

James Ruse Agricultural High School

Theory

Year 11 Preliminary Chemistry Exam 2012

General Instructions

- **Reading Time:** 5 minutes
- **Working Time:** 50 minutes
- Write using black or blue pen
- Board approved calculators may be used
- Write your Student Number at the top of page 9
- A Periodic Table and Data sheet are provided

Total Marks 55

Part A

Multiple Choice: 15 marks

Attempt Questions 1-15

Section I

75 marks

Part A – 15 marks

Attempt Questions 1–15

Allow about 30 minutes for this part

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

A B C D A B C D A B C D A B C D

► **Mark your answers for Questions 1 – 15 in the Answer Box on page 9**

Multiple Choice Questions

1. The chemical and physical properties of water under normal conditions are significant to life on Earth. Indicate whether the property which is significant for the indicated role is physical or chemical.

	<i>Role</i>	<i>Property</i>
(A)	as a constituent of cells	mainly chemical only
(B)	as a habitat with less temperature extremes	mainly physical only
(C)	an agent of weathering	mainly physical only
(D)	a natural resource for humans and other organism	mainly chemical only

2. The properties of water as a solvent depend on the properties of its components:

Choose the correct sequence of interactions to explain the macroscopic properties of water.

	<i>Sequence of interactions</i>
(A)	atomic properties→molecular properties→polarity→hydrogen bonding
(B)	hydrogen bonding→polarity→atomic properties→molecular properties
(C)	polarity→atomic properties→hydrogen bonding→molecular ptoperties
(D)	molecular properties→atomic properties→polarity→hydrogen bonding

3. Water has higher surface tension, viscosity and, boiling and melting points than other liquids:

What property of water contributes to these higher values?

- (A) Its high density
- (B) Its high molar mass
- (C) Its bent structure

(D) Its open structure when solid

4. Water interacts with various solutes to dissolve them.

Which predominant interaction accounts for the dissolution of the given solute in water?

	<i>Solute</i>	<i>Interaction</i>
(A)	sodium chloride	hydrogen bonding
(B)	sucrose	ion-dipole interaction
(C)	hydrogen chloride	hydrogen bonding
(D)	oxygen molecule	dispersion forces

5. The solubility of calcium hydroxide is 0.12 g/100 g water and sodium chloride is 36 g/ 100 g water.

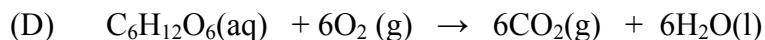
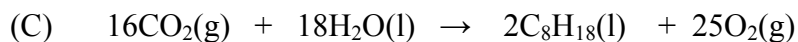
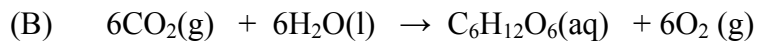
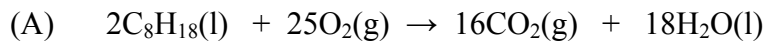
When the 14 g of calcium hydroxide and 14 g of sodium chloride are added to a beaker containing 100g water what type of solution results for each solute in the solution?

	<i>Calcium hydroxide</i>	<i>Sodium chloride</i>
(A)	unsaturated	unsaturated
(B)	supersaturated	unsaturated
(C)	saturated	saturated
(D)	saturated	unsaturated

6. Which of the following fossil fuels was formed in ancient swamps and marshes?

- (A) Coal
- (B) Petroleum
- (C) Natural Gas
- (D) Uranium

7. Which of the following equations represents photosynthesis?



8. What is the standard used to compare relative atomic masses of atoms ?

(A) Carbon – 14

(B) Carbon – 12

(C) Nitrogen – 14

(D) Nitrogen – 13

9. What is the molar mass of a substance ?

(A) The mass of one mole of the substance.

(B) The ratio of the mass of one mole of the substance to 12.0 g of carbon – 12.

(C) The sum of the relative atomic masses of the elements in the formula of the substance.

(D) The mass of one molecule of the substance relative to the mass of one atom of carbon – 12 taken as exactly 12.0 g

10. Strict safety rules must be adhered to in and around flour mills to prevent explosions due to the presence of fine particles of flour.

Which of the following statements is the best explanation for this?

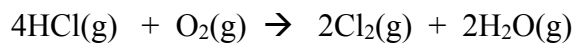
- (A) It is very easy to heat the fine particles of flour to their ignition temperature.
 - (B) The surface area of the flour particles is very large and thus combustion reactions are very rapid.
 - (C) The activation energy for the reaction of fine particles of flour is much lower than for larger particles.
 - (D) When flour is ground to fine particles the energy profile for the combustion reaction is changed.
11. An important reaction for the production of ammonia, NH_3 is shown below.



Which of the following procedures would NOT cause the rate of the reaction to increase, if the reaction takes place in a sealed container?

- (A) Increasing the temperature.
- (B) Increasing the concentration of hydrogen.
- (C) Adding a suitable catalyst.
- (D) Adding an inert gas.

12. The equation for the reaction of HCl and O₂ is shown below.



50 mL of oxygen gas reacts completely with excess hydrogen chloride gas.
What volume of hydrogen chloride will have reacted and what is the volume of the products formed ?

	Volume of HCl (mL)	Volume of Product (mL)
(A)	200	100
(B)	50	200
(C)	12.5	25
(D)	100	50

Student No.

Mark

Part A: Answer grid for multiple choice questions

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|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 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 ☐ |

Part B. 43 marks

Attempt Questions 13- 22

Allow about 40 minutes for this part

► *Show all relevant working in questions involving calculations.*

Question 13. (4 marks)

Both hydrogen sulfide and water are triatomic, yet they differ significantly in their physical properties.

<i>Property</i>	<i>hydrogen sulfide</i>	<i>water</i>
Melting point (°C)	–83	0.00
Boiling point (°C)	–62	100.0
Solubility in hexane (g/100g)	0.70	0.01

(a) Explain the difference in the boiling point between water and hydrogen sulfide.(2 marks)

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(b) Explain the difference in the solubility of water and hydrogen sulfide in hexane.
(2 marks)

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Question 14 (4 marks)

How many mL of a 0.250 mol L^{-1} BaCl_2 solution are required to precipitate all the sulfate ions from 10.0 mL of a 10.0 % (w/v) solution of Na_2SO_4 ?

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Question 15 (2 marks)

A solution contains both magnesium chloride and potassium chloride. Predict the reaction(s) that can occur if a solution of sodium hydroxide is added to this solution. Use (a) net ionic equation(s) to represent the reaction(s).

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Question 16 (3 marks)

In the process of recrystallization, an impure solid sample is dissolved in a minimum quantity of hot solvent; the solution is filtered and allowed to cool, after which a purer solute separates.

- (a) Explain how this process removes both soluble and insoluble impurities from the solid sample. (2 marks)

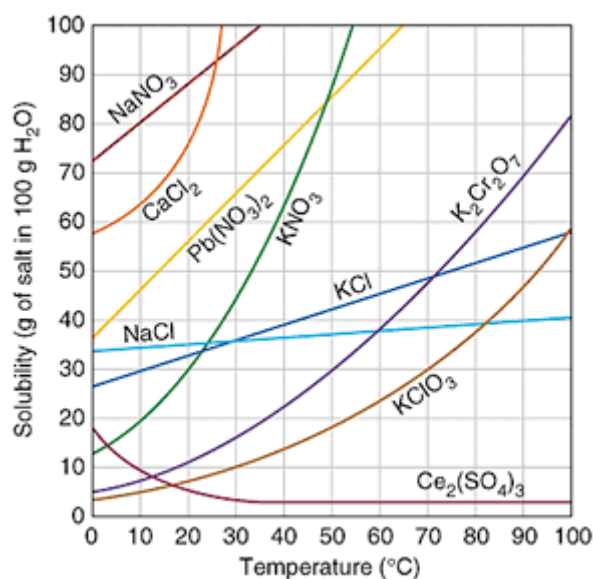
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- (b) Refer to the diagram:



Which compound, KCl or KNO₃ would be more easily purified by recrystallization? Explain your choice. (1 mark)

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Question 17 (4 marks)

Draw two separate diagrams to represent the dissolution and formation of a saturated solution by the ionic compounds (XZ) and (XL) when equal number of moles are placed in water. Represent the ions with the symbols:



XZ has a solubility of 0.100 mol L^{-1} , while XL has a solubility of $= 0.050 \text{ mol L}^{-1}$

Dissolution of XZ to form a saturated solution.

Dissolution of XL to form a saturated solution

Question 17 (4 marks)

Draw two separate diagrams to represent the dissolution and formation of a saturated solution by the ionic compounds (XZ) and (XL) when 0.20 mole of each are placed in 100 g water. Represent the ions with the symbols:



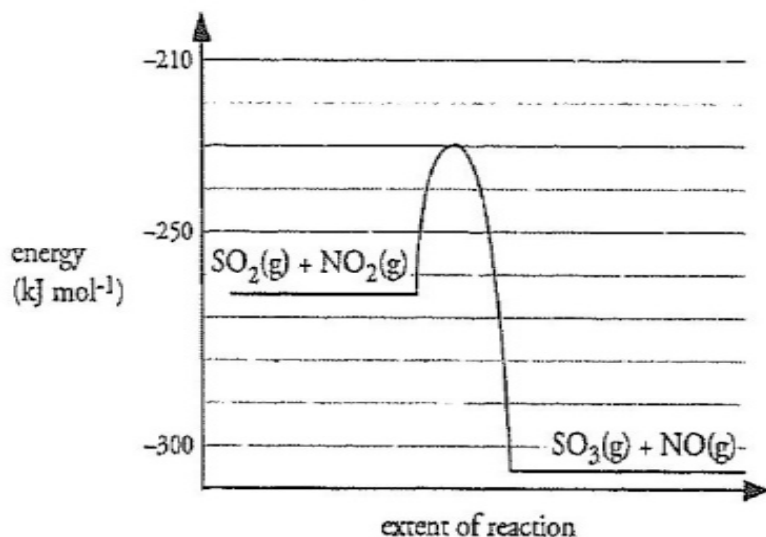
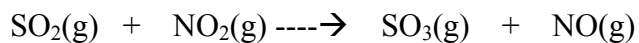
XZ has a solubility of 0.100 mol L^{-1} , while XL has a solubility of $= 0.050 \text{ mol L}^{-1}$

Dissolution of XZ to form a saturated solution.

Dissolution of XL to form a saturated solution

Question 18 (7 marks)

The graph below represents the energy changes in following chemical reaction :



- (a) What is the magnitude and sign of ΔH for the above reaction? (2 marks)

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- (b) What is the activation energy for the reaction? (1 mark)

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- (c) Explain why the rate of the reaction increases with increasing temperature. (2 marks)

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- (d) Explain how the use of a catalyst would affect the rate of the reaction. (2 marks)

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Question 19 (6 marks)

Ethane (C_2H_6) undergoes complete combustion in excess oxygen to form carbon dioxide and water.

- (a) Write a balanced equation for the complete combustion of ethane in excess oxygen. (1 mark)

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- (b) Calculate how many mole of oxygen would react with 3.01 g of ethane. (2 marks)

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- (c) Calculate how many litres of oxygen are needed to react with 3.01 g of ethane at 25°C and 100kPa. (3 marks)

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Question 20 (7 marks)

A compound of carbon, hydrogen, oxygen and nitrogen has the following percentage composition: % C = 50.00 ; % H = 8.33 ; %N = 19.44

21.6 g is found to represent 0.150 mol of the compound.

- (a) Calculate the percentage of oxygen in the compound. (1 mark)

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- (b) Calculate the empirical formula of the compound. (3 Marks)

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- (c) Calculate the molar mass of the compound. (1 mark)

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- (d) Deduce the molecular formula of the compound. (2 marks)

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Question 21 (3 marks)

Discuss the implications for aquatic life in a water body affected by thermal pollution.

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Question 22 (3 marks)

Instant cold packs used to treat sporting injuries often contain ammonium nitrate and a plastic bag of water. When the bag is broken the ammonium nitrate dissolves.

- (a) Is this reaction exothermic or endothermic? Justify your answer. (1 mark)

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- (b) Give an equation for the dissolution of ammonium nitrate including heat as a reactant or product. (2 marks)

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End of Test

Student No.

Mark

Part A: Answer grid for multiple choice questions

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|-----|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 1. | A ☐ | B ☒ | C ☐ | D ☐ |
| 2. | A ☒ | B ☐ | C ☐ | D ☐ |
| 3. | A ☐ | B ☐ | C ☒ | D ☐ |
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| 11. | A ☐ | B ☐ | C ☐ | D ☒ |
| 12. | A ☐ | B ☐ | C ☐ | D ☐ |

1. The chemical and physical properties of water under normal conditions are significant to life on Earth. Indicate whether the property which is significant for the indicated role is physical or chemical.

	<i>Role</i>	<i>Property</i>
(A)	as a constituent of cells	mainly chemical only
(B)	as a habitat with less temperature extremes	mainly physical only
(C)	an agent of weathering	mainly physical only
(D)	a natural resource for humans and other organism	mainly chemical only

Outcomes:P6,P14

2. The properties of water as a solvent depend on the properties of its components:
Choose the correct sequence of interactions to explain the macroscopic properties of water.

	<i>Sequence of interactions</i>
(A)	atomic properties→molecular properties→polarity→hydrogen bonding
(B)	hydrogen bonding→polarity→atomic properties→molecular properties
(C)	polarity→atomic properties→hydrogen bonding→molecular ptorperities
(D)	molecular properties→atomic properties→polarity→hydrogen bonding

Outcomes:P6,P13,P14

3. Water has higher surface tension, viscosity and, boiling and melting points than other liquids:

What property of water contributes to these higher values?

- (A) Its high density
- (B) Its high molar mass
- (C) Its bent structure**
- (D) Its open structure when solid

Outcomes:P6,P13

4. Water interacts with various solutes to dissolve them.

Which predominant interaction accounts for the dissolution of the given solute in water.

	<i>Solute</i>	<i>Interaction</i>
(A)	sodium chloride	hydrogen bonding
(B)	sucrose	ion-dipole interaction
(C)	hydrogen chloride	hydrogen bonding
(D)	oxygen molecule	dispersion forces

Outcomes:P6,P13,P4

5. The solubility of calcium hydroxide is 0.12 g/100 g water and sodium chloride is 36 g/ 100 g water.

When the 14 g of calcium hydroxide and 14 g of sodium chloride are added to a beaker containing 100g water what type of solution results for each solute?

	<i>Calcium hydroxide</i>	<i>Sodium chloride</i>
(A)	unsaturated	unsaturated
(B)	supersaturated	unsaturated
(C)	saturated	saturated
(D)	saturated	unsaturated

Outcomes:P6,P13,P14

6. Which of the following fossil fuels was formed in ancient swamps and marshes?

- (A) Coal
- (B) Petroleum
- (C) Natural Gas
- (D) Uranium

Outcomes:P9

7. Which of the following equations represents photosynthesis?

- (A) $2\text{C}_8\text{H}_{18}(\text{l}) + 25\text{O}_2(\text{g}) \rightarrow 16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O}(\text{l})$
- (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) $16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{C}_8\text{H}_{18}(\text{l}) + 25\text{O}_2(\text{g})$
- (D) $\text{C}_6\text{H}_{12}\text{O}_6(\text{aq}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$

Outcomes:P9, P4

8. What is the standard used to compare relative atomic masses of atoms ?

- (A) Carbon – 14
- (B) Carbon – 12**
- (C) Nitrogen – 14
- (D) Nitrogen – 13

Outcomes:P1

9. What is the molar mass of a substance ?

- (A) The mass of one mole of the substance.
- (B) The ratio of the mass of one mole of the substance to 12.0 g of carbon – 12.
- (C) The sum of the relative atomic masses of the elements in the formula of the substance.**
- (D) The mass of one molecule of the substance relative to the mass of one atom of carbon – 12 taken as exactly 12.0 g

Outcomes:P2

10. Strict safety rules must be adhered to in and around flour mills to prevent explosions due to the presence of fine particles of flour.

Which of the following statements is the best explanation for this?

- (A) It is very easy to heat the fine particles of flour to their ignition temperature.
- (B) The surface area of the flour particles is very large and thus combustion reactions are very rapid.**
- (C) The activation energy for the reaction of fine particles of flour is much lower than for larger particles.
- (D) When flour is ground to fine particles the energy profile for the combustion reaction is changed.

Outcomes:P4

11. An important reaction for the production of ammonia, NH_3 is shown below.

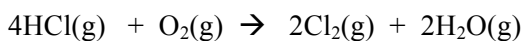


Which of the following procedures would NOT cause the rate of the reaction to increase, if the reaction takes place in a sealed container?

- (A) Increasing the temperature.
- (B) Increasing the concentration of hydrogen.
- (C) Adding a suitable catalyst.
- (D) Adding an inert gas.**

Outcomes:P5,P8

12. The equation for the reaction of HCl and O_2 is shown below.



50 mL of oxygen gas reacts completely with excess hydrogen chloride gas.

What volume of hydrogen chloride will have reacted and what is the volume of the products formed?

	Volume of HCl (mL)	Volume of Product (mL)
(A)	200	100
(B)	50	200
(C)	12.5	25
(D)	100	50

Outcomes:P10

Question 13 (2 marks)

Both hydrogen sulfide and water are triatomic, yet they differ significantly in their melting and boiling points.

<i>Property</i>	<i>Hydrogen sulfide</i>	<i>Water</i>
Melting point (°C)	–83	0.00
Boiling point (°C)	–62	100.0

Explain the differences in the boiling point and melting point of hydrogen sulfide and water.

Outcomes: P6, P13

Sample answer:

Boiling point is an indication of the strength of the intermolecular forces existing between molecules. Water exhibit hydrogen bonding because of the small size of the hydrogen atom and the high electronegativity of oxygen, dipole-dipole interaction and dispersion forces. Hydrogen sulfide is polar, has dispersion forces but does not hydrogen bond. Hydrogen bonding is a stronger interaction than dipole-dipole and dispersion forces and therefore water has the higher boiling point.

<i>Criteria</i>	<i>Mark(s)</i>
Listing and comparing the intermolecular forces in water and in hydrogen sulfide	1
Relating the relative strength of intermolecular forces in hydrogen sulfide and in water to the boiling point.	1

Question 14 (4 marks)

How many mL of a 0.250 mol L⁻¹ BaCl₂ solution is required to precipitate all the sulfate ions from 10.0 mL of a 10.0 % (w/v) solution of Na₂SO₄?

Outcomes:P10, P13

Sample answer:

$$C \text{ in mol L}^{-1} \text{ of Na}_2\text{SO}_4 = \frac{10.0}{2 \times 22.99 + 32.07 + 4 \times 16.00} \times \frac{1000}{100} = 0.704 \text{ mol L}^{-1}$$

(1 marks)



$$\text{moles Ba}^{2+} = \text{moles SO}_4^{2-} = C \times V = 0.704 \times 0.0100 = 0.00704 \text{ moles} \quad (1 \text{ mark})$$

$$\text{Volume of BaCl}_2 = \frac{\text{moles}}{\text{concentration}} = \frac{0.00704}{0.250} = 0.02816 = 28.2 \text{ mL} \quad (1 \text{ mark})$$

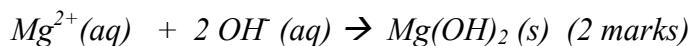
Question 15 (2 marks)

A solution contains both magnesium chloride and potassium chloride. Predict the reaction(s) that can occur if a solution of sodium hydroxide is added to this solution. Use (a) net ionic equation(s) to represent the reaction(s).

Outcomes: P8,P13

Sample answer:

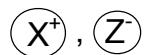
Only magnesium chloride will react with the sodium hydroxide to form magnesium hydroxide.



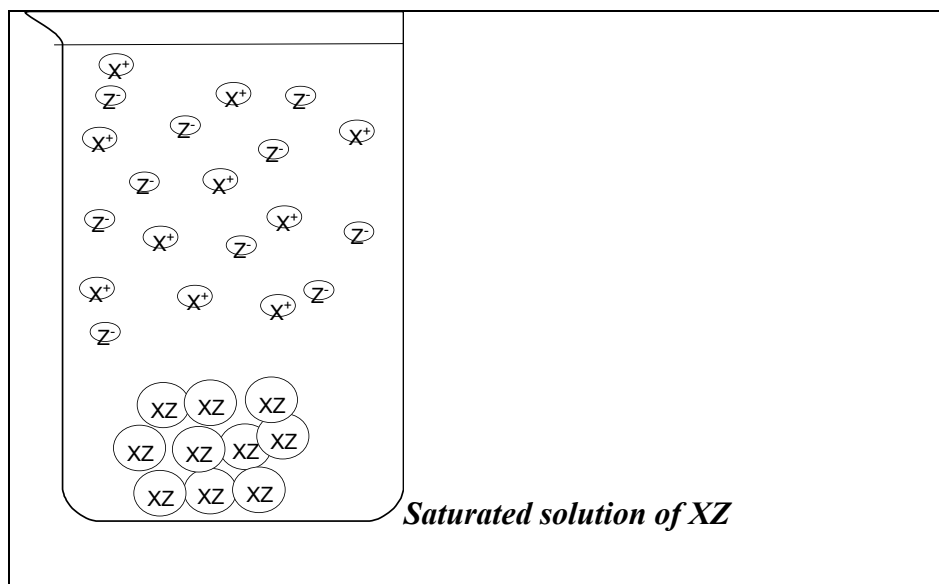
Criteria	Mark(s)
Correct ionic equation with phase labels	2
Correct ionic equation without phase labels	1

Question 16 (2 marks)

Draw a diagram to represent the dissolution and formation of a saturated solution by the ionic compounds (XZ) when 0.20 mole is placed in 100 g water. Represent the ions with the symbols:



XZ has a solubility of 0.100 mol L^{-1}



Marking Guidelines

<i>Criteria</i>	<i>Mark(s)</i>
<i>XZ broken up to component ions</i>	<i>2</i>
<i>Extra undissolved solute present</i>	
<i>1 of the above</i>	<i>1</i>

Question 17 (5 marks)

When 100 mL of a 0.500 mol L⁻¹ silver nitrate solution is added to 200 mL of 1.00 mol L⁻¹ sodium hydroxide solution, a brown precipitate of silver hydroxide forms

- (a) Calculate the mass of precipitate formed (3 marks)



$$\text{mol AgNO}_3 = C \times V = 0.50 \times 0.100 = 0.050$$

$$\text{mol NaOH} = C \times V = 1.00 \times 0.200 = 0.200$$

Silver nitrate is the limiting reagent (1 mark)

$$\text{Therefore, mol of AgOH} = 0.050$$

$$\text{Mass of AgOH} = \text{mol} \times \text{molar mass} = 0.05 \times (107.9 + 16.00 + 1.008) = 6.25\text{g} \quad (1 \text{ mark})$$

- (b) Calculate the concentration of hydroxide ions in the final solution. (2 marks)

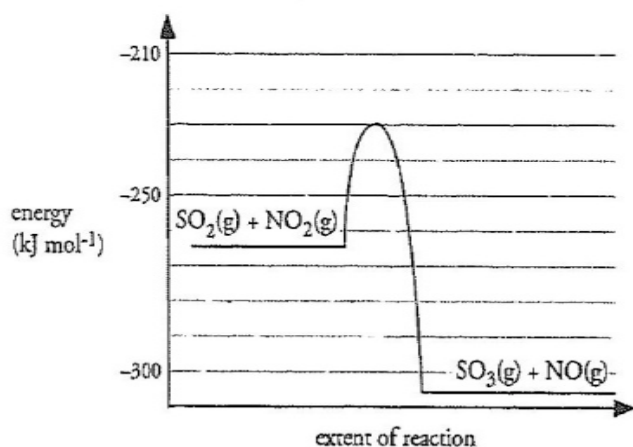
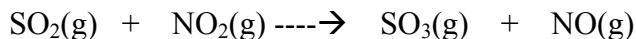
$$\text{mol hydroxide ions left over after precipitation} = 0.200 - 0.05 = 0.150 \text{ mol} \quad (1 \text{ mark})$$

$$[\text{OH}^-] = \text{mol/volume} = \frac{0.150 \text{ mol}}{(0.1 + 0.2) \text{ L}} = 0.50 \text{ mol L}^{-1} \quad (1 \text{ mark})$$

Question 18 (7 marks)

Outcomes: P8,P10

The graph below represents the energy changes in following chemical reaction :



- (a) What is the magnitude and sign of ΔH for the above reaction? (2 marks)

$$\Delta H = -305 - -265 = -40 \text{ kJ mol}^{-1}$$

- (b) What is the activation energy for the reaction? (1 mark)

$$\text{Activation energy} = -230 - -305 = 75 \text{ kJ mol}^{-1}$$

- (c) Explain why the rate of the reaction increases with increasing temperature. (2 marks)

Temperature increases cause the kinetic energy of the molecules to increase thus there are more successful collisions per second due to more molecules having energy equal to or greater than the activation energy.

- (d) Explain how the use of a catalyst would affect the rate of the reaction. (2 marks)

A catalyst would provide an alternative reaction pathway with a lower activation energy.

a

Criteria	Mark
Correct calculation of ΔH using information from graph and sign	2
Either correct calculation or sign	1

b

Criteria	Mark
Correct calculation of activation energy	1

c

Criteria	Mark
Explanation of increasing rate of reaction with increasing temperature	2
Description of increasing rate with increasing temperature	1

d

Criteria	Mark
Explain how a catalyst affects reaction pathway	2
Describe how a catalyst affects reaction pathway	1

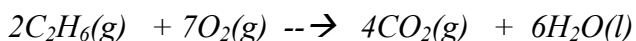
Question 19 (6 marks)

Outcomes: P7,P9

Ethane (C₂H₆) undergoes complete combustion in excess oxygen to form carbon dioxide and water.

- (a) Write a balanced equation for the complete combustion of ethane in excess oxygen.

(1 mark)



Criteria	Mark
Correct balanced equation with reactants and products	1

- (b) Calculate how many mole of oxygen would react with 3.01 g of ethane. (2 marks)

$$\text{Molar mass ethane} = 2(12.01) + 6(1.008) = 30.068 \text{ g}$$

$$N(\text{ethane}) = m / M = 3.01 / 30.068 = 0.100 \text{ mol ethane}$$

$$\text{Reacting mole ration } 2 : 7 : 4 : 6$$

$$\text{If } 0.01 \text{ mol ethane reacts, the reacting ratio becomes } 0.10 : 0.35 : 0.20 : 0.30$$

$$\text{Thus } 0.35 \text{ mol of O}_2 \text{ will react with } 0.10 \text{ mol ethane}$$

$$V(\text{O}_2) = n \times VM = (0.35) \times (24.79) = 8.68 \text{ L at } 250\text{C and } 100\text{kPa}$$

Criteria	Mark
Correct calculation of no moles of ethane showing all working	2
One correct calculation	1

- (c) Calculate how many litres of oxygen are needed to react with 3.01 g of ethane at 25⁰C and 100kPa. (3 marks)

Criteria	Mark
Correct calculation of volume of oxygen required at 250C showing all working	3
Some correct calculations and formula / values used	2
One correct calculation	1

Question 20 (7 marks)

Outcomes: P9,P10

A compound of carbon, hydrogen, oxygen and nitrogen has the following percentage composition: % C = 50.00 ; % H = 8.33 ; %N = 19.44

21.6 g is found to represent 0.150 mol of the compound.

- (a) Calculate the percentage of oxygen in the compound. (1 mark)

Sample Answer :

$$\% O = 100 - 50.0 - 8.33 - 19.44 = 22.23 \%$$

- (b) Calculate the empirical formula of the compound. (3 Marks)

	<i>Carbon</i>	<i>Hydrogen</i>	<i>Nitrogen</i>	<i>Oxygen</i>
%	50.0	8.33	19.44	22.23
No. Mol	$50.0 / 12 = 4.17$	$8.33 / 1.0 = 8.33$	$19.44 / 14 = 1.39$	$22.23 / 16 = 1.39$
Smallest ratio	$4.17 / 1.39 = 3.0$	$8.33 / 1.39 = 5.99 = 6.0$	1.0	1.0

Thus empirical formula is C3H6NO

- (c) Calculate the molar mass of the compound. (1 mark)

$$\text{Molar mass of compound} = 21.6 / 0.15 = 144 \text{ g mol}^{-1}$$

(d) Deduce the molecular formula of the compound. (2 marks)

Molecular formula is $(C_3H_6NO)_x$

Thus $36x + 6x + 14x + 16x = 144$ ie $72x = 144$ and $x = 2$

Thus molecular formula is $C_6H_{12}N_2O_2$

a

Criteria	Mark
Correct calculation of % oxygen	1

b

Criteria	Mark
Correct determination of empirical formula with correct calculation of mol and ratios	3
Correct calculations of some quantities eg mol and ratios	2
Some correct calculations	1

c

Criteria	Mark
Correct calculation of molar mass	1

d

Criteria	Mark
Correct determination of molecular formula with calculations	2
Some correct calculations	1

Question 21 (3 marks)

Discuss the implications for aquatic life in a water body affected by thermal pollution.

Sample answer

Excess heat energy discharged in to the environment can cause thermal pollution. This can cause the water to have less dissolved oxygen which can be fatal to fish and other aquatic organisms. Fish also have higher metabolic rates in hotter water and require more oxygen which has been depleted. Higher water temperatures can also trigger early migration or spawning in fish at the wrong time of year, causing disruption to breeding cycles.

<i>Marking Criteria</i>	<i>Mark(s)</i>
<i>Defines thermal pollution and gives two implications to aquatic life.</i>	<i>3</i>
<i>Defines thermal pollution and gives one implication to aquatic life. OR Gives two implications to aquatic life</i>	<i>2</i>
<i>Defines thermal pollution OR gives one implication to aquatic life.</i>	<i>1</i>

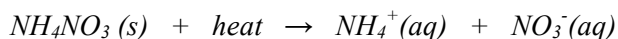
Outcomes: P4**Question 22** (3 marks)

Instant cold packs used to treat sporting injuries often contain ammonium nitrate and a plastic bag of water. When the bag is broken the ammonium nitrate dissolves.

- (a) Is this reaction exothermic or endothermic? Explain. (1 mark)

Endothermic, as the pack gets colder.

- (b) Give an equation for the dissolution of ammonium nitrate including heat as a reactant or product. (2 marks)



1 mark for balanced equation 1 mark for the inclusion of heat

Outcomes: P7