

# Chemistry preliminary exam-james ruse



**ASSIGN  
BUSTER**

Student Number Mark / 39 Chemistry Preliminary Course Final Examination -  
2006 General Instructions - - - - - Reading time — 5 minutes Working time

— 45 minutes Write using black or blue pen Draw diagrams using pencil

Board-approved calculators may be used A Data Sheet and a Periodic Table  
are provided Write your Student Number at the top of this page Total Marks

— 39 Part A — 10 marks - Attempt Questions 1 — 10 - Allow about 10

minutes for this part Part B — 29 marks - Attempt Questions 11 — 19 - Allow

about 35 minutes for this part Part A — 10 marks Attempt Questions 1 — 10

Allow about 10 minutes for this part Answer Box for Questions 1 — 10 1 2 3 4

5 6 7 8 9 10 A A A A A A A A A B B B B B B B B B C C C C C C C C C D D

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â–° Mark your answers for Questions 1 — 10 in the Answer Box on page 2. 1

The law of combining volumes states that the ratio of gases involved in a  
chemical reaction can be expressed in simple whole number ratios. Identify

who proposed this law? (A) (B) (C) (D) Dalton Gay—Lussac Avogadro

Mendeleev 2 Which statement is correct for NO<sub>2</sub> gas? (A) (B) (C) (D) One

molecule has a mass of 46 g. One molecule occupies a volume of 24. 79 L at

0°C and 100 kPa. One mole contains 6. 02 Å— 10<sup>23</sup> atoms of oxygen. One

mole contains 6. 02 Å— 10<sup>23</sup> molecules. 3 The extraction of a metal from its

ore involves a series of steps as shown... mine ore concentrate ore extract

metal via smelting purify the metal Which chemical equation represents a

reaction that would be appropriate for the metal extraction step for copper

from its ore? (A) (B) (C) (D)  $\text{FeO (s)} + \text{SiO}_2 \text{ (s)} \rightarrow \text{FeSiO}_3 \text{ (l)}$   $2\text{CuFeS}_2 \text{ (s)} +$

$5\text{O}_2 \text{ (g)} \rightarrow 2\text{Cu (l)} + 2\text{FeO (s)} + 4\text{SO}_2 \text{ (g)}$   $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$   $\text{CuO (s)} + \text{Mg}$

$\text{(s)} \rightarrow \text{MgO (s)} + \text{Cu (s)}$  4 Which of these processes is endothermic? (A) (B)

(C) (D) decomposition of silver chloride to silver and chlorine burning

methane condensing steam adding sodium metal to water JRAHS Chem 11 — Final Examination — 2006 Page 3 of 11

5 Which graph represents the change in potential energy for the reaction...  $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2(\text{g}) + 2\text{O}_2(\text{g})$   $\Delta H = +33.7 \text{ kJ mol}^{-1}$  (A) (B) (C) (D)

6 Graph A Graph B Graph C Graph D A compound contains potassium, sulfur and oxygen only. A sample of the compound is found to contain 41.1 mg of potassium, 33.8 mg of sulfur and 25.2 mg of oxygen. Which of the following represents the empirical formula of the compound? (A) (B) (C) (D)  $\text{K}_2\text{SO}_4$   $\text{K}_2\text{SO}_3$   $\text{K}_2\text{S}_2\text{O}_3$   $\text{K}_2\text{SO}_2$

7 In a calorimeter, a 1.000 g sample of magnesium is burned to form  $\text{MgO}$ , and in so doing, releases 6.075 kJ of energy. What is the heat of combustion, in kJ, of one mole of magnesium? (A) (B) (C) (D) 6.075 72.90 147.7 3.65

8 10 mL of hydrogen fluoride gas reacts with 5 mL of dinitrogen difluoride gas to form 10 mL of a gas. All gas volumes are measured at the same temperature and pressure. Which of the following is the most likely equation for the reaction? (A) (B) (C) (D)  $\text{HF}(\text{g}) + \text{N}_2\text{F}_2(\text{g}) \rightarrow \text{N}_2\text{HF}_3(\text{g})$   $2\text{HF}(\text{g}) + \text{N}_2\text{F}_2(\text{g}) \rightarrow \text{N}_2\text{H}_2\text{F}_4(\text{g})$   $2\text{HF}(\text{g}) + \text{N}_2\text{F}_2(\text{g}) \rightarrow 2\text{NHF}_2(\text{g})$   $\text{HF}(\text{g}) + 2\text{N}_2\text{F}_2(\text{g}) \rightarrow \text{N}_4\text{HF}_5(\text{g})$

9 The table shows the solubility of salts in water at  $25^\circ\text{C}$ .

ANION	All Nitrate, $\text{NO}_3^-$	All Acetate/ethanoate $\text{CH}_3\text{COO}^-$	All Chloride, $\text{Cl}^-$	All Bromide, $\text{Br}^-$	All Iodide, $\text{I}^-$	All Sulfate, $\text{SO}_4^{2-}$	All Group I metals Ammonium, $\text{NH}_4^+$
CATION	soluble	soluble	soluble	soluble	soluble	soluble	soluble
Group I and II metals, $\text{NH}_4^+$	soluble	soluble	soluble	soluble	soluble	soluble	soluble
All others	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Hydroxide, $\text{OH}^-$	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Group I metals, $\text{NH}_4^+$ , $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$	soluble	soluble	soluble	soluble	soluble	soluble	soluble
All others	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Carbonate, $\text{CO}_3^{2-}$	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Phosphate, $\text{PO}_4^{3-}$	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Sulfite, $\text{SO}_3^{2-}$	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble
Group I metals, $\text{NH}_4^+$	soluble	soluble	soluble	soluble	soluble	soluble	soluble
All others	soluble	soluble	insoluble	insoluble	insoluble	insoluble	insoluble

several salt solutions as described in the table. Mixture number 1 2 3 Salt solutions mixed sodium sulfate + magnesium nitrate sodium chloride + magnesium iodide calcium nitrate + ammonium sulfate In which mixture(s) will a precipitate occur? (A) (B) (C) (D) 1 only 1 and 3 1 and 2 3 only JRAHS Chem 11 — Final Examination — 2006 Page 5 of 11 10 A single piece of zinc was put into 2 mol L<sup>-1</sup> hydrochloric acid. It was observed that the rate of production of hydrogen gas soon reached a maximum and then decreased. The following reasons were put forward for the decrease in the rate of formation of hydrogen... I II III The concentration of the acid decreased as the reaction proceeded. The surface area of the zinc decreased as the reaction proceeded. The reaction was exothermic. Which of the above three suggestions explains the decreasing reaction rate? (A) (B) (C) (D) I, II and III I and II only I only II only JRAHS Chem 11 — Final Examination — 2006 Page 6 of 11 Part B — 29 marks Attempt Questions 11 — 19 Allow about 35 minutes for this part <sup>9</sup>Show all relevant working in questions involving calculations. Question 11 (2 marks) Describe the energy changes involved in the dissolving of copper(II) sulfate crystals in water.

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\_\_\_\_\_ Question 12 ( 3 marks) During a chemical reaction, chemical bonds are broken and then reformed. (a) Outline the role of activation energy in this process. (1 mark)

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\_\_\_\_\_ (b) Compare the overall energy involved in breaking and reforming bonds in the combustion of methane. (2 marks)

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\_\_\_\_\_ JRAHS Chem 11 — Final Examination — 2006 Page 7 of 11 Question 13 (6 marks) A group of students were assigned to verify the value of the specific heat capacity of water. The diagram shows their experimental set-up... thermometer immersion heater beaker 250 g water The immersion heater provided 75.7 kJ of heat which raised the temperature of the water in the beaker from 25°C to 85°C. (a) Calculate the experimental value of the specific heat capacity of water. (2 marks)

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water. (2 marks)

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\_\_\_\_\_ Question 15 (4 marks) Identify the molecular shapes and draw the Lewis electron dot structures of water and hydrogen sulfide.

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\_\_\_\_\_ water hydrogen sulfide JRAHS Chem 11 — Final Examination —  
2006 Page 9 of 11 Question 16 (3 marks) Hydrogen gas can be generated by reacting an acid with an active metal. (a) Write an equation for the reaction between magnesium and hydrochloric acid. (1 mark)

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\_\_\_\_\_ (b) Calculate the volume of hydrogen gas generated at 25°C and 100 kPa when 4.86 g of magnesium are reacted with excess 1.00 mol L<sup>-1</sup> hydrochloric acid. (2 marks)

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