

JAN 2014 PAST PAPER

Part B-2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 51 through 54 on the information below and on your knowledge of chemistry.

The diagram below represents three elements in Group 13 and three elements in Period 3 and their relative positions on the Periodic Table.

| | | |
|----|----|---|
| Al | Si | P |
| Ga | | |
| In | | |

Some elements in the solid phase exist in different forms that vary in their physical properties. For example, at room temperature, red phosphorus has a density of 2.16 g/cm^3 and white phosphorus has a density of 1.823 g/cm^3 .

*Group 14:
valence electrons
= 4*

51 Identify the element from the diagram that will react with chlorine to form a compound with the general formula XCl_4 . [1]

52 Consider the Period 3 elements in the diagram in order of increasing atomic number. State the trend in electronegativity for these elements. [1]

*Density question:
Table S*

53 Compare the number of atoms per cubic centimeter in red phosphorus with the number of atoms per cubic centimeter in white phosphorus. [1]

*Same group,
then same no of
valence electrons*

54 Identify *one* element from the diagram that will combine with phosphorus in the same ratio of atoms as the ratio in aluminum phosphide. [1]

Base your answers to questions 55 through 57 on the information below and on your knowledge of chemistry.

The compounds KNO_3 and NaNO_3 are soluble in water.

What causes increase in entropy?

- 55 Compare the entropy of 30. grams of solid KNO_3 at $20.^\circ\text{C}$ with the entropy of 30. grams of KNO_3 dissolved in 100. grams of water at $20.^\circ\text{C}$. [1]

What's the relationship between kinetic energy and heat?

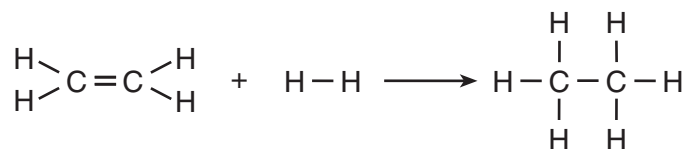
- 56 Explain why the total thermal energy of a sample containing 22.2 grams of NaNO_3 dissolved in 200. grams of water at $20.^\circ\text{C}$ is greater than the total thermal energy of a sample containing 11.1 grams of NaNO_3 dissolved in 100. grams of water at $20.^\circ\text{C}$. [1]

Boiling point elevation, freezing point depression question --> solutions!

- 57 Compare the boiling point of a NaNO_3 solution at standard pressure to the boiling point of water at standard pressure. [1]
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Base your answers to questions 58 through 61 on the information below and on your knowledge of chemistry.

Ethene and hydrogen can react at a faster rate in the presence of the catalyst platinum. The equation below represents a reaction between ethene and hydrogen.



Same as getting the gram formula mass

- 58 Determine the molar mass of the product. [1]

Covalent bonding question. What's the valency of carbon?

- 59 State the number of electrons shared between the carbon atoms in one molecule of the reactant ethene. [1]

Rates of reaction!

- 60 Explain, in terms of activation energy, why the catalyzed reaction occurs at a faster rate. [1]

Organic question. Not done yet but look it up anyway.

- 61 Explain why the reaction is classified as an addition reaction. [1]
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Base your answers to questions 62 and 63 on the information below and on your knowledge of chemistry.

In a titration, 50.0 milliliters of 0.026 M HCl(aq) is neutralized by 38.5 milliliters of KOH(aq).

Titration question.
Use the formula:
 $M_1 \times V_1 = M_2 \times V_2$

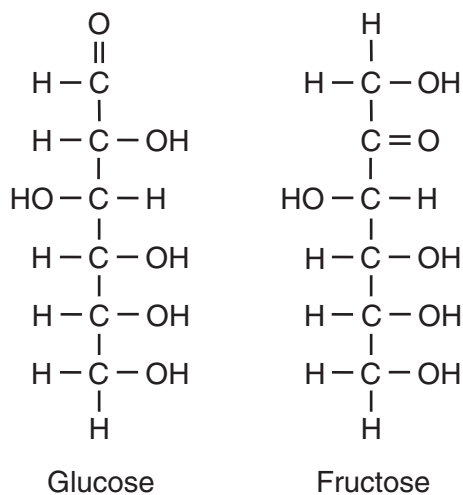
62 In the space *in your answer booklet*, show a numerical setup for calculating the molarity of the KOH(aq). [1]

Clue: titration are double replacement rxns. One product is water.

63 Complete the equation *in your answer booklet* for the neutralization by writing the formula of the missing product. [1]

Base your answers to questions 64 and 65 on the information below and on your knowledge of chemistry.

Table sugar, sucrose, is a combination of two simple sugars, glucose and fructose. The formulas below represent these simple sugars.



Organic question.
Check Table R

64 Identify the functional group that appears more than once in the fructose molecule. [1]

Look up definition of isomer.

65 Explain, in terms of atoms and molecular structure, why glucose and fructose are isomers of each other. [1]

Part C

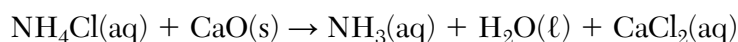
Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2011 Edition Reference Tables for Physical Setting/Chemistry*.

Base your answers to questions 66 through 70 on the information below and on your knowledge of chemistry.

Baking soda, NaHCO_3 , can be commercially produced during a series of chemical reactions called the Solvay process. In this process, $\text{NH}_3(\text{aq})$, $\text{NaCl}(\text{aq})$, and other chemicals are used to produce $\text{NaHCO}_3(\text{s})$ and $\text{NH}_4\text{Cl}(\text{aq})$.

To reduce production costs, $\text{NH}_3(\text{aq})$ is recovered from $\text{NH}_4\text{Cl}(\text{aq})$ through a different series of reactions. This series of reactions can be summarized by the overall reaction represented by the unbalanced equation below.



Check Table E
for name of the
polyatomic ion
in this.

66 Write a chemical name for baking soda. [1]

$\% \text{comp} = \frac{\text{mass C}}{\text{g.f.m}} \times 100$

67 Determine the percent composition by mass of carbon in baking soda (gram-formula mass = 84 grams per mole). [1]

Acids/Bases question.

Check table M

NH_3 is weak base,
 $\text{pH} 10$

68 State the color of bromcresol green in a sample of $\text{NH}_3(\text{aq})$. [1]

Table G question

69 Determine the mass of NH_4Cl that must be dissolved in 100. grams of H_2O to produce a saturated solution at $70.^\circ\text{C}$. [1]

Balance the
equation above

70 Balance the equation *in your answer booklet* for the overall reaction used to recover $\text{NH}_3(\text{aq})$, using the smallest whole-number coefficients. [1]

Base your answers to questions 71 through 75 on the information below and on your knowledge of chemistry.

Rubbing alcohol is a product available at most pharmacies and supermarkets. One rubbing alcohol solution contains 2-propanol and water. The boiling point of 2-propanol is 82.3°C at standard pressure.

Calculate differences in electronegativity using table S

71 Explain, in terms of electronegativity differences, why a C – O bond is more polar than a C – H bond. [1]

Intermolecular forces question. What were the 3 types we talked about?

72 Identify a strong intermolecular force of attraction between an alcohol molecule and a water molecule in the solution. [1]

Table H

73 Determine the vapor pressure of water at a temperature equal to the boiling point of the 2-propanol. [1]

Diference between polar and nonpolar molecules?

74 Explain, in terms of charge distribution, why a molecule of the 2-propanol is a polar molecule. [1]

Organic question. Look it up anyway.

75 In the space *in your answer booklet*, draw a structural formula for the 2-propanol. [1]

Base your answers to questions 76 and 77 on the information below and on your knowledge of chemistry.

Silver-plated utensils were popular before stainless steel became widely used to make eating utensils. Silver tarnishes when it comes in contact with hydrogen sulfide, H_2S , which is found in the air and in some foods. However, stainless steel does *not* tarnish when it comes in contact with hydrogen sulfide.

Lewis dot structure for H_2S Valency/bonding question

76 In the space *in your answer booklet*, draw a Lewis electron-dot diagram for the compound that tarnishes silver. [1]

Electronic structure for S^{2-} ion?

77 In the ground state, an atom of which noble gas has the same electron configuration as the sulfide ion in Ag_2S ? [1]

Base your answers to questions 78 through 81 on the information below and on your knowledge of chemistry.

Common household bleach is an aqueous solution containing hypochlorite ions. A closed container of bleach is an equilibrium system represented by the equation below.



- Equilibrium question* 78 Compare the rate of the forward reaction to the rate of the reverse reaction for this system. [1]
- REDOX (not done)* 79 State the change in oxidation number for chlorine when the $\text{Cl}_2(\text{g})$ changes to $\text{Cl}^-(\text{aq})$ during the forward reaction. [1]
- Look at the state symbol for chlorine in the equation* 80 Explain why the container must be closed to maintain equilibrium. [1]
- Le Chatelier's principal* 81 State the effect on the concentration of the ClO^- ion when there is a *decrease* in the concentration of the OH^- ion. [1]
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Base your answers to questions 82 through 85 on the information below and on your knowledge of chemistry.

Iodine has many isotopes, but only iodine-127 is stable and is found in nature. One radioactive iodine isotope, I-108, decays by alpha particle emission. Iodine-131 is also radioactive and has many important medical uses.

- mass no - atomic no.* 82 Determine the number of neutrons in an atom of I-127. [1]
- What's an isotope?* 83 Explain, in terms of protons and neutrons, why I-127 and I-131 are different isotopes of iodine. [1]
- Write the nuclear eqn for the sentence above.* 84 Complete the equation *in your answer booklet* for the nuclear decay of I-108. [1]
- Half-life question check Table N for half-life. Then find fraction remaining.* 85 Determine the total time required for an 80.0-gram sample of I-131 to decay until only 1.25 grams of the sample remains unchanged. [1]
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