

Name: _____

Date: _____



Direction for Questions: 1 to 4

An optical bench is set up with the following components:

- A light bulb with a filament in it which serves as the object.
- A white screen on a movable stand.
- A converging lens of focal length 10 cm mounted on a movable holder.

The distance between the lens and filament is kept fixed at 12 cm, and the screen is adjusted until a clearly focused image of the filament is formed on the screen.

Question: 1 of 21

QID: 240

Marks: 2

Which of the following terms can be used to describe the nature of the image of the filament? **(2 marks)**

- Real
 - Virtual
 - Magnified
 - Diminished
-

Question: 2 of 21

QID: 241

Marks: 1

If the top half of the lens was covered with black paper, what will happen to the image of the filament?

.....

- A. There will be no image
- B. You will only see the bottom half of the filament
- C. You will only see the top half of the filament
- D. You will still see the full image of the filament

Question: 3 of 21

QID: 242

Marks: 1

The lens is then removed from the holder. What will happen to the image of the filament?

- A. There will be no image of the filament
- B. You will see a larger image of the filament
- C. You will see an upright image of the filament
- D. You will see a faint image of the filament

Question: 4 of 21

QID: 243

Marks: 3

The original converging lens is removed and replaced by a second converging lens of unknown focal length. The positions of the lens and screen are adjusted until a clearly focused image of the filament is formed on the screen. The distance between the lens and screen is found to be 30 cm. A diverging lens is now placed 16 cm to the right of converging lens. The screen has to be moved a further 20 cm away from the converging lens in order to form a clearly focused image of the filament.

Calculate the focal length of the diverging lens (3 marks)

Direction for Questions: 5 to 13

Application of Sulphuric Acid in Industries

The consumption of sulphuric acid H_2SO_4 is usually an index of a country's industrial development, because of its extensive use in a large number of manufacturing operations. It is a highly corrosive, dense, oily liquid, with colourless to dark brown colour depending on its purity.

This is produced on a large scale by two commercial processes, **the Contact process** and the **Lead-Chamber process**.

In the Contact process, sulphur (IV) oxide is converted to sulphur (VI) oxide, in the presence of vanadium(V)oxide promoted by molybdenum oxide at $450^{\circ}C$ and 1-2 atmospheric pressure. The sulphur (IV) oxide is oxidised to sulphur (VI) oxide by vanadium(V)oxide. In the process, the vanadium (V) oxide is reduced to Vanadium (III) oxide then re-oxidised. This is a good example of the way a catalyst can be changed during the course of a reaction. In the absence of vanadium (V) oxide as a catalyst, the reaction is very slow. Sulphur (VI) oxide is converted to oleum ($H_2S_2O_7$ - sulphuric acid and sulphur (VI) oxide) by dissolution in sulphuric acid. The oxidation of sulphur (IV)oxide to sulphur (VI) oxide in the Contact Process is an exothermic reaction.

Concentrated sulphuric acid has a very strong affinity for water and is sometimes used as a dehydrating agent. It reacts with sucrose, leaving a brittle spongy black mass of carbon. The acid reacts similarly with skin tissue, cellulose, plant and animal matter.

Sulphuric acid is formed naturally in mines by the oxidation of sulfide minerals, such as iron (II) sulfide (FeS). The aqueous solution formed when such sulfide minerals dissolve is acidic and is capable of dissolving metal ores. The resultant solution is a brightly colored toxic stream.

During combustion, sulfide minerals in fossil fuels produce sulphur (IV) oxide which is given off to the Earth's atmosphere. The sulphur (IV) oxide can be converted to sulphur (VI) oxide by radiation from the sun and can be transformed into sulphuric acid during precipitation (rainfall).

The lead-chamber process depends upon the oxidation of sulfur (IV) oxide with nitric acid (HNO_3) in the presence of steam.

Question: 5 of 21

QID: 231

Marks: 2

Choose the **two** correct options from A-F, why it is not commercially suitable to dissolve SO_3 directly in water to give concentrated sulphuric acid?

- | | |
|--|--|
| <input type="checkbox"/> A. To reduce the hazards of spillage | <input type="checkbox"/> B. Because the density of the product is too high |
| <input type="checkbox"/> C. To minimise transport costs of large volumes | <input type="checkbox"/> D. Because the last step of the process is too expensive |
| <input type="checkbox"/> E. Because the last step of the process is too exothermic | <input type="checkbox"/> F. An aerosol of the sulphuric acid rapidly fills the container |

Question: 6 of 21

QID: 232

Marks: 4

Match the role that sulphuric acid plays in manufacturing with each of the following industrial activities as shown below.

- | | |
|---|--|
| [] 1. Electroplating of iron and steel | A. Manufacture of lead acid accumulators |
| [] 2. Fertilizer industry | B. Functionalization of compounds with SO groups |
| [] 3. Manufacture of detergents | C. Dissolution of phosphate rocks |
| [] 4. Automotive industry | D. Cleaning of metal surfaces by dissolution of oxide layers |

Question: 7 of 21

QID: 233

Marks: 4

Write balanced equations for the **four** major reactions in the Contact process. **(4 marks)**

Question: 8 of 21

QID: 234

Marks: 1

Choose one option from A-C why vanadium (V) oxide is suitable for use as a catalyst in the Contact process

- A. Vanadium (V) oxide removes electron from SO_2 and is re-oxidised by oxygen
- B. Vanadium (V) oxide supplies electrons to SO_2 and is in turn reduced to vanadium (III) ions
- C. Vanadium (V) oxide reacts with oxygen to give a complex which is regeneratable

Question: 9 of 21

QID: 235

Marks: 4

If the Contact process is 80% efficient, calculate the weight of 98% sulfuric acid produced from 100 kg of pure sulphur. Assume 100% conversion of sulphur to sulphur (IV) oxide. (S = 32.0, H = 1.0, O = 16.0 and the density of 98% sulfuric acid is 1.98g/cm^3). **(4 marks)**

Question: 10 of 21

QID: 236

Marks: 2

Write a balanced equation for the reaction of excess sodium chloride and concentrated sulfuric acid. **(2 marks)**

Question: 11 of 21

QID: 237

Marks: 2

Write a balanced equation representing the dehydration of sucrose by concentrated sulphuric acid. The formula for sucrose is $C_{12}H_{22}O_{11}$ (2 marks)

Question: 12 of 21

QID: 238

Marks: 2

What volume of $0.20\text{mol}\cdot\text{dm}^{-3}$ sulphuric acid is required to neutralise completely 25cm^3 of 16.0g of sodium hydroxide dissolved in 0.25dm^{-3} of water? (Na = 23.0, O = 16.0, H = 1, S = 32.0) (2 marks)

Question: 13 of 21

QID: 239

Marks: 3

From the list supplied below, select three (3) fuels that will give the most acid rain. **(3 marks)**

- a) Firewood
 - b) petroleum
 - c) coal
 - d) biodiesel
 - e) bioethanol
 - f) natural gas
-

Question: 14 of 21

QID: 251

Marks: 1

Why can liquids not be compressed easily?

- A. The particles are in a random arrangement
- B. The particles are closely packed
- C. The particles are free to move over each other

Question: 15 of 21

QID: 250

Marks: 1

Which theory describes the arrangement and movement of particles in solids, liquids and gases?

- A. Theory of relativity
- B. Kinetic theory
- C. Atomic theory

Question: 16 of 21

QID: 249

Marks: 1

Sound travels through a gas under which of the following condition?

- A. Isothermal condition
- B. Non-isothermal condition
- C. Adiabatic condition
- D. Transverse condition

Question: 17 of 21

QID: 248

Marks: 1

When a pebble is dropped into a pond of still water, what happens?

- A. Particles move
- B. Waves move
- C. The pebble moves
- D. Water moves

Question: 18 of 21

QID: 247

Marks: 1

Which of the following is correct about the properties of Sound waves?

- A. Sound waves are longitudinal waves
- B. Sound waves are transverse waves
- C. Sound waves are both longitudinal and transverse
- D. None of the above

Which of the following conditions will not show any Doppler effect?

- A. When source and listener both are at rest
- B. When medium alone is moving
- C. When source and listener are moving in mutually perpendicular directions
- D. All of the above

In which of the following mediums will sound travel with greater speed at 0° C?

- A. Aluminium
- B. Water
- C. Hydrogen
- D. Same in all of the above

What is the time taken by two consecutive compressions or rarefactions to cross a fixed point in a sound wave known as?

- A. Amplitude
- B. Time period
- C. Angular Frequency
- D. Angular Displacement

--- END OF QUESTION PAPER ---