

STUDENT:	TEACHER:
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CSE TEST – OCTOBER 2010

YEAR 11 – CHEMISTRY

Written test 2

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	30
B	7	7	55	60
			Total 75	90

- Students are permitted to bring into the test room: pens, pencils, highlighters, erasers, sharpeners, rulers, an approved graphics calculator (memory cleared) and/or one 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 18 pages with an accompanying data sheet.
- Detachable answer sheet for multiple choice questions. You may remove this during reading time.

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

Which one of the following equations most accurately represents the process of photosynthesis?

- A. $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g}) \xrightarrow{\text{UV light, Chlorophyll}} 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$
- B. $6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g})$
- C. $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) \rightarrow 2\text{C}_2\text{H}_5\text{OH}(\text{aq}) + 2\text{CO}_2(\text{g})$
- D. $6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l}) \xrightarrow{\text{UV light, Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g})$

Question 2

The same amount of heat energy is supplied to each of 100 g of water and 100 g of copper. The effect on the substances would be that

- A. the temperature of both substances would increase by the same amount as they have absorbed the same amount of heat.
- B. the temperature of the water would increase more than that of the copper as copper is a better conductor of heat than water.
- C. the temperature of the copper would increase more than that of the water as water has a higher specific heat capacity than copper.
- D. the temperature of the water would increase more than that of the copper as water has a higher specific heat capacity than copper.

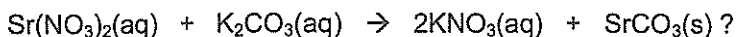
Question 3

Which one of the following processes is most likely to occur when each of the substances hydrogen bromide, HBr, methanol, CH_3OH , sodium nitrate, NaNO_3 , zinc carbonate, ZnCO_3 is added to water?

	Insoluble	Dissociates	Ionises	Hydrogen bonds to water
A.	sodium nitrate	hydrogen bromide	methanol	zinc carbonate
B.	zinc carbonate	sodium nitrate	hydrogen bromide	methanol
C.	hydrogen bromide	sodium nitrate	methanol	zinc carbonate
D.	zinc carbonate	hydrogen bromide	sodium nitrate	methanol

Question 4

Which one of the following is the correct ionic equation derived from the balanced equation



- A. $\text{Sr}^{2+}(\text{aq}) + \text{NO}_3^-(\text{aq}) + 2\text{K}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow 2\text{KNO}_3(\text{aq}) + \text{SrCO}_3(\text{s})$
- B. $2\text{K}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq}) \rightarrow 2\text{KNO}_3(\text{aq})$
- C. $\text{K}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{KNO}_3(\text{aq})$
- D. $\text{Sr}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{SrCO}_3(\text{s})$

Question 5

When shaken, then left to stand, a mixture of oil and water separates into two layers with oil as the upper layer. The best explanation of this is that

- A. oil is less dense than water and the intermolecular bonds between oil molecules are weaker than the intermolecular bonds between oil molecules and water molecules.
- B. oil is more dense than water and the intermolecular bonds between oil molecules are stronger than the intermolecular bonds between oil molecules and water molecules.
- C. oil is less dense than water and the intermolecular bonds between oil molecules are stronger than the intermolecular bonds between oil molecules and water molecules.
- D. oil is more dense than water and the intermolecular bonds between oil molecules are weaker than the intermolecular bonds between oil molecules and water molecules.

Question 6

The solubility of barium carbonate is 0.002 g/100 g at 25°C. This concentration expressed as ppb (parts per billion) is

- A. 2×10^4 ppb.
- B. 2×10^6 ppb.
- C. 2×10^7 ppb.
- D. 2×10^9 ppb.

Question 7

- | | |
|--|---|
| 1. $\text{HF}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_3\text{O}^+(\text{aq}) + \text{F}^-(\text{aq})$ | 4. $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s})$ |
| 2. $\text{HCO}_3^-(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{CO}_3^{2-}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ | 5. $\text{H}_3\text{O}^+(\text{aq}) + \text{SO}_3^{2-}(\text{aq}) \rightarrow \text{HSO}_3^-(\text{aq}) + \text{H}_2\text{O}(\text{l})$ |
| 3. $\text{O}_2(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$ | 6. $\text{H}_2\text{O}_2(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$ |

Which of the above equations represent Lowry-Brønsted acid-base reactions?

- A. 2. 5.
- B. 3. 4. 6.
- C. 1. 2. 3. 4. 5.
- D. 1. 2. 4. 5.

Question 8

A 0.1 M aqueous solution of hydrochloric acid, HCl, a strong acid, and a 0.2 M aqueous solution of hydrofluoric acid, HF, a weaker acid, are prepared.

- A. The concentration of H_3O^+ ions in HCl is 0.1 M and in HF is 0.2 M.
- B. The concentration of H_3O^+ ions in HCl is 0.1 M and in HF is less than 0.2 M.
- C. The concentration of H_3O^+ ions in HCl is less than 0.1 M and in HF is 0.2 M.
- D. The concentration of H_3O^+ ions in HCl is less than 0.1 M and in HF is less than 0.2 M.

Question 9

An electrochemical cell consists of a Cd^{2+}/Cd half cell and an Ag^+/Ag half cell. When this cell operates which of the following statements is incorrect?

- A. Electrons flow from the silver electrode to the cadmium electrode in the external circuit.
- B. Cadmium metal loses electrons.
- C. Silver ions are the oxidant.
- D. Negative ions flow from the salt bridge into the cadmium half cell and positive ions flow into the silver half cell.

Question 10

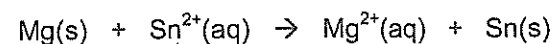
In which of the following equations is a chemical species acting as a diprotic acid?

- A. $\text{H}_3\text{AsO}_4(\text{aq}) + 3\text{NaOH}(\text{aq}) \rightarrow \text{Na}_3\text{AsO}_4(\text{aq}) + 3\text{H}_2\text{O}(\text{l})$
- B. $\text{HPO}_4^{2-}(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{PO}_4^{3-}(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- C. $2\text{HCl}(\text{aq}) + \text{Ca}(\text{OH})_2(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
- D. $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{KOH}(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

Question 11

The pH of a solution of barium hydroxide, $\text{Ba}(\text{OH})_2$, is 12 at 25°C . What is the concentration of barium hydroxide in the solution?

- A. $5 \times 10^{-3} \text{ M}$.
- B. $1 \times 10^{-2} \text{ M}$.
- C. 2 M.
- D. 12 M.

Question 12

The half equations which have been combined to form the redox equation above are

- | Oxidation half equation | Reduction half equation |
|---|--|
| A. $\text{Sn}^{2+} + 2\text{e}^- \rightarrow \text{Sn}$ | $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ |
| B. $\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$ | $\text{Sn} \rightarrow \text{Sn}^{2+} + 2\text{e}^-$ |
| C. $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ | $\text{Sn}^{2+} + 2\text{e}^- \rightarrow \text{Sn}$ |
| D. $\text{Sn} \rightarrow \text{Sn}^{2+} + 2\text{e}^-$ | $\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$ |

Question 13

An aqueous solution of 4.81g of hydrated potassium carbonate, $K_2CO_3 \cdot xH_2O$, reacts completely with 24.0 mL of 2.30 M hydrochloric acid. The value of x is closest to

- A. 1.5.
- B. 2.
- C. 3.
- D. 4.

Question 14

Which of the following atmospheric gases is least likely to increase in concentration in an urban or industrially polluted environment?

- A. Argon.
- B. Carbon dioxide.
- C. Methane.
- D. Ozone.

Question 15

The environment in which an iron bar is least likely to corrode is

- A. the sea bed in a very deep part of the ocean.
- B. a rural area with average rainfall.
- C. an industrial area with low rainfall.
- D. the intertidal zone on the sea shore.

Question 16

The following reactions occur in the nitrogen cycle. In which reaction is nitrogen reduced?

- A. $N_2(g) + O_2(g) \rightarrow 2NO(g)$
- B. $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
- C. $2NO_2(g) + H_2O(l) \rightarrow HNO_2(aq) + HNO_3(aq)$
- D. $2NO_2^-(aq) + O_2(g) \rightarrow 2NO_3^-(aq)$

Question 17

The particles in a sample of gas at a fixed temperature and in a closed container

- A. all have the same velocity.
- B. travel in straight lines until they collide.
- C. all have the same kinetic energy.
- D. have strong interparticle attractive forces.

Question 18

Which one of the following is not equivalent to a gas pressure of 1.27 atm?

- A. 1.29 bar.
- B. 1.29×10^2 kPa.
- C. 1.29×10^5 Pa.
- D. 1.29×10^6 N m⁻².

Question 19

10.9 g of a gas occupies a volume of 7.32 L at SLC. The gas is most likely to be

- A. Carbon dioxide.
- B. Helium.
- C. Hydrogen chloride.
- D. Krypton.

Question 20

Which of the following does not involve the absorption of UV radiation?

- A. The breakdown of CFCs in the stratosphere.
- B. The trapping of atmospheric heat by Greenhouse gases.
- C. The formation of photochemical smog.
- D. Photosynthesis.

END OF SECTION A

SECTION B – Short answer questions

Instructions for Section B

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

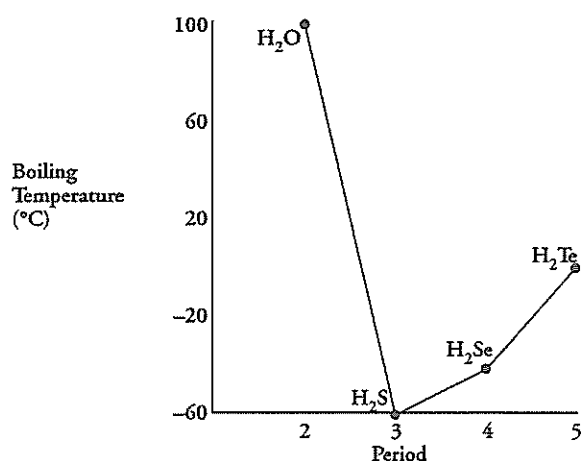
To obtain full marks for your responses you should

- 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

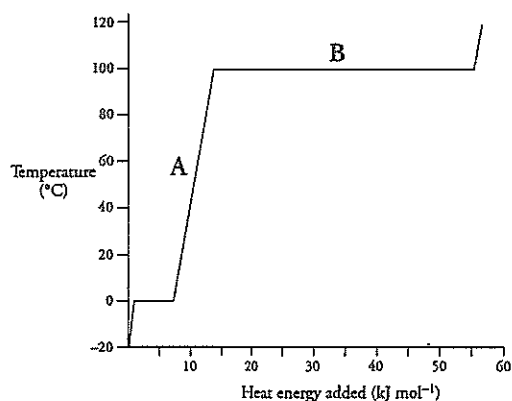
Use the information in the graphs to explain the properties and behaviour of water.

- a. High boiling point of water.



Explain, in terms of chemical bonding, the boiling point of water compared with the other group 16 hydrides.

2 marks

b. Changes of state of water.

The graph on the previous page shows the variation in temperature when heat energy is given to ice initially at -20°C.

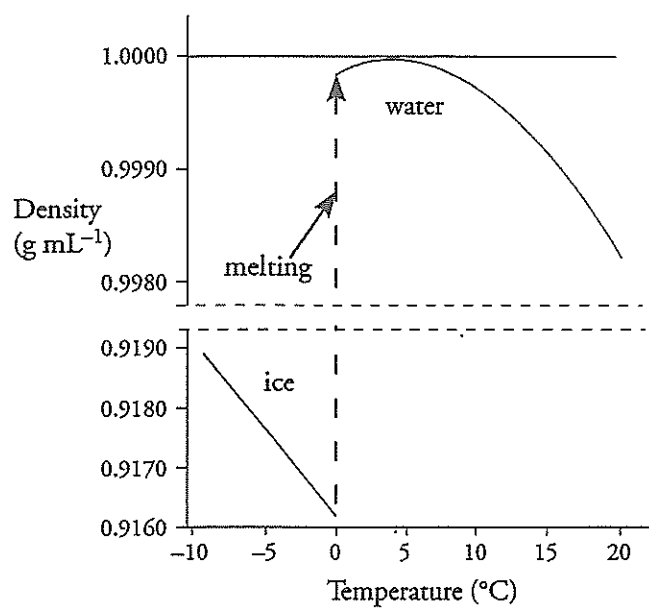
Describe the effect on the water molecules at points A and B of this added heat energy.

A.

B.

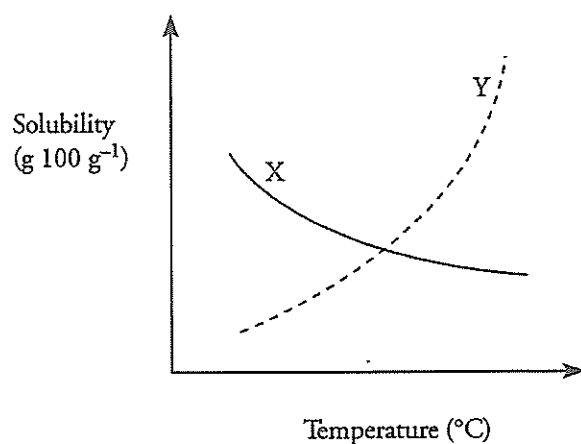
2 marks

c. Changes of water density as the temperature increases.



Explain in terms of chemical bonding the changes in water density shown on the graph from -5°C to 10°C .

2 marks

d. Solubility of salts and gases

Identify which curve represents the solubility of a typical salt, and which the solubility of a typical gas. For each explain the shape of the curve.

X

Reason

Y

Reason

2 marks

Total 8 marks

Question 2

- a. 100 mL of a 1.5 M solution of aluminium sulfate, $\text{Al}_2(\text{SO}_4)_3$, are mixed with 100 mL of a 2.0 M solution of potassium sulfate, K_2SO_4 . What is the concentration of sulfate ions in the resulting solution?

2 marks

- b. Sulfate ions in the combined solution produced in a. are precipitated as barium sulfate by adding 200 mL 3.0 M barium chloride solution.

- i. Write a balanced ionic equation for this reaction.

1 mark

- ii. Determine whether the sulfate ions or the barium ions are in excess and by what amount.

2 marks

iii. Calculate the mass of the barium sulfate precipitate.

1 mark

c.

i. In a separate experiment, 5.72 g of potassium sulfate is completely dissolved in 100 mL of water. Calculate the molarity of the potassium sulfate solution.

2 marks

ii. 60.0 mL of water are added to the potassium sulfate solution. Calculate the molarity after dilution.

1 mark

iii. Convert the molarity calculated in c. ii. above to a concentration in % m/v.

2 marks

Total 11 marks

Question 3

- a. Name one naturally occurring type of acid rain and one type of acid rain formed by an industrial pollutant. Describe one possible effect of each on the environment.

1. Natural acid rain

Effect

2. Industrial acid rain

Effect

2 marks

- b. The process of purifying water may involve the addition of calcium hydroxide, $\text{Ca}(\text{OH})_2$, to the water to neutralise acidity. 3.0×10^4 L of water with a pH of 4.0 is to be neutralised using calcium hydroxide.

- i. Write an ionic equation for the neutralisation reaction.

1 mark

- ii. Calculate the number of moles of H_3O^+ ions in the water and hence the number of moles of OH^- ions required for complete neutralisation.

2 marks

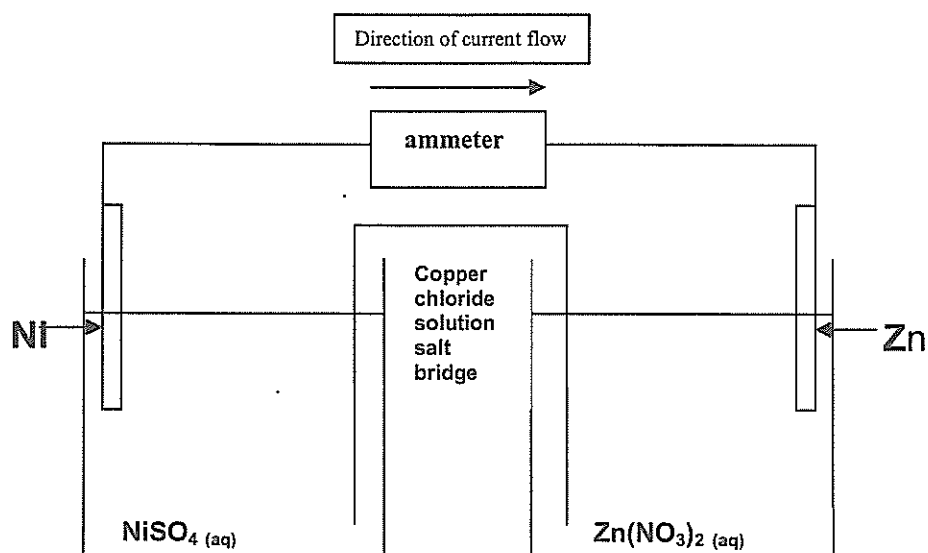
iii. Calculate the required mass of calcium hydroxide.

2 marks

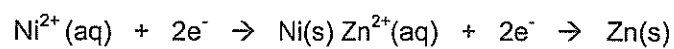
Total 7 marks

Question 4

- a. The galvanic cell below contains three errors. State and explain these in the space provided below the diagram.



Half Equations



	Error	Explanation
1.		
2.		
3.		

6 marks

- b. State which of the reactions in the table below are redox reactions, and for each redox equation, identify the oxidant.

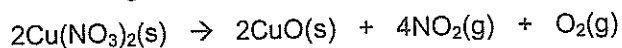
Reaction	Redox Yes/No	Oxidant
$\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{HNO}_3(\text{aq}) + \text{BaSO}_4(\text{s})$		
$2\text{Mg}(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow \text{MgCl}_2(\text{s})$		
$2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{l})$		
$\text{NaCl}(\text{s}) \rightarrow \text{Na}^+(\text{aq}) + \text{Cl}^-(\text{aq})$		

3 marks

Total 9 marks

Question 5

20.0 g of solid copper nitrate decomposes completely on heating producing solid copper oxide, nitrogen dioxide gas and oxygen gas according to the following equation



- a. Calculate the mass of copper oxide formed.

2 marks

- b. Calculate the total volume of gas formed at a temperature of 60.0°C and 1.10 atm pressure.

4 marks

Total 6 marks

Question 6

- a. **Either** Write a balanced equation for the laboratory preparation of oxygen **or** carbon dioxide gas. Include any catalysts used.
- or** Briefly describe the industrial preparation of a sample of nitrogen from air.

2 marks

b.

- i. Describe an appropriate method for collection of the gas chosen in a.

2 marks

- ii. Explain why you have chosen this method.

2 marks

- c. Write a balanced equation for each of the following gas preparations.

- i. Nitrogen(IV)oxide by the reaction of copper metal with concentrated nitric acid. The products are copper(II) nitrate solution, nitrogen(IV) oxide gas and water.

2 marks

- ii. Sulfur dioxide by the reaction of zinc metal and concentrated sulfuric acid. The products are zinc sulfate solution, sulphur dioxide gas and water.

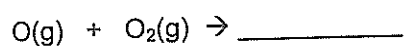
2 marks

Total 10 marks

Question 7

Ozone in the earth's atmosphere has both beneficial and harmful effects.

- a. Complete the following equations for the reactions by which ozone is formed by filling in the underlined spaces.



2 marks

- b. Describe one harmful effect on living things of ozone in the atmosphere.

1 mark

- c. Describe one way in which ozone is beneficial to living things.

1 mark

Total 4 marks**END OF SECTION B****END OF QUESTION AND ANSWER BOOK**

CSE TEST – OCTOBER 2010

YEAR 11 – CHEMISTRY

Written test 1

Data Sheet

Directions to students

This data sheet is for your reference.

Any writing, notes, drawings or jottings you make on this data sheet will **not** be considered in the marking.

You may keep this data sheet.

Physical Constants

Gas constant (R) = $8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

Ionic Product for Water (K_w) = $1.00 \times 10^{-14} \text{ mol}^2 \text{ L}^{-2}$ at 298°K

Molar Volume (V_m) of an ideal gas at 25°C and 101.3 kPa (SLC) = 24.5 L mol^{-1}

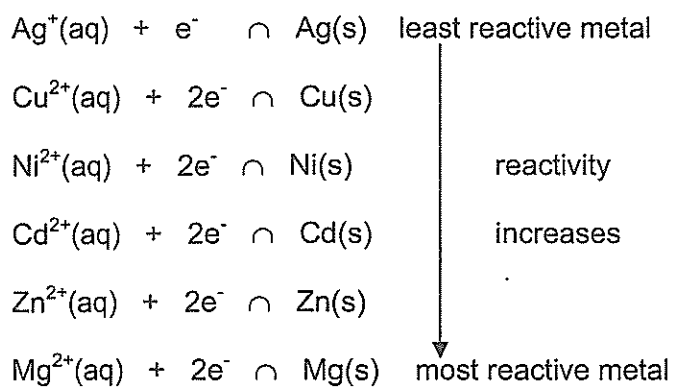
Specific Heat Capacity of water = $4.18 \text{ J g}^{-1} \text{ C}^{-1}$

Specific Heat Capacity of copper = $0.38 \text{ J g}^{-1} \text{ C}^{-1}$

1 atm = 101.3 kPa = 1.013 bar

$1 \text{ N m}^{-2} = 1 \text{ Pa}$

Activity Series (Electrochemical Series) of Metals



1. Periodic table of the elements

1 H 1.0 Hydrogen	2 He 4.0 Helium																
3 Li 6.9 Lithium	4 Be 9.0 Beryllium	5 B 10.8 Boron	6 C 12.0 Carbon	7 N 14.0 Nitrogen	8 O 16.0 Oxygen	9 F 19.0 Fluorine	10 Ne 20.1 Neon										
11 Na 23.0 Sodium	12 Mg 24.3 Magnesium	13 Al 27.0 Aluminium	14 Si 28.1 Silicon	15 P 31.0 Phosphorus	16 S 32.1 Sulfur	17 Cl 35.5 Chlorine	18 Ar 39.9 Argon										
19 K 39.1 Potassium	20 Ca 40.1 Calcium	21 Sc 44.9 Scandium	22 Ti 47.9 Titanium	23 V 50.9 Vanadium	24 Cr 52.0 Chromium	25 Mn 54.9 Manganese	26 Fe 55.9 Iron	27 Co 58.9 Cobalt	28 Ni 58.7 Nickel	29 Cu 63.6 Copper	30 Zn 65.4 Zinc	31 Ga 69.7 Gallium	32 Ge 72.6 Germanium	33 As 74.9 Arsenic	34 Se 79.0 Selenium	35 Br 79.9 Bromine	36 Kr 83.8 Krypton
37 Rb 85.5 Rubidium	38 Sr 87.6 Strontium	39 Y 88.9 Yttrium	40 Zr 91.2 Zirconium	41 Nb 92.9 Niobium	42 Mo 95.9 Molybdenum	43 Tc 98.1 Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
55 Cs 132.9 Cesium	56 Ba 137.3 Barium	57 La 138.9 Lanthanum	72 Hf 178.5 Hafnium	73 Ta 180.9 Tantalum	74 W 183.8 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.1 Platinum	79 Au 197.0 Gold	80 Hg 200.6 Mercury	81 Tl 204.4 Thallium	82 Pb 207.2 Lead	83 Bi 209.0 Bismuth	84 Po (209) Polonium	85 At (210) Astatine	86 Rn (222) Radon
87 Fr (223) Francium	88 Ra (226) Radium	89 Ac (227) Actinium	104 Rf (261) Rutherfordium	105 Db (262) Dubnium	106 Sg (266) Seaborgium	107 Bh (264) Bohrium	108 Hs (277) Hassium	109 Mt (268) Meitnerium	110 Ds (271) Darmstadtium	111 Rg (272) Roentgenium	112 Uub (272) Ununbium	114 Uuq (272) Ununquadium	116 Uuh (272) Ununhexium	118 Uuo (272) Ununoctium			

58 Ce 140.1 Cerium	59 Pr 140.9 Praseodymium	60 Nd 144.2 Neodymium	61 Pm (145) Promethium	62 Sm 150.3 Samarium	63 Eu 152.0 Europium	64 Gd 157.2 Gadolinium	65 Tb 158.9 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.9 Holmium	68 Er 167.3 Erbium	69 Tm 168.9 Thulium	70 Yb 173.0 Ytterbium	71 Lu 175.0 Lutetium
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90 Th 232.0 Thorium	91 Pa 231.0 Protactinium	92 U 238.0 Uranium	93 Np (237.1) Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (262) Lawrencium
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TURN OVER

CENTRE FOR STRATEGIC EDUCATION – YEAR 11 CHEMISTRY
Written Test – October 2010

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.

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