



James Ruse Agricultural High School

Student Number.....

Mark

Theory

Year 11 Preliminary Chemistry Exam 2008

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 this page

Total Marks 45

Part A

Multiple Choice: 13 marks Attempt Questions 1-13

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

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9
A B C D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A B C D

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

A B C D
correct →

▶ Mark your answers for Questions 1 – 13 in the Answer Box on page 8

1. Which of the following accurately describes the percentage and distribution of water in the atmosphere, lithosphere and hydrosphere?

	Atmosphere	Lithosphere	Hydrosphere
(A)	0.001	0.6	99.4
(B)	0.2	12.9	86.9
(C)	0.6	0.001	99.4
(D)	12.9	0.2	86.9

2. Identify the compound that has the empirical formula CH_2 .

- (A) CH_4
(B) $\text{CH}_3 - \text{CH}_3$
(C) $(\text{CH}_3)_2\text{C} = \text{CH}_2$
(D) $\text{CH}_3 - \text{C} \equiv \text{C} - \text{H}$

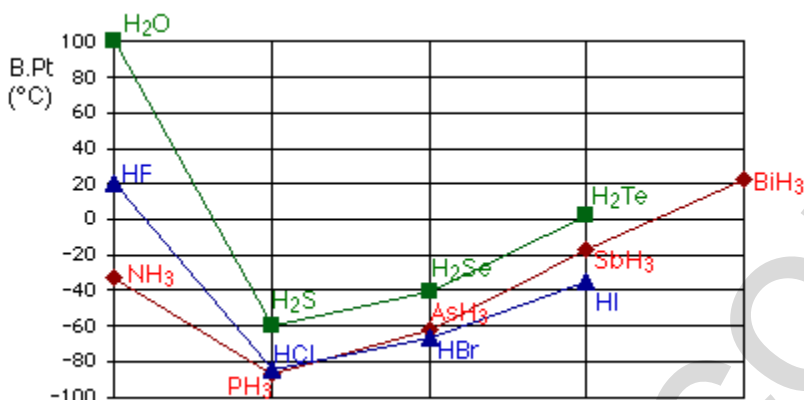
3. Which of the following will NOT dissolve in water?

- (A) sodium chloride
(B) hydrogen chloride
(C) oxygen
(D) silicon dioxide

4. How many chloride ions are there in 0.25 mole of calcium chloride?

- (A) 0.50
(B) 0.25
(C) 3.01×10^{23}
(D) 1.51×10^{23}

5. The diagram shows a graph of the hydrides of groups 5, 6, 7 elements.



What type of intermolecular force(s) exhibited by H₂O, HF and NH₃ specifically explains the elevated boiling points of these substances?

- (A) dipole-dipole interaction
- (B) hydrogen bonding
- (C) dispersion forces
- (D) dispersion forces and dipole-dipole interaction
6. Which of the following statements is true regarding a saturated solution of Ca(OH)₂ in water at 25°C?
- (A) $[Ca^{2+}] = 2 \times [OH^-]$
- (B) solubility of Ca(OH)₂ in mol L⁻¹ 25°C = $[Ca^{2+}]$
- (C) solubility of Ca(OH)₂ in mol L⁻¹ 25°C = $[OH^-]$
- (D) $[Ca^{2+}] = [OH^-]$
7. Which of the following phenomena is explained by the comparatively large specific heat capacity of water?
- (A) ice floating on water
- (B) high viscosity of water
- (C) cooling effect of evaporating perspiration
- (D) the moderating effect of oceans on the Earth's temperature

8. Match the indicated measures of concentration with the appropriate substances

	% v/v	% w/v	ppm	mol L⁻¹
(A)	alcohol in wine	vinegar (aq)	Se in soil	HCl (aq)
(B)	vinegar (aq)	HCl (aq)	alcohol in wine	Se in soil
(C)	HCl (aq)	Se in soil	vinegar (aq)	alcohol in wine
(D)	alcohol in wine	HCl (aq)	Se in soil	vinegar (aq)

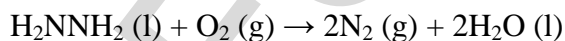
9. What is a result of an increase in the temperature of a substance?
- (A) An increase in the substance's chemical energy.
 - (B) A decrease in the substance's chemical energy.
 - (C) An increase in the average kinetic energy of the substance's particles.
 - (D) A decrease in the average kinetic energy of the substance's particles.
10. Which condition determines whether a reaction is classified as explosive?
- (A) release of heat energy
 - (B) the amount of oxygen available to react
 - (C) rapid rate of reaction
 - (D) heat absorbed

11. The ignition temperatures of various fuels are given in the table.

Fuel	Ignition temperature (°C)
Butane	405
Petrol (octane)	390
Ethanol	392
oil	350

Which type of fuel would most likely spontaneously ignite without the need for a spark?

- (A) butane
(B) petrol
(C) ethanol
(D) oil
12. Nitrogen may be formed from reacting oxygen with hydrazine.



Which chemical bonds require energy to break and which bonds release energy when hydrazine reacts with oxygen?

	Bonds requiring energy to break	Bonds releasing energy when formed
(A)	N-N	H-N
(B)	H-N	N-N
(C)	H-O	O-O
(D)	O-O	H-N

13. Which equations represent complete combustion and incomplete combustion?

	complete combustion	incomplete combustion
(A)	$2\text{C}_8\text{H}_{18(l)} + 25\text{O}_{2(g)} \rightarrow 16\text{CO}_{2(g)} + 18\text{H}_2\text{O}_{(l)}$	$\text{CH}_{4(l)} + 2\text{O}_{2(g)} \rightarrow \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)}$
(B)	$2\text{C}_3\text{H}_{8(g)} + 7\text{O}_{2(g)} \rightarrow 6\text{CO}_{(g)} + 8\text{H}_2\text{O}_{(l)}$	$2\text{C}_3\text{H}_{8(g)} + 10\text{O}_{2(g)} \rightarrow 6\text{CO}_{2(g)} + 8\text{H}_2\text{O}_{(l)}$
(C)	$2\text{C}_8\text{H}_{18(l)} + 17\text{O}_{2(g)} \rightarrow 16\text{CO}_{(g)} + 18\text{H}_2\text{O}_{(l)}$	$2\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow 2\text{CO}_{(g)}$
(D)	$2\text{C}_6\text{H}_{6(l)} + 15\text{O}_{2(g)} \rightarrow 12\text{CO}_{2(g)} + 6\text{H}_2\text{O}_{(l)}$	$2\text{C}_8\text{H}_{18(l)} + 8\text{O}_{2(g)} \rightarrow 7\text{CO}_{(g)} + 9\text{C}_{(s)} + 9\text{H}_2\text{O}_{(l)}$

Student No.

Part A: Answer grid for multiple choice questions

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| 1. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 4. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 5. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 6. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 7. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 8. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 9. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 10. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 11. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 12. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 13. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

Marks:

14. The electron dot structure of a substance shows the electron distribution in that substance.

(a) Draw the electron dot structure for H₂O and for NH₃.(1 mark)



(b) Compare the shape of the water molecule with the shape of the ammonia molecule.(2 marks)

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15. Water has a number of unusual properties which can be traced to its molecular structure.

(a) Discuss the implications, in terms of physical properties of water, if the water molecule was *linear*. (2 marks)

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(b) Discuss the environmental implications, for aquatic invertebrates, of the unusually high surface tension of water . (2 marks)

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16. $\text{Ba}(\text{OH})_2$ reacts with H_2SO_4 to produce a precipitate of BaSO_4 and water.

(a) Write a balanced net ionic equation for this reaction. Include the states of the substances (1 mark)

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(b) Calculate the mass of solid BaSO_4 produced if 20.0 mL of $0.20 \text{ mol L}^{-1} \text{ Ba}(\text{OH})_2$ is mixed with 40.0 mL of $0.20 \text{ mol L}^{-1} \text{ H}_2\text{SO}_4$. (2 marks)

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17. An unscrupulous factory owner dumped about 6.0 kg of solid NaOH in a 75,000L pond. If the heat of solution of NaOH is 44.2 kJ mol^{-1} ,

(a) Calculate how much heat is released with the complete dissolution of the NaOH in the pond. (2 marks)

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(b) What will be the final temperature of the pond if the original temperature was 10°C ? (1 mark)

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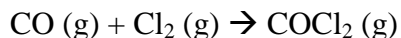
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(c) Does this constitute thermal pollution of the pond? Explain your answer. (1 mark)

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18. The equation for the production of phosgene is



(a) State one variable that would need to be controlled when investigating the effect of concentration on the rate of the reaction for the production of phosgene. (1 mark)

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(b) Explain the effect of increasing the concentration of the reactants on the rate of the reaction. (2 marks)

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(c) Identify one other factor that may influence the rate of the reaction. (1 mark)

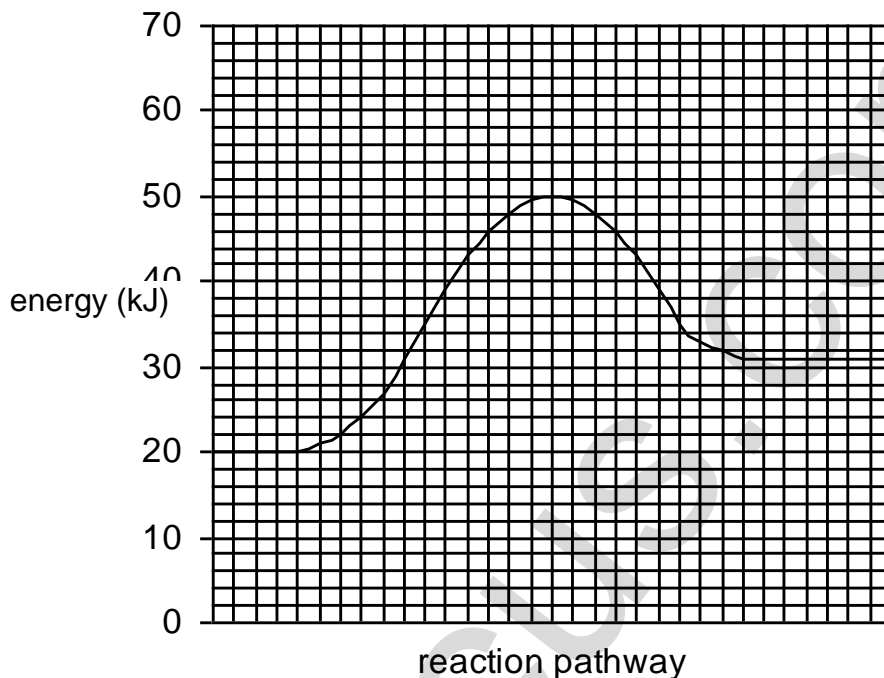
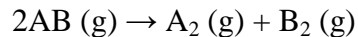
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19. Describe one condition in industrial environments that may contribute to an explosion. (1 mark)

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20. The energy pathway for the following reaction is shown in the graph.



(a) Identify the reaction as endothermic or exothermic. (1 mark)

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(b) Give a reason for your answer to (a). (1 mark)

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(c) State the activation energy for the reaction. (1 mark)

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(d) On the graph above, construct a graph for the reaction to show the effect of using a catalyst on the reaction pathway. (1 mark)

(e) Identify the effect of using a catalyst on this reaction. (1 mark)

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21. Fluorine gas was passed over solid tin(II)sulfide at 500°C and the products were sulfur hexafluoride gas and a solid. The solid contained 61% by mass of tin and 39% by mass of fluorine.

(a) Determine the empirical formula of the solid produced. (1 mark)

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(b) Name the solid (1 mark)

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22. 2.25 g scandium metal reacts with excess hydrochloric acid to give 1.86 L hydrogen gas at 25°C and 100 kPa and a salt.

(a) How many moles of scandium reacted? (1 mark)

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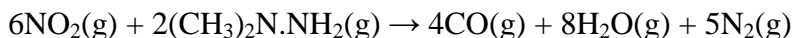
(b) How many moles of hydrogen were produced? (1 mark)

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(c) Use your answers in (a) and (b) to write an equation for this reaction. (1 mark)

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23. Dimethyl hydrazine, $(\text{CH}_3)_2\text{N.NH}_2$, together with the nitrogen dioxide is the fuel mixture sometimes used in rockets. The combustion equation is



At the temperature of the reaction, all reactants and products are gaseous.

- (a) How many litres of nitrogen dioxide gas would have to be supplied to produce 85 L of gaseous product in this reaction? Assume all gases were measured at the same temperature and pressure (500°C and 350 kPa). (2 marks)

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- (b) Whose Law of Combining Volumes of Gases is used to determine the answer in (a)? (1 mark)

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