Student name

CHEMISTRY
Unit 2
Trial Examination

QUESTION AND ANSWER BOOK

Total writing time: 1 hour 30 minutes

Structure of book

Section	Number of questions	Number of marks
A	20	20
B	10	67
Total		87

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

Materials supplied

- Question and answer book of 18 pages, with a detachable data sheet in the centrefold and a detachable answer sheet for multiple-choice questions inside the front cover.

Instructions

- Detach the data sheet from the centre of this book and the answer sheet for multiple-choice questions during reading time.
- Write your **name** in the space provided above on this page and on the answer sheet for multiple-choice questions.
- All written responses should be in English.

At the end of the examination

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

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CHEMISTRY
Unit 2 Trial Examination
MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME:	

INSTRUCTIONS: **USE PENCIL ONLY**
- Write your name in the space provided above.
- Use a **PENCIL** for **ALL** entries.
- If you make a mistake, **ERASE** it – **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- Mark your answer by **SHADING** the letter of your choice.

	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

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 mark will be given if more than one answer is completed for any question.

Question 1

Water has a higher latent heat of vapourisation than molecules of similar size and structure. This is due to water molecules having

A.   strong covalent bonds within the molecule which need more energy to be broken.

B.   strong intermolecular dispersion forces.

C.   two non-bonding electron pairs per molecule.

D.   hydrogen bonding between the molecules.

Question 2

Which of the following lists only significantly soluble substances in water?

A.   ethanol, ethane, ethene, polyethene

B.   glucose, sucrose, ethanol, ethanoic acid

C.   methanol, methane, ethanol, ethane

D.   carbon dioxide, ethanol, ethane, ethanoic acid

Question 3

Which of the following substances is likely to be insoluble?

A.   sodium sulfate

B.   magnesium nitrate

C.   ammonium carbonate

D.   calcium sulfate

Question 7

Gaseous hydrogen chloride consists of molecules. The best evidence that an aqueous solution of hydrogen chloride is not composed of the same particles as the gas is

A.   the dissolving of HCl in water is accompanied by a substantial temperature rise.

B.   HCl (aq) is a good conductor of electricity whereas water is a poor conductor.

C.   HCl (aq) turns blue litmus paper red whereas neither dry hydrogen chloride nor water has any effect on blue litmus paper.

D.   HCl is evolved when concentrated hydrochloric acid is boiled.

Question 8

Which of the following is a diprotic acid species?

A. $HCOOH$

B. $H_2PO_4^-$

C. C_2H_2

D. CH_3COOH

Question 9

If HNO_3 reacts with KOH, the reaction that has really occurred in the solution is

A. $H_3O^+ + OH^- \rightarrow 2H_2O$

B. $2H_2O \rightarrow H_3O^+ + OH^-$

C. $K^+ + NO_3^- \rightarrow KNO_3$

D. $HNO_3 + KOH \rightarrow KNO_3 + H_2O$

Question 10

Which of the following solutions will have the lowest pH?

A.   0.1 M HCl

B.   0.1 M CH_3COOH

C.   Pure water

D.   1 M HCl

Question 15

A solution has CO_2 bubbled under pressure into water. To raise the pH, which of the following could be added?

A.   lemon juice

B.   more CO_2

C.   water

D.   vinegar

Question 16

In which of the following species does arsenic have an oxidation number of -3?

A. AsH_3

B. As_4O_6

C. H_3AsO_4

D. As_2O_5

Question 17

Which of the following is **not** a redox reaction?

A. $Cr_2O_7^{2-}(aq) + 2OH^-(aq) \rightarrow 2CrO_4^{2-}(aq) + H_2O(l)$

B. $2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}(aq) + I_2(g)$

C. $PbS(s) + 4H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$

D. $Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$

Question 18

Each of the following represents a redox reaction. In which of the following is the bolded substance acting as a reductant?

A. $ZnO(s) + \mathbf{CO}(g) \rightarrow Zn(s) + CO_2(g)$

B. $Cu(s) + \mathbf{N_2O}(g) \rightarrow CuO(s) + N_2(g)$

C. $3Cu(s) + \mathbf{N_2}(g) \rightarrow 3H_2O(g) + CuO(s) + 2NH_3(g)$

D. $H_2S(g) + \mathbf{Cl_2}(aq) \rightarrow 2H^+(aq) + 2Cl^-(aq) + S(s)$

SECTION B – Short answer questions

Instructions for Section B

Answer all questions in the spaces provided.
To obtain full marks for your response you should:

- give simplified answers with an appropriate number of significant figures for 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 all chemical equations are balanced and that the formulas for individual substances include an indication of state (for example, $H_2(g)$; $NaCl(s)$.

Question 1

An ice cube of mass 10.0 g was taken from a freezer, (temperature –20 °C), and placed in a bowl. It was left overnight in a warm room at a constant temperature of 25 °C. By the morning, the contents of the bowl had completely evaporated.

a. Sketch a graph to show how the temperature of the contents of the bowl changed on standing.
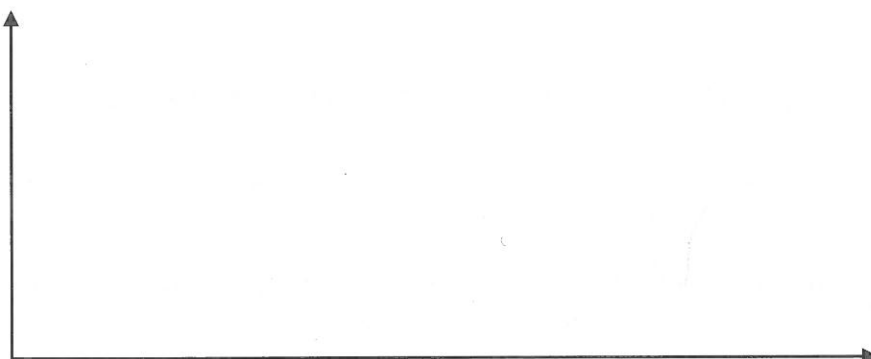
2 marks

b. How much energy must be given to the ice at –20 °C to raise its temperature to 0 °C, assuming no evaporation takes place?

_____

_____

1 mark

Question 2

The graphs below show how the solubility changes with temperature for three compounds, X, Y and Z.
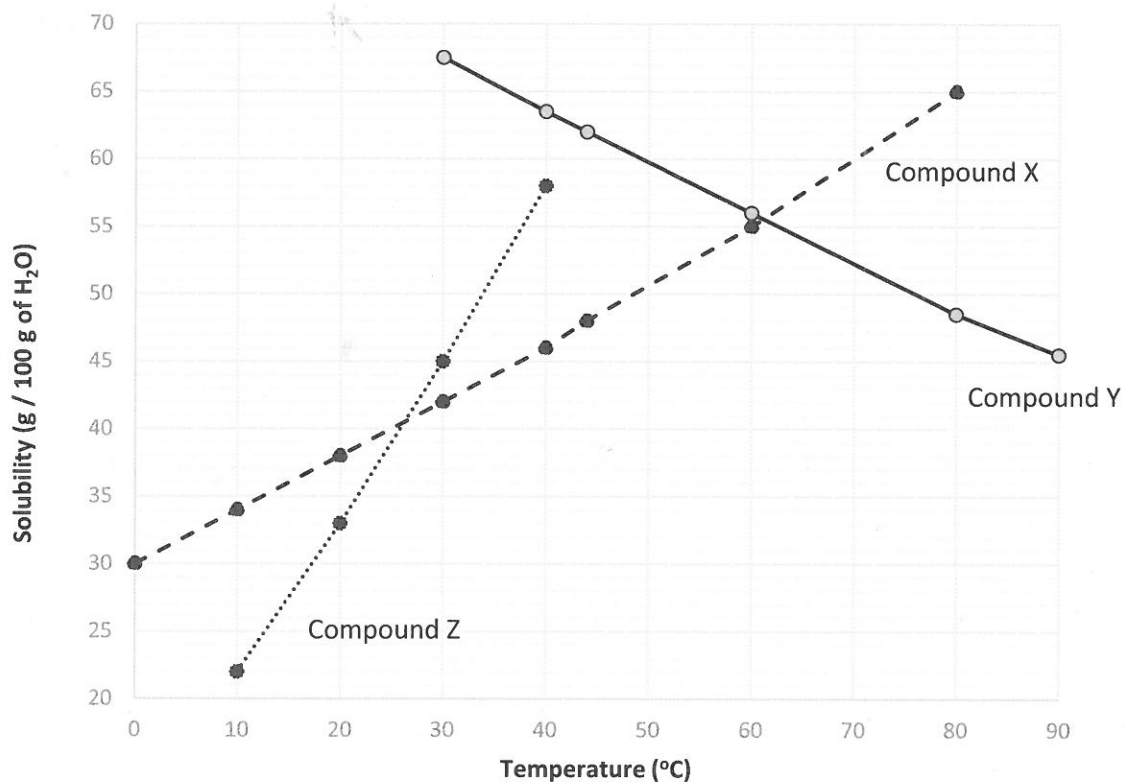
a.   Which one or more of the compounds: X, Y and Z is a gas? Explain your answer.

_____

_____

2 marks

b.   What is the solubility of compound Y at 55 °C? _____

1 mark

c.   What mass of water (to 2 significant figures) at 60 °C is needed to make a saturated solution from 50 g of compound X?

_____

_____

2 marks

d.   If 80 g of Z is added to 60 g of water at 40 °C, what mass of Z would remain undissolved?

_____

_____

3 marks

Question 4

a.   Gaseous hydrogen bromide, HBr, will ionise when it dissolves in water. Write a chemical equation to represent the dissolving process for this compound in water.

_____

                                                                                                                                      1 mark

b.   i.   Write an overall equation for the precipitate which forms between sodium iodide and lead(II) nitrate.

       _____

       ii.   Write the ionic equation for the reaction in part **i.**

       _____

                                                                                                                                      3 marks

c.   i.   Write an overall equation for the precipitate which forms between potassium hydroxide and iron(III) nitrate.

       _____

       ii.   Write the ionic equation for the reaction in part **i.**

       _____

                                                                                                                                      3 marks

d.   Identify the type of bonding that is always present between water and ions.

_____

                                                                                                                                      1 mark

Question 6

In a series of experiments involving the displacement of one metal ion from solution by another metal, the following results were recorded by a group of students.

Combination	Result
copper(II) nitrate + lead	reaction occurred
copper(II) nitrate + zinc	reaction occurred
iron(II) sulfate + zinc	reaction occurred
lead(II) nitrate + copper	no reaction occurred
lead(II) nitrate + iron	no reaction occurred
lead(II) nitrate + tin	reaction occurred
magnesium sulfate + zinc	no reaction occurred
tin(II) chloride + iron	reaction occurred
tin(II) chloride + magnesium	reaction occurred
zinc sulfate + lead	no reaction occurred
zinc sulfate + tin	no reaction occurred

a.   Circle the number corresponding to the order of reactivity of the five metal elements used in this series of experiments (with the most reactive element first). Explain your reasoning.

   i.   copper, lead, tin, zinc, magnesium
   ii.   magnesium, tin, zinc, copper, lead
   iii. magnesium, zinc, tin, lead, copper
   iv.   tin, zinc, magnesium, lead, copper
   v.   zinc, magnesium, lead, copper, tin

_____

_____

_____

                                                                                                    2 marks

b.   Which experimental result do you think is likely to be in error? Explain your reasoning.

_____

_____

_____

_____

                                                                                                    2 marks

Question 7

A student wishes to determine the amount of potassium ion in a sample of liquid soup using atomic absorption spectroscopy.

In the determination, 2.65 g of the soup was weighed and added to a small volume of water. The insoluble material is removed by filtration and washed with more de-ionised water. The filtrate and washings are collected and the volume is made up to 250.0 mL in a volumetric flask.

A 25.00 mL aliquot of this solution is run into a second volumetric flask and again the volume made up to 250.0 mL with de-ionised water. This diluted solution is sprayed into the flame of an atomic absorption spectrophotometer and the absorbance is recorded. The student also measures the absorbance of solutions containing known concentrations of potassium ion. All the results are tabulated below.

$c(K^+)$ (aq) mg L^{-1}	Absorbance
10	0.021
20	0.041
30	0.063
40	0.083
50	0.104
diluted soup	0.049

a. Use the data for the standard solutions in the table to plot the calibration line for K^+ (aq) on the axes provided below.

2 marks
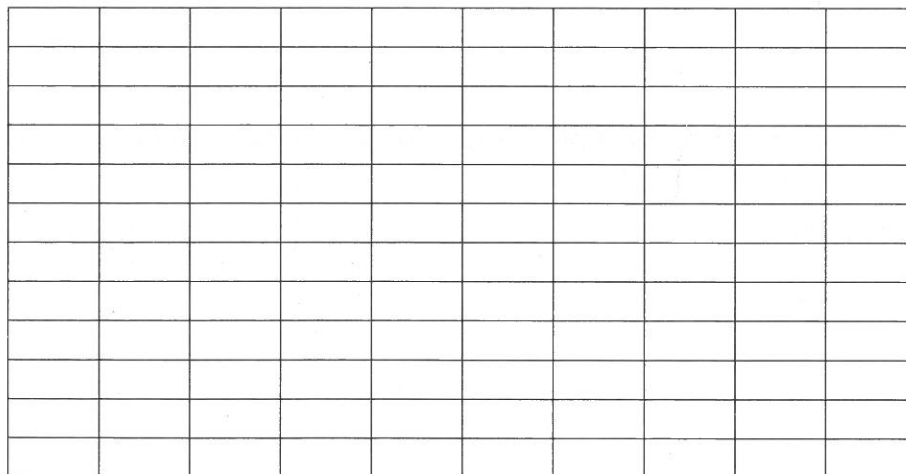
b. Use your graph to determine the concentration of potassium ion in the **diluted** soup.

_____

1 mark
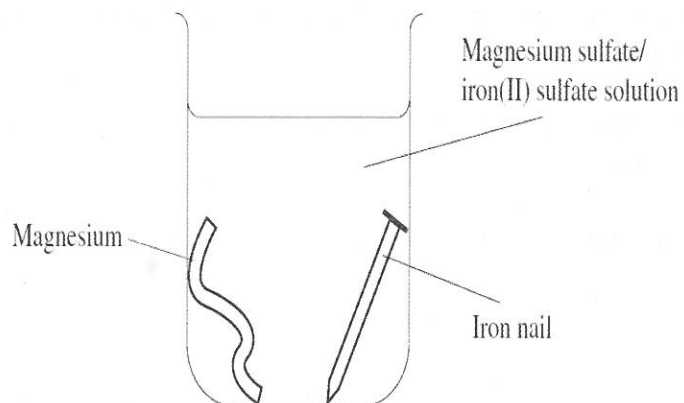
c. What is the concentration of potassium ion in mg L^{-1} in the original sample of soup?

_____

_____

3 marks

Question 9

A student set up a laboratory experiment in which a beaker contained a strip of magnesium, an iron nail, and a solution of iron(II) sulfate and magnesium sulfate. This was left for several days.

Describe what would happen in this experiment. Include relevant chemical equations in your answer.

_____

_____

_____

_____

_____

_____

5 marks