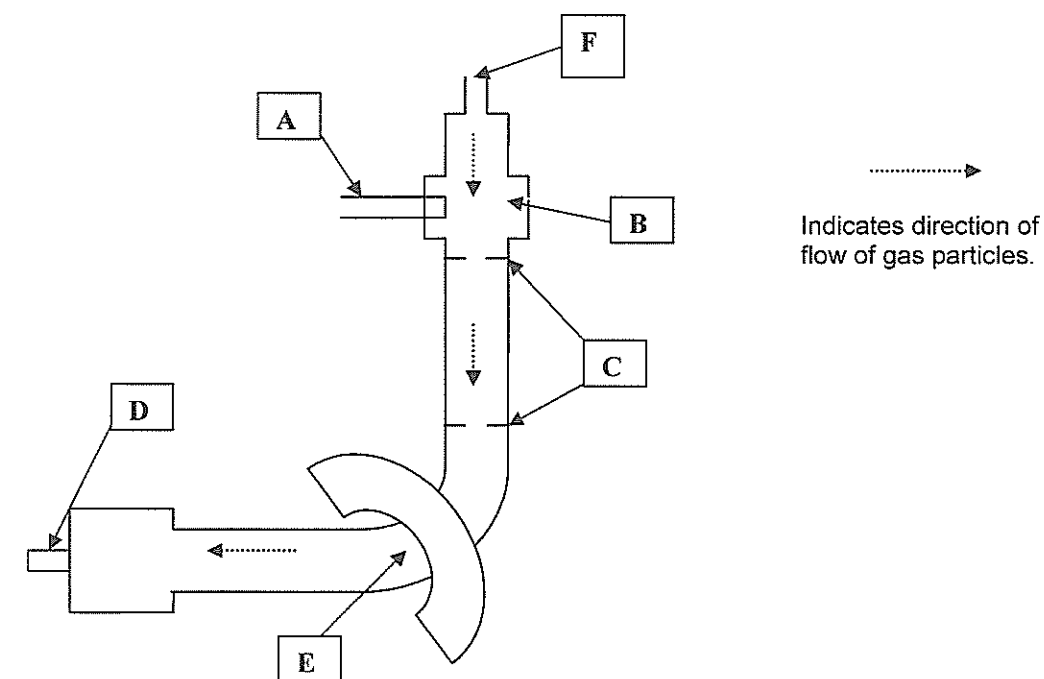
Answer **all** questions in the spaces provided.

To obtain full marks for your responses you should

- give simplified answers with an appropriate number of significant figures to all numerical questions; unsimplified answers will not be given full marks.
- show all working in your answers to numerical questions. No credit will be given for an incorrect answer unless it is accompanied by details of the working.
- make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example $\text{H}_2(\text{g})$; $\text{NaCl}(\text{s})$

Question 1

a.



The diagram shows a simplified cross section of a **mass spectrometer**.

After each statement below, write the letter indicating the place as shown on the diagram where each process occurs.

- | | | |
|------|--|-------|
| i. | Sample gas at low pressure | _____ |
| ii. | Electric field separates particles by charge | _____ |
| iii. | Ions are collected | _____ |
| iv. | Filament supplies bombarding electrons | _____ |
| v. | Element sample is injected. | _____ |
| vi. | Magnetic field separates particles by mass | _____ |

3 marks

Year 11 Chemistry - Periodic table of the elements

1 H Hydrogen 1.0	2 He Helium 4.0										
3 Li Lithium 6.9	4 Be Beryllium 9.0										
11 Na Sodium 23.0	12 Mg Magnesium 24.3										
19 K Potassium 39.1	20 Ca Calcium 40.1										
37 Rb Rubidium 85.5	38 Sr Strontium 87.6										
55 Cs Caesium 132.9	56 Ba Barium 137.3										
87 Fr Francium (223)	88 Ra Radium (226)										
		79 Au Gold 197.0		atomic number		symbol of element		name of element			
		21 Sc Scandium 44.9		22 Ti Titanium 47.9		23 V Vanadium 50.9		24 Cr Chromium 52.0		25 Mn Manganese 54.9	
		29 Cu Copper 63.6		30 Zn Zinc 65.4		31 Ga Gallium 69.7		32 Ge Germanium 72.6		33 As Arsenic 74.9	
		47 Ag Silver 107.9		48 Cd Cadmium 112.4		49 In Indium 114.8		50 Sn Tin 118.7		51 Sb Antimony 121.8	
		77 Ir Iridium 192.2		78 Pt Platinum 195.1		79 Au Gold 197.0		80 Hg Mercury 200.6		81 Tl Thallium 204.4	
		109 Mg Magnesium (268)		110 Dz Darmstadtium (271)		111 Rg Roentgenium (272)		112 Uub Ununbium (273)		113 Nh Nihonium (284)	
		105 Db Dubnium (262)		106 Sg Seaborgium (266)		107 Bh Bohrium (264)		108 Hs Hassium (277)		109 Mt Meitnerium (268)	
		89 Ac Actinium (227)		90 Th Thorium (232)		91 Pa Protactinium (231)		92 U Uranium (238)		93 Np Neptunium (237)	
		82 Pb Lead (208)		83 Bi Bismuth (209)		84 Po Polonium (210)		85 At Astatine (210)		86 Rn Radon (222)	
		114 Uuq Ununquadium (284)		115 Uup Ununpentium (285)		116 Uuh Ununhexium (286)		117 Uuq Ununseptium (287)		118 Uuo Ununoctium (288)	

68 Er Erbium 167.3	69 Tm Thulium 168.9	70 Yb Ytterbium 173.0	71 Lu Lutetium 175.0
66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3	69 Tm Thulium 168.9
65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9	68 Er Erbium 167.3
64 Gd Gadolinium 157.2	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5	67 Ho Holmium 164.9
63 Eu Europium 152.0	64 Gd Gadolinium 157.2	65 Tb Terbium 158.9	66 Dy Dysprosium 162.5
62 Sm Samarium 150.3	63 Eu Europium 152.0	64 Gd Gadolinium 157.2	65 Tb Terbium 158.9
61 Pm Promethium (145)	62 Sm Samarium 150.3	63 Eu Europium 152.0	64 Gd Gadolinium 157.2
60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium 150.3	63 Eu Europium 152.0
59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)	62 Sm Samarium 150.3
58 Ce Cerium 140.1	59 Pr Praseodymium 140.9	60 Nd Neodymium 144.2	61 Pm Promethium (145)

90 Th Thorium (232)	91 Pa Protactinium (231)	92 U Uranium (238)	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)
90 Th Thorium (232)	91 Pa Protactinium (231)	92 U Uranium (238)	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

CENTRE FOR STRATEGIC EDUCATION – YEAR 11 CHEMISTRY 2009
Written Test 1 – May

ANSWER SHEET

STUDENT NAME:

INSTRUCTIONS:

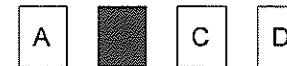
Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.

All answers must be completed like **THIS** example:

Marks will not be deducted for incorrect answers.

NO MARK will be given if more than **ONE** answer is completed for any question.

If you make a mistake, **ERASE** the incorrect answer – **DO NOT** cross it out.



ONE ANSWER PER LINE					ONE ANSWER PER LINE				
1	A	B	C	D	11	A	B	C	D
2	A	B	C	D	12	A	B	C	D
3	A	B	C	D	13	A	B	C	D
4	A	B	C	D	14	A	B	C	D
5	A	B	C	D	15	A	B	C	D
6	A	B	C	D	16	A	B	C	D
7	A	B	C	D	17	A	B	C	D
8	A	B	C	D	18	A	B	C	D
9	A	B	C	D	19	A	B	C	D
10	A	B	C	D	20	A	B	C	D

YEAR 11 CHEMISTRY

Written test 1

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DATA Book

Directions to students

This data sheet is for your reference.

You may keep this data book.