CHEMISTRY

BOOKS - EVERGREEN CHEMISTRY (ENGLISH)

STUDY OF SULPHURIC ACID (H_2SO_4)

Questions

1. With the help of equations, give an outline for the manufacture of sulphuric acid by the contact process.

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2. Write balanced chemical equations to show how SO_3 is converted to Sulphuric acid in the contact process.

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3. In the manufacture of sulphuric acid by contact process give the equation for the conversion of sulphur trioxide to sulphuric acid.

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4. State the name of the process by which H_2SO_4 is manufactured . Name the catalyst used.

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5. When dilute sulphuric acid reacts with iron sulphide, the gas evolved is

A. Hydrogen sulphide

B. Sulphide dioxide

C. Sulphuric trioxide

D. Vapour of sulphuric acid

Answer:

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6. Give balanced chemical equation for the action of sulphuric acid on each of the following:

Potassium hydrogen carbonate.

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7. (i) Give balanced chemical equations for the action of sulphuric acid on each of the following:

(1) Potassium hydrogen carbonate.

(2) Sulphur.' (ii) In the contact process for the manufacture of sulphuric acid give the equations for the conversion of sulphur trioxide to sulphuric acid.

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8. What would you observe in the following ? Sugar crystals are added to a hard glass test tube containing concentrated sulphuric acid.

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9. What would you observe in the following ?

Copper is heated with concentrated nitric acid in a hard glass test tube.

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10. What property of concentrated sulphuric acid is in the reaction when sugar turns black in its presence ?

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11. Given equation for each of the following:

Concentrated sulphuric acid is poured over sugar.

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12. Write the equation for each of the following reactions :

Sulphur is heated with concentrated sulphuric acid.

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13. Name the process used for the large scale manufacture of sulphuric acid.

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14. Which property of sulphuric acid accounts for its use as a dehydrating agent ?

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15. Concentrated sulphuric acid is both an oxidising agent and a non-volatile acid. Write one equation each to illustrate the above mentioned properties of sulphuric acid.

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16. What is the property of concentrated sulphuric acid which allows it to be used in the preparation of hydrogen chloride and nitric acid ?

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17. Concentrated sulphuric acid is used in the laboratory preparation of nitric acid and hydrochloric acid because it is

_____[less volatile/stroger]in comparison to these two acids.

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18. Give one equation each to show the following properties of sulphuric acid :

(i) Dehydrating property.

(ii) Acidic nature.

(iii) As a non-volatile acid.

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19. Give one equation each to show the following properties of sulphuric acid :

(i) Dehydrating property.

(ii) Acidic nature.

(iii) As a non-volatile acid.

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20. Give one equation each to show the following properties of sulphuric acid :

(i) Dehydrating property.

(ii) Acidic nature.

(iii) As a non-volatile acid.

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21. What is observed when concentrated sulphuric acid is added drop wise to a crystal of copper sulphate?

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22. Choose the most appropriate answer from the following options :

In the given equation, identify the role played by concentrated sulphuric acid :

$S + 2H_2SO_4 \rightarrow 3SO_2 2H_2O$

A. Nonvolatile acid

B. Oxidising agent

C. Dehydrating agent

D. None of these

Answer:

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23. Write balanced chemical equations to show:

(i) The oxidizing action of conc. Sulphuric acid on Carbon.

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24. Write balanced chemical equations to show:

The behaviour of H_2SO_4 as an acid when it reacts with Magnesium

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25. Write balanced chemical equations to show:

The dehydrating property of conc. Sulphuric acid with sugar

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26. Write a balanced chemical equation for the following:

Action of concentrated sulphuric acid on Sulphur.

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27. Write balanced chemical equations to show:

Action of concentrated Sulphuric acid on hydrated copper sulphate.

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28. What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with

(A) Potassium nitrate

(B) Carbon ?

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29. What property of sulphuric acid is shown by the reaction of concentrated sulphuric acid when heated with

(A) Potassium nitrate

(B) Carbon ?

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30. Both dilute hydrochloric acid and dilute sulphuric acid are colourless solutions. How will the addition of barium chloride solution to each help to distinguish between the two?

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31. How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?

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32. How will you distinguish between dilute hydrochloric acid and dilute sulphuric acid using lead nitrate solution?

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Questions For Practice

1. Some bacteria obtain their energy by oxidising sulphur, producing sulphuric acid as a by-product. In the laboratory, or in industry, the first step in the conversion of sulphur to

sulphuric acid is to produce sulphur dioxide. The sulphur dioxide is converted to sulphur trioxide, which reacts with water to give sulphuric acid.

Name one catalyst used industrially which speeds up the conversion of sulphur dioxide to sulphur trioxide.

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2. Some bacteria obtain their energy by oxidising sulphur, producing sulphuric acid as a by-product. In the laboratory, or in industry, the first step in the conversion of sulphur to sulphuric acid is to produce sulphur dioxide. The sulphur dioxide is converted to sulphur trioxide, which reacts with water to give sulphuric acid.

Write the equation for the conversion of sulphur dioxide to sulphur trioxide. Why does this reaction supply energy?

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3. Some bacteria obtain their energy by oxidising sulphur, producing sulphuric acid as a by-product. In the laboratory, or in industry, the first step in the conversion of sulphur to sulphuric acid is to produce sulphur dioxide. The sulphur dioxide is converted to sulphur trioxide, which reacts with water to give sulphuric acid.

What is the name of the compound formed between sulphur trioxide and sulphuric acid?

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4. What is the name of the process by which sulphuric acid is manufactured? Name the catalyst used in the process.

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5. Write all the chemical reactions involved in the manufacture of sulphuric acid by contact process.

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6. Name the product when sulphur trioxide is dissolved in concentrated sulphuric acid. Give the equation also.

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7. Explain the following giving suitable reasons: In the manufacture of H_2SO_4 by contact process:

The impurity of arsenic oxide must be removed before

passing the mixture of SO_2 and air through the catalytic chamber.

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8. Explain the following giving suitable reasons: In the manufacture of H_2SO_4 by contact process:

For the production of concentrated sulphuric acid, SO_3 is not directly dissolved in water.

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9. Explain the following giving suitable reasons: In the manufacture of H_2SO_4 by contact process:

For the dilution of sulphuric acid, water is not added to the acid but acid is added to water.

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10. Give an example of the process which demonstrates the dehydrating nature of concentrated sulphuric acid.

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11. Give two balanced reactions of each type to show the following properties of sulphuric acid :

Acidic nature

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12. Give two balanced reactions of each type to show the following properties of sulphuric acid :

Oxidising agent

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13. Give two balanced reactions of each type to show the following properties of sulphuric acid :

Non-volatile nature

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14. Write a test of sulphuric acid in which an insoluble white precipitate is formed.

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15. Name the products formed when copper is heated with concentrated sulphuric acid.

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16. Write balanced chemical equations for the reactions of zinc with:

Dilute H_2SO_4

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17. Write balanced chemical equations for the reactions of zinc with:

Conc. H_2SO_4

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18. What happens when hot and concentrated sulphuric acid reacts with the following:

Carbon

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19. Name the products formed when hot and concentrated sulphuric acid reacts with the following:

(a) Sulphur (b) NaOH (c) Sugar (d) Carbon (e) $CuSO_{4.5}H_2O$

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20. What happens when Zinc reacts with conc H2SO4

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21. What happens when hot and concentrated sulphuric acid reacts with the following:

Sugar

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22. What happens when hot and concentrated sulphuric acid reacts with the following:

$NaNO_3$

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23. Explain the following:

A piece of paper becomes black when concentrated sulphuric acid is poured on it.

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24. Explain the following:

Blue colour of solid copper sulphate disappears when concentrated sulphuric acid is added to it.

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25. How many types of salts are formed by H_2SO_4 with NaOH

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26. Explain the following:

Brisk effervescence is formed on adding dilute sulphuric acid to sodium carbonate.

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27. Write the changes when

Two drops of indicator methyl orange are added to dilute H_2SO_4

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28. Write the changes when

One millilitre of blue litmus solution is added to 5 mL of dilute sulphuric acid.

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29. Write the changes when

Four millilitre of alkaline solution of phenolphthalein is added to 10 mL of sulphuric acid.

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30. Write the equation for each of the following reactions :

Concentrated sulphuric acid is poured over sugar.

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31. Write balanced chemical equations for the preparation of the following gases using dilute sulphuric acid as one of the

reactants:

Hydrogen

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32. Write balanced chemical equations for the preparation of the following gases using dilute sulphuric acid as one of the reactants:

Carbon dioxide

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33. Write balanced chemical equations for the preparation of the following gases using dilute sulphuric acid as one of the reactants:

Sulphur dioxide.

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34. Write balanced chemical equations for the reaction of dilute sulphuric acid with each of the following:

Calcium carbonate

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35. Write balanced chemical equations for the reaction of dilute sulphuric acid with each of the following:

Lead nitrate solution

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36. Write balanced chemical equations for the reaction of dilute sulphuric acid with each of the following:

Zinc hydroxide.

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37. Some properties of sulphuric acid are listed below. Choose the property A, B, C, or D which is responsible for the reactions . Some properties may be repeated:

$$C_{12}H_{22}O_{11} + nH_2SO_4 \rightarrow 12C + 11H_2O + nH_2SO_4$$

A. Acid

B. Dehydrating agent

C. Nonvolatile acid

D. Oxidising agent

Answer: B

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38. Some properties of sulphuric acid are listed below. Choose the property A, B, C or D which is responsible for the reactions (i) to (v). Some properties may be repeated :

$$S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$$

A. Acid

B. Dehydrating agent

C. Nonvolatile acid

D. Oxidising agent

Answer: D

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39. Some properties of sulphuric acid are listed below. Choose the property A, B, C or D which is responsible for the reaction :

$$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$$

A. Acid

B. Dehydrating agent

C. Nonvolatile acid

D. Oxidising agent

Answer: C

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40. Some properties of sulphuric acid are listed below. Choose the property A, B, C, or D which is responsible for the reactions . Some properties may be repeated:

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

A. Acid

B. Dehydrating agent

C. Nonvolatile acid

D. Oxidising agent

Answer: A

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41. Some properties of sulphuric acid are listed below. Choose the property A, B, C or D which is responsible for the reactions

(i) to (v). Some properties may be repeated :

$$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$$

A. Acid

B. Dehydrating agent

C. Nonvolatile acid

D. Oxidising agent

Answer: A

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42. Name the gas evolved in each case (formula is not acceptable).

The gas produced by the action of concentrated sulphuric acid on sodium chloride.

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43. Name the gas evolved in each case (formula is not acceptable).

The gas produced by the action of dilute nitric acid on copper.

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44. Name the gas evolved in each case (formula is not acceptable).

The gas produced on heating sodium nitrate.

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45. Name the gas evolved in each case (formula is not acceptable).

The gas that burns in oxygen with a green flame.

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46. Name the gas evolved in each case (formula is not acceptable).

The gas that can be oxidised to sulphur.

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47. Write the balanced chemical equation for each of the following reactions:

Sodium thiosulphate is reacted with dilute hydrochloric acid

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48. Write the balanced chemical equation for each of the following reactions:

The gas produced by the action of dilute nitric acid on copper.

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49. Write the balanced chemical equation for each of the following reactions:

Dilute sulphuric acid is poured over sodium sulphite.

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50. Write the balanced chemical equation for each of the following reactions:

Chlorine reacts with excess of ammonia.

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51. Write the balanced chemical equation for each of the following reactions:

Ferric hydroxide reacts with nitric acid.

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52. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.

Choose the property (A, B, C, or D) depending on which one is

relevant to each of the following:

Preparation of hydrogen chloride gas.

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: B

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53. A, B, C and D summarize the properties of sulphuric acid depending on whether it is dilute or concentrated.

A = Typical acid property

B = Non-volatile acid

C = Oxidizing agent

D = Dehydrating agent

Choose the property (A, B, C or D) depending on which is relevant to each of the following:

(i) Preparation of Hydrogen chloride gas.

(ii) Preparation of Copper sulphate from copper oxide.

(iii) Action of conc. Sulphuric acid on Sulphur.

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: A

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54. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.

Choose the property (A, B, C, or D) depending on which one is relevant to each of the following:

Action of concentrated sulphuric acid on sulphur.

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: C

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55. Some properties of sulphuric acid are listed below. Choose the role played by sulphuric acid as A, B, C, or D which is responsible for the reaction.

$$CuSO_4.5H_2O \xrightarrow{conc.H_2SO_4} CuSO_4 + 5H_2O$$

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: D

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56. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.Choose the role played by sulphuric acid as A, B, C, or D which is responsible for the reactions. Some role(s) may be repeated.

$$S + H_2SO_4(conc.) \rightarrow 3SO_2 + 2H_2O$$

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: C

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57. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.Choose the role played by sulphuric acid as A, B, C, or D which is responsible for the reactions. Some role(s) may be repeated.

$NaNO_3 + H_2SO_4(conc.) \xrightarrow{<200^\circ C} NaHSO_4 + HNO_3$ A = Typical acid property B = Nonvolatile acid C = Oxidising agent D = Dehydrating agent

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: B

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58. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.Choose the role played by sulphuric acid as A, B, C, or D which is responsible for the reactions. Some role(s) may be repeated.

$$MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$$

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: A

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59. A, B, C and D illustrate the properties of sulphuric acid whether dilute or concentrated.Choose the role played by sulphuric acid as A, B, C, or D which is responsible for the reaction. Some role(s) may be repeated.

$$Zn + 2H_2SO_4(conc.) \rightarrow ZnSO_4 + SO_2 + 2H_2O$$

A : Dilute acid B : Dehydrating agent C : Non - volatile acid D : Oxidising agent

A. A = Typical acid property

B. B = Nonvolatile acid

C. C = Oxidising agent

D. D = Dehydrating agent

Answer: A

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Questions For Practice On Examination Pattern

1. Dilute sulphuric acid will produce a white precipitate when added to a solution of:

Copper sulphate ; Sodium nitrate : Zinc nitrate : Lead nitrate

A. Copper sulphate

B. Sodium nitrate

C. Zinc nitrate

D. Lead nitrate

Answer: D

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2. When sodium chloride is heated with concentrated sulphuric acid, the gas liberated is

A. Chlorine

B. Sulphur dioxide

C. Hydrogen chloride

D. Sulphur trioxide

Answer: C

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3. Haber process is related to the manufacture of

A. Hydrogen

B. Ammonia

C. Nitric acid

D. HCl

Answer: B

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4. Nitric acid is manufactured by

A. Catalytic oxidation of ammonia

B. Nitration of hydrogen and oxygen

C. Contact process

D. Haber process

Answer: A

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5. When copper metal is treated with concentrated sulphuric acid, the gas liberated is

A. Hydrogen

B. Sulphur dioxide

C. Hydrogen sulphide

D. Ammonia

Answer: B

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6. In the Fountain experiment with ammonia, the colour of the fountain is

A. Red

B. Blue

C. Pink

D. Dark green

Answer: B

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7. A white precipitate is formed when silver nitrate is added to a solution containing chloride ions. This precipitate is soluble in

Hydrochloric acid ; Nitric acid ; Dilute H 2 S O 4 ; Ammonium hydroxide ;

A. Hydrochloric acid

B. Nitric acid

C. Dilute H_2SO_4

D. Ammonium hydroxide

Answer: D

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8. The reaction $KCl + H_2SO_4(conc.) \rightarrow KHSO_4 + HCl$ demonstrates which nature of sulphuric acid?

A. Acidic

B. Nonvolatile

C. Oxidising

D. Dehydrating

Answer: B

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9. The ring test is given by

A. HCl

B. H_2SO_4

C. HNO_3

D. NH_3

Answer: C

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10. When dilute nitric acid is added to copper turning, the gas evolved is

A. NO

B. N_2O

C. NO_2

D. H_2

Answer: A

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11. Complete the following using the correct word given in the brackets.

Ammonia is manufactured by _____ process. (Ostwald/Haber)

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12. Complete the following using the correct word given in the brackets.

Hydrogen chloride gas is formed when sodium chloride is treated with concentrated _____acid. (hydrochloric/sulphuric)

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13. Complete the following using the correct word given in the brackets.

Nitric acid is manufactured by Ostwald process on catalytic oxidation of ____

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14. Complete the following using the correct word given in the brackets.

Fountain experiment shows that ammonia is _____soluble in water. (not/highly)

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15. Complete the following using the correct word given in the brackets.

The density of hydrogen chloride is _____than air. (lower/higher)

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16. Complete the following using the correct word given in the brackets.

The density of air is _____than ammonia. (lower/higher)

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17. Complete the following using the correct word given in the brackets.

Hydrogen chloride gas dissolves in toluene and this solution _____electricity. (doesnot conduct/conducts)

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18. Complete the following using the correct word given in the brackets.

In the reaction $Cu(s) + 2H_2SO_4(conc.) \rightarrow CuSO_4(aq) + 2H_2O(1) + SO_2(g)$, copper acts as _____agent. (reducing/oxidising)

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19. Complete the following using the correct word given in the brackets.

The ring test is given by _____ acid. (hydrochloric/nitric)

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20. Give reason for each of the following:

Copper sulphate pentahydrate turns white when treated with concentrated sulphuric acid.

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21. Give reason for each of the following:

Hydrogen chloride gas dissolves in toluene, but this solution does not conduct electricity.

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22. Give reason for each of the following:

A white thick fume is formed when a glass rod dipped in

concentrated hydrochloric acid is brought near the mouth of a bottle full of ammonia gas.

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23. Give reason for each of the following:

Concentrated nitric acid turns yellowish brown when exposed to sunlight

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24. Give reason for each of the following:

In the contact process of manufacture of sulphuric acid, the oxide of arsenic is removed.

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25. Match (A) iron sulphide, (B) sodium thiosulphate, (C) calcium carbonate, (D) ammonium chloride, (E) concentrated sulphuric acid, (F) nitric acid, with its correct description given in (i) - (vi) below:

(i) It forms colloidal sulphur when treated with dilute hydrochloric acid. (ii) When it is heated with an alkali a gas is formed which produces white fumes with HCI. (iii) It reacts with acids and a gas having smell like rotten eggs is liberated. (iv) It gives a brisk effervescence when treated with dilute sulphuric acid. (v) It gives ring test. (vi) It oxidises sulphur to sulphur dioxide.

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26. Select odd one and justify your answer :

$HCI, NH_3, HNO_3, H_2SO_4$

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27. Select odd one and justify your answer :

Calcium sulphate, copper sulphate, sugar, cotton

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28. Select odd one and justify your answer :

CO_2, SO_2, NH_3, Na_2O

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29. Select odd one and justify your answer :

Mg, Zn, Fe, Cu

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30. In the industrial preparation of ammonia by Haber process from nitrogen and hydrogen, the reaction is carried in the temperature range of $450^{\circ}C$ to $500^{\circ}C$ and in a pressure range of 200 atm to 300 atm. Now answer the following question.

The reaction is not carried out at a lower temperature. Give one reason.

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31. In the industrial preparation of ammonia by Haber process from nitrogen and hydrogen, the reaction is carried in the temperature range of $450^{\circ}C$ to $500^{\circ}C$ and in a pressure range of 200 atm to 300 atm. Now answer the following question.

The reaction is not carried at very high pressure. Give one reason.

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32. In the industrial preparation of ammonia by Haber process from nitrogen and hydrogen, the reaction is carried in the temperature range of $450^{\circ}C$ to $500^{\circ}C$ and in a pressure range of 200 atm to 300 atm. Now answer the following

question.

What is the name of the catalyst used in the reaction?

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33. In the industrial preparation of ammonia by Haber process from nitrogen and hydrogen, the reaction is carried in the temperature range of $450^{\circ}C$ to $500^{\circ}C$ and in a pressure range of 200 atm to 300 atm. Now answer the following question.

How is ammonia separated from unreacted nitrogen and hydrogen?

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34. Copy and complete the following table. Column III has the names of gases to be prepared using the substance you enter in column I along with dilute or concentrated sulphuric acid as indicated by you in column II.

Column I	Column II	Column III
Substance reacted with acid	Dilute or concentrated sulphuric acid added	Gas liberated
(*a*)		Hydrogen
(*b*)		Carbon dioxide
(*c*)		Hydrogen chloride

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35. Copy and complete the following table relating to important industrial processes.

Name of process	Inputs	Catalyst	Equation for catalysed reaction	Main product
Haber process	Hydrogen +			
	Ammonia + Air			Nitric acid
Contact process	Sulphur dioxide + Oxygen			

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36. Write the equations for the following reactions:

Dilute nitric acid and copper.

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37. Write the equations for the following reactions:

Dilute sulphuric acid and barium chloride.

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38. Write the equations for the following reactions:

Dilute hydrochloric acid and sodium thiosulphate.

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39. Write the equations for the following reactions:

Dilute hydrochloric acid and lead nitrate solution.

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40. Write the equations for the following reactions:

Dilute sulphuric acid and sodium sulphide

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41. Select from the list given (A to E) one substance in each case which matches the description given in parts (i) to (v). (Note: Each substance is used only once in the answer.

(A) Nitroso iron (II) sulphate (B) Iron (III) chloride

(C) Chromium sulphate (D) Lead (II) chloride (E) Sodium

chloride

(i) A compound which is yellow brown.

(ii) A compound which is insoluble in cold water, but soluble in hot water.

(iii) The compound responsible for the brown ring during the ring test of nitrate ion.

(iv) A compound whose aqueous solution is neutral in nature.

(v) The compound which is responsible for the green colouration when sulphur dioxide is passed through acidified potassium dichromate solution.

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