

Beijing City Senior High School Entrance Examination 2008

Chemistry Examination Paper

Notice to Candidates	<ol style="list-style-type: none">1. This examination paper is divided into Paper I and Paper II. Paper I has 4 pages in total, and Paper II has 7 pages in total. There are 4 long questions and 40 short questions in this paper.2. The total score for this examination paper is 80 points, and the time limit for the examination is 100 minutes.3. Write down the name of your district (county), the name of your school, your name, Registration No. and Admission Card No. accurately below the end line of the examination paper (including Paper I and Paper II).4. Return this paper together with the answer sheet upon completion of the examination.5. The symbols “=” and “—” that appear in the chemical equations in this examination paper have the same meaning.
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Relative atomic masses that may be used

H 1 C 12 O 16 Na 23 Mg 24 Si 28 Cl 35.5 Ca 40 Fe 56 Cu 64 Zn 65

Solubility table for parts of alkaline and salt (20°C)

Anion \ Cation	Ba^{2+}	Ca^{2+}	Mg^{2+}	Zn^{2+}	Fe^{2+}	Cu^{2+}
OH^-	Soluble	Slightly soluble	Not soluble	Not soluble	Not soluble	Not soluble
CO_3^{2-}	Not soluble	Not soluble	Slightly soluble	Not soluble	Not soluble	Not soluble

Paper I (Machine-readable Paper, 30 points in total)

Notice to Candidates	<ol style="list-style-type: none">1. Paper I starts on page 1 and ends on page 4. There are 4 pages in total. There is 1 long question and 30 short questions.2. Candidate, please insert your chosen options on the answer sheet according to the requirements. Any answers that are written on the examination paper shall be considered invalid.
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I. Multiple Choice (Each short question has one correct answer only. There are 30 short questions in total, with 1 point for each short question, and 30 points in total).

1. The most abundant element in terms of mass contained in the earth's crust is:
A. Oxygen B. Silicon C. Aluminium D. Iron

2. Natural gas is the most important fossil fuel. Its main component is:

- A. Oxygen B. Nitrogen C. Hydrogen D. Methane

3. Which of the following processes belongs to chemical change?



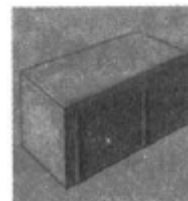
A. Burning a candle



B. Melting snow



C. Extraction of pineapple juice



D. Seepage through brick

4. Which of the following substances is an oxide?

- A. NaCl B. MnO₂ C. NaOH D. H₂SO₄

5. Which of the following metals has the strongest reactivity?

- A. Zn B. Mg C. Fe D. Cu

6. Which of the following substances contains molecular oxygen?

- A. O₂ B. H₂O C. CO₂ D. SO₂

7. The supplemental element required to prevent osteoporosis is:

- A. Iron B. Zinc C. Calcium D. Carbon

8. What determines the type of element?

- A. Proton number B. Neutron number
C. Electron number D. Electron number of the outermost layer

9. In our daily life, the substance that cannot serve as a condiment is:

- A. Edible salt B. Cane sugar C. White vinegar D. Tap water

10. Which of the following substances is a pure substance?



A. Tea drink




B. Distilled water



C. Apple vinegar



D. Milk

11. An ancient poet once praised the chrysanthemum in a line of a poem: “Permeating aroma flies all over Chang-an”. The reason the dense fragrance of this flower spread across Chang-an is:
- A. The mass of the molecule is very small. B. There is space between molecules.
C. Molecules are moving continuously. D. Molecules are composed of atoms.
12. Which of the following items is an incorrect usage of carbon dioxide?
- A. Respiration. B. Serving as a gas fertilizer.
C. Fire extinction. D. Production of carbonated drink
13. Which of the following substances does not need to be tightly sealed when stored?
- A. Concentrated sulphuric acid. B. Sodium hydroxide.
C. Marble. D. Clear limewater.
14. The substance inside the airbag of a car can instantly react within 10 milliseconds after collision, producing the type of gas of which air is mainly composed. This gas is:
- A. Oxygen B. Carbon dioxide
C. Nitrogen D. Noble gas
- 
15. Which of the following chemical formulas is correctly written?
- A. $C + O_2 \text{ === } CO_2$ B. $Zn + HCl \text{ === } ZnCl_2 + H_2$
C. $H_2SO_4 + NaOH \text{ === } NaSO_4 + H_2O$ D. $2KMnO_4 \xrightarrow{\Delta} KMnO_4 + MnO_4 + O_2 \uparrow$
16. When crops are lacking in potassium, their resistance against pests, diseases and falling is reduced. During this time, the chemical fertilizer that should be applied is:
- A. KCl B. $CO(NH_2)_2$ C. NH_4Cl D. $Ca_3(PO_4)_2$

17. Beijing is a city with a serious shortage of water. Which of the following habits should the citizens of Beijing abandon?

- A. Using a washbowl when washing vegetables.
- B. Using fish-feeding water when watering plants.
- C. Using the water-saving tap.
- D. Discarding mineral water bottles that still contain water.

18. Which of the following basic operations of an experiment is correct?



A. Pouring in the liquid.



B. Filtering.



C. Heating a Liquid.



D. Extinguishing an alcohol lamp.

19. Among the following characteristics, which is of a chemical nature?

- A. Aluminium possesses electric conductivity.
- B. Sodium hydrogen carbonate can react to diluted hydrochloric acid.
- C. Sodium chloride is a white solid.
- D. Methane is a colourless and odourless gas under normal temperature.

20. Which of the following substances, with their pH values shown in the brackets, has its acidity and alkalinity closest to neutral?

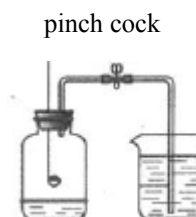
- A. Apple juice (2.9 ~ 3.3).
- B. Tomato juice (4.0 ~ 4.4).
- C. Sweet corn congee (6.8 ~ 8.0).
- D. Soap water (9.8 ~ 10.2).

21. In order to remove a small amount of CO_2 from CO , you should:

- A. pour in thick sulphuric acid
- B. pour in sodium hydroxide solution
- C. ignite a mixed gas
- D. add calcined ferric oxide

22. The device shown in the following diagram can be used to test the oxygen content in air. Before the experiment, add a small amount of water to the gas-collecting bottle and leave a mark on the bottle. Which of the following statements is incorrect?

- A. Red phosphorus must be excessive in the experiment.
- B. Before igniting the red phosphorus, a pinchcock is used to clamp the latex tube.
- C. After the red phosphorus is extinguished, the pinchcock is immediately released.



- D. The volume of water finally entering the bottle is almost the same as the volume of oxygen.

23. Which of the following actual applications follow the principles of neutralisation reaction?

- ① Using quicklime as the desiccant of food.
- ② Using slaked lime and copper sulphate to make Bordeaux mixture.
- ③ Using slaked lime to improve the acidic soil.
- ④ Using sodium hydroxide solution to handle leaked concentrated sulphuric acid.

- A. ①② B. ③④ C. ①④ D. ②③

24. The diagram below shows the molecular model of an organic substance ($C_9H_{10}O_3$).

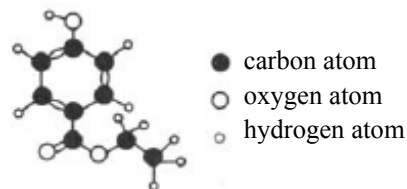
This organic substance is a highly effective desiccant of food. Which of the following statements is incorrect?

A. The organic substance is composed of 3 elements.

B. The organic substance can alleviate the deterioration of food.

C. The proportion of the number of carbon atoms to the number of oxygen atoms in the molecule of the organic substance is 3:1.

D. The mass fraction of the oxygen-bearing elements in this organic substance is the smallest.



25. A “three-way catalytic converter” can convert toxic gas in the tail-pipe gas of a vehicle to non-toxic gas. The following diagram is a schematic diagram of this reaction. The various balls shown in the diagram represent different types of atoms. Which of the following statements is incorrect?



The type of reactant molecules

The type of product molecules

A. Molecules can be separated in chemical change.

B. There must be a single product generated from this reaction.

C. Atoms cannot be separated in chemical change.

D. The ratio of the two types of molecules involved in the reaction is 1:1.

26. Which of the following relationships between the descriptions before and after the connecting line is incorrect?

- A. Limited use of plastic bag — Decrease of pollution
- B. Elimination of illegal mining — Protection of resources
- C. Offshore oil excavation — Development of new energy
- D. Study of the production of self-cleaning glass — Study of new material

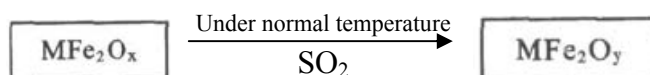
27. To compare the activity of 4 metals, X, Y, Z, W, Xiao Gang performs a series of experiments, the results of which are shown below. Metals that can react are indicated by the symbol “✓”; those that cannot react are indicated by “—”; for those with no symbol, no experiment was conducted.

Substances for reaction test	X	Y	Z	W
$W(NO_3)_2$ solution	—	✓	—	
ZNO_3 solution	✓	✓		✓
Diluted hydrochloric acid	—	✓	—	✓

Their metal activity series is therefore:

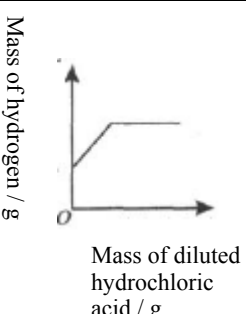
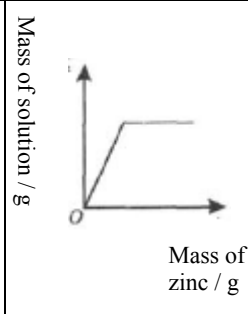
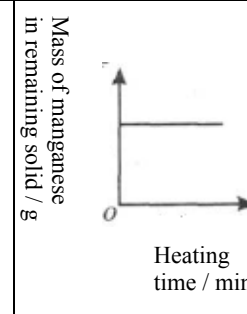
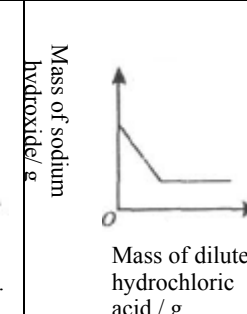
- A. $Y > W > X > Z$
- B. $Y > W > Z > X$
- C. $Y > X > W > Z$
- D. $X > Y > W > Z$

28. In the new nano material MFe_2O_x ($3 < x < 4$), M is a divalent (+2) metallic element, with its valence remaining unchanged in reaction. Under a normal temperature, MFe_2O_x can convert the SO_2 found in industrial waste gas to be S. The conversion process is shown in the following diagram:



We know that the Fe in MFe_2O_y is trivalent (+3). Which of the following statements is incorrect?

- A. SO_2 is a pollutant of the atmosphere.
 - B. SO_2 is not a catalyst of the reaction.
 - C. The numerical value of y is 4.
 - D. SO_2 has undergone a decomposition reaction.
29. The following 4 graphs show certain mass changes in 4 experimental processes respectively. The correct one is:

A	B	C	D
Add drops of diluted hydrochloric acid to a fixed volume of iron powder.	Continuously add zinc powder to a fixed volume of copper sulphate solution.	Heat a fixed volume of potassium permanganate solid.	Add drops of diluted hydrochloric acid to a fixed volume of sodium hydroxide solution.
 <p>Mass of hydrogen / g</p> <p>Mass of diluted hydrochloric acid / g</p>	 <p>Mass of solution / g</p> <p>Mass of zinc / g</p>	 <p>Mass of manganese in remaining solid / g</p> <p>Heating time / min.</p>	 <p>Mass of sodium hydroxide / g</p> <p>Mass of diluted hydrochloric acid / g</p>

30. A certain crude salt sample contained soluble magnesium chloride, calcium chloride and insoluble sand. Under a normal temperature, 140 g of this crude salt sample was dissolved in water. After filtering, no more than 3 g of sand and 1000 g of solution were obtained. 500 g of the solution was removed for testing. It contained 1.2 g of magnesium element, 2 g of calcium element, and 42.6 g of chlorine element. The mass fraction of sodium chloride in the original crude salt was therefore:

- A. 83.6% B. 86.3% C. 88.1% D. 91.6%

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Chemistry Examination Paper

Paper II (Non-machine-readable Paper, 50 points in total)

Notice to Candidates	1. Paper II starts from page 1 and ends in page 7, with 7 pages in total. It has 3 long questions and 10 short questions. 2. Candidates must use black or blue ballpoint or fountain pen to answer the questions.
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Question No.	II	III	IV	Total points
Points				
Examiner				
2 nd examiner				

II. Fill in the blanks (5 short questions in total, 1 point for each blank, 26 points in total)

31. (5 points) On 8 August 2008, the 29th Olympic Games was held in Beijing.

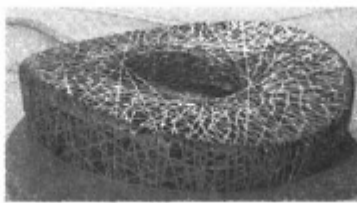
- (1) The venues of the Beijing Olympics are attractive to people throughout the world. In the following introduction of materials, the material which is an organic synthetic material is _____ (write down the letter, and the same hereinafter).

Points



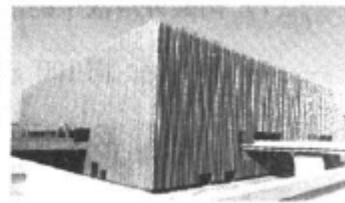
The plastic film material of National Aquatics Centre has the functions of heat insulation, temperature retaining and self-cleaning.

A



The steel structure of National Stadium can bear an external force at 4.6×10^8 Pa.

B



The aluminium alloy plates for the outer walls of Beijing Olympic Basketball Gymnasium are beautiful and durable.

C

- (2) One of the major dishes provided during the Beijing Olympics was Beijing roast duck. When eating Beijing roast duck, it is served with thin pancakes, shallots, sweet soy sauce and cucumber. The dish is rich in nutrients such as fat, sugar, _____, water, vitamins and inorganic salt.

Points

- (3) The hot water used in the Beijing Olympic Village was supplied by the solar energy hot water system. Which of the following statements about solar energy is correct? _____.

- A. It has an endless supply.
- B. It is a fossil fuel.
- C. It is a pollution-free energy.
- D. It can be transformed into heat or electric energy.



Solar heat collecting pipe installed on the roof.

Points

- (4) Regarding the lucky-cloud torch of the Beijing Olympics, there are 430 ventilation holes at the upper end of its surface. These holes can not only drain waste gas created from burning, but can also _____, ensuring that the fuel is fully burned.

Points

- (5) The “Blue Sky Plan” of the Beijing Olympics aims at improving air quality in Beijing. One of the effective measures taken by the municipal government is the burning of natural gas to provide warmth in winter, in order to replace the burning of coal. The purpose of this measure is to _____

Points

32. (4 points) The following data are based on the solubility of potassium nitrate solid under different temperatures.

Temperature / °C	0	20	40	60	80
Solubility / g	13.3	31.6	63.9	110	169

(1) The solvent in the potassium nitrate solution is _____.

Points

(2) Add 31.6 g of potassium nitrate into 100 g of water at 20 °C. After it has completely dissolved, _____ (write down “saturated” or “unsaturated”) solution is obtained.

Points

(3) Add 40 g of potassium nitrate into 100 g of water at 20°C. If the potassium nitrate is to be completely dissolved, the method that should be used is _____.

Points

(4) As shown in the diagram, the potassium nitrate solution obtained in (2) above is poured into the small beaker. If a small amount of the following substances are carefully added to the water inside the large beaker, and then they are stirred continuously, with which will a solid be released from the small beaker? _____ (write down the letter(s)).

A. ice

B. concentrated sulfuric acid

C. ammonium nitrate

D. dry ice

E. sodium hydroxide

F. calcium oxide



Points

33. (6 points) Iron and steel are important metallic materials.

- (1) Among the following iron products with different purposes, the one using heat conduction of metal is _____ (write down the letter, the same hereinafter). Points



A. iron hammer



B. iron wok



C. iron wire



D. water tap

- (2) Currently, more than 50% waste iron and steel is being recycled in the world. Its purpose is to _____.

- A. save metal resources. B. perform reasonable mining.
C. prevent iron and steel from rusting.

Points

- (3) To prevent a water tap from being rusted, a layer of chromium is plated on its surface. The condition for iron to rust is _____.

Points

- (4) Place a rusted iron product in a washbasin containing excessively diluted hydrochloric acid. It is observed that the solution turns yellow, and colourless air bubbles are coming out from it.

- ① Write down the chemical formula of the reaction that has occurred:

_____.

- ② Ferric chloride solution can serve as a water-purifying agent if the ferric substance in the solution obtained above is recycled in the form of ferric chloride. The reaction when adding hydrogen peroxide to the solution is the generation of ferric chloride and water. We know that while 162.5 g of ferric chloride is generated, 18 g of water is produced at the same time. Therefore, the chemical formula for the reactant of

this reaction is _____.

34. (5 points) Disinfectant plays an important role during the hygienic cleaning and prevention of epidemics in public places.

(1) Sodium hydroxide can kill bacteria, virus and parasites. Its common name is

_____.

(2) Chlorine dioxide (ClO_2) can be used as a disinfectant and can kill the bacteria found in drinking water. The valence of the chlorine element inside is _____.

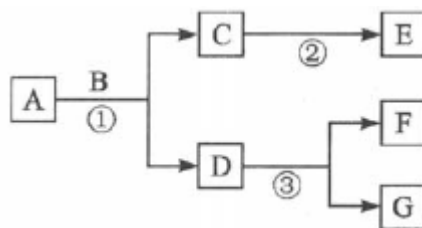
(3) After calcium oxide reacts to water, a type of substance with a disinfecting quality is produced. The chemical formula of the substance is _____

_____.

(4) Peracetic acid (CH_3COOOH) is a highly effective disinfectant, which is extensively used. It is unstable, can easily decompose and release a kind of commonly seen simple gaseous substance, and can generate acetic acid (CH_3COOH). The chemical equation of this reaction is _____

_____. If a bottle of peracetic acid that has been stored for a long time has been completely decomposed, and the mass fraction of the acetic acid in the solution is 12%, then the mass fraction of peracetic acid in the original solution is _____ % (keep one decimal in the result).

35. (6 points) A ~ G are 7 types of substances commonly seen in chemistry at secondary school level. At least one of these substances is a colourless gas, and A and G contain the same metallic element. Under certain conditions, the transformation relationship among them is shown in the following diagram, with part of the reactants or products being omitted.



Answer the questions according to the two situations below.

(1) If the mass ratio of the two elements in A is 7:3, and F is a type of red metal, then the chemical formula of F is _____. Write down the chemical equations of reaction ① and ③:

① _____;

③ _____ . Points

(2) If F and C can react with each other under normal temperature, and ②, ③ belong to the same type of basic reaction, then the chemical formula of A is _____.

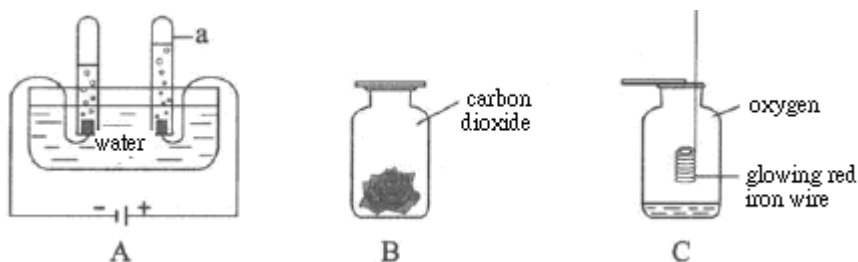
Write down the chemical equations of reaction ①

_____ . The kind of basic reaction of reaction ② is _____

_____ . Points

III. Experimental Problems (3 short questions in total, 1 point for each blank, 18 points in total)

36. (6 points) Answer the following questions according to the nature of the experiments of water, carbon dioxide and oxygen that shown in following diagram:



(1) The name of apparatus A is _____. The chemical equation of the reaction that happened in device A is _____. Use a wooden rod with fire spark to test the gas in A. It is observed that the wooden rod resumes burning, so the gas is _____.

Points

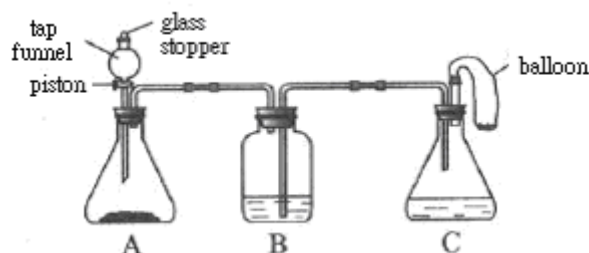
(2) Spray the purple litmus test solution on a white paper flower, and place it in gas-collecting bottle B. The phenomenon observed is _____.

Points

(3) The phenomenon in gas-collecting bottle C: the iron wire burns intensely in oxygen, _____, releases a great deal of heat, and generates some black solids. The chemical equation of the reaction is _____.

Points

37. (4 points) The teacher uses the devices shown in diagram below to make an interesting experiment for students. Device A contains black powder of manganese dioxide. Device B contains a sufficient volume of clear limewater. Device C contains sufficient volume of diluted hydrochloric acid. A small volume of sodium carbonate powder is poured in from the balloon.



- (1) Open the piston and glass stopper of the tap funnel and allow device A to connect with the atmosphere. Pour all the sodium carbonate powder from inside the balloon into the diluted hydrochloric acid. The phenomenon observed in device C is

_____.

Points

- (2) After the above reaction ends, pour in a sufficient volume of hydrogen peroxide solution from the tap funnel. Close the piston and glass stopper. The chemical equation of the reaction that occurred in device A is

_____.

Points

- (3) In the entire experimental process, the phenomenon in device B is _____

_____.

Points

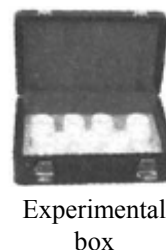
- (4) The function of the balloon in device C is to _____ (write down the letter).

- a. collect of pure gas b. add a solid substance
c. adjust the capacity of device C d. control the total volume of gas

38. (8 points) In the experimental box, there are 7 types of unlabelled solution. The teacher gives the solutions to the chemistry experiment team of students to identify.

(1) **Investigation research:**

- ① The 7 solutions registered on the record sheet inside the experimental box are: KMnO_4 , Na_2CO_3 , CuSO_4 , NaCl , $\text{Ca}(\text{OH})_2$, NaOH and diluted hydrochloric acid. Among them, the solutions with colour are _____.



- ② Information for reference: When the colourless hydrogen chloride gas with irritating smell is dissolved in water, hydrochloric acid can be obtained.
- ③ Research method: Remove 4 of the 5 types of colourless solutions at random to form a group for identification. There are _____ groups of this type.

Points

(2) **Supposition proposed:** The students remove 4 of the 5 types of colourless solutions, and label them with A, B, C, D stickers respectively. They assume that this group of solutions may be Na_2CO_3 , NaCl , $\text{Ca}(\text{OH})_2$ and diluted hydrochloric acid.

(3) **Experimental investigation:** The students undergo identification according to the following steps.

Step 1: Remove 4 test tubes and pour in a small volume of A, B, C, D solutions respectively. Next, add a small volume of hydrochloric acid into them one by one. The experimental phenomena are recorded as follows:

Solution	A	B	C	D
Phenomenon after addition of hydrochloric acid	No obvious change	No obvious change	Bubbles produced	No obvious change

Experimental conclusion: C is _____ solution.

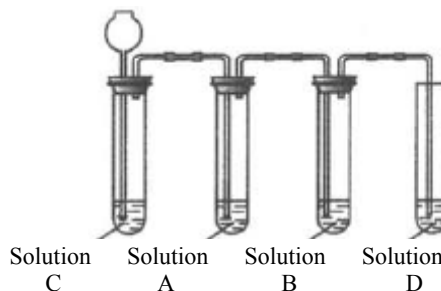
Step 2: The experiment is made

according to the

diagram to the right,

the clamping and

fixing devices are



omitted. Add hydrochloric acid from the long-neck funnel. It

is observed that: bubbles are produced in solution C; white

sediments are formed in solution A; and no obvious change is

found in solutions B and D.

Explanation of the experiment: The chemical equation of the reaction

that occurred in solution A is _____.

Step 3: Perform 2 experiments according to the

device shown in the diagram. Pour a small

volume of solution B into the evaporation

dish for heating. When an irritating smell is

sent out, stop heating. Pour a small volume

of solution D into another evaporation dish for heating.

When a white solid is released, stop heating.



Experimental conclusion: B is diluted hydrochloric acid, and D is

NaCl solution.

After following these 3 steps of the experiment, the students think that

the 5th colourless solution is NaOH solution.

Points

(4) **Re-thinking of the experiment:** The teacher leads the students to discuss the above experimental investigation process, and makes a comprehensive re-thinking.

① The teacher indicates that an uncertainty still exists in the conclusion of the experiment. The uncertainty is on _____ solution, and its identification method is: _____

_____.

② Hints from the teacher: After solution C is identified, solutions A and B can be easily identified, without the need to add any reagent.

Please complete the following experimental report.

Procedures of experiment	Phenomena and conclusions of experiment

Points

IV. Calculation Problem (2 short questions in total, 6 points in total)

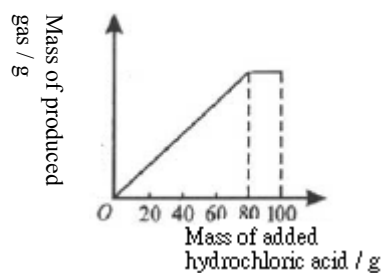
39. (3 points) CO is one of the pollutants in the atmosphere. Chloride fertilizer (PdCl_2) can be used to test the existence CO in small volume. The chemical equation of this reaction is $\text{PdCl}_2 + \text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{Pd} \downarrow + 2\text{HCl} + \text{CO}_2$. If the mass of Pd acquired after the reaction is 1.06 g, what is the tested mass of CO in grams? (We know that its relative atomic mass is 106.)

[Solution]

Points

40. (3 points) A limestone sample has the components CaCO_3 and SiO_2 . The students of the extra-curricular team add 100 g of hydrochloric acid in 5 stages into 35 g of limestone sample (we know that SiO_2 does not react to hydrochloric acid). Part of the data and a graph are shown below.

No of times	1 st time	2 nd time	3 rd time
Mass of added hydrochloric acid / g	20	20	20
Mass of the remaining solid / g	30	a	20



Calculate:

- (1) After the 2nd addition of hydrochloric acid, **a** is _____ g.

Points

- (2) What is the mass ratio of calcium element to carbon element to oxygen element in the limestone sample? (Express the result in the simplest integer.)

[Solution]

Points

- (3) The solution with 10% CaCl_2 can serve as a road surface moisturiser. If the solution obtained after the 5th part of the experiment is blended to be a solution with 10% CaCl_2 , a sufficient volume of limestone powder can be firstly added to this solution. After complete reaction, filtering is conducted. During this time, how many grams of water are required to be added to the filtrate? (In the process of experiment, the loss of solution is neglected and not calculated.)

[Solution]

Points