

# Engineering Chemistry – Unit 3 Premium Notes

## Lubricants and Lubrication

RGPV Engineering Chemistry Notes

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### Unit Overview

This unit is very important in Engineering Chemistry because questions related to:

- Lubrication Mechanism
- Properties of Lubricants
- Numerical Problems
- Viscosity Index
- Flash & Fire Points

are frequently asked in RGPV examinations.

This unit is scoring because:

- Theory is easy
  - Numerical formulas are direct
  - Definitions are important
  - Many short notes are repeated
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### Introduction to Lubricants

#### Definition

A lubricant is a substance introduced between moving surfaces to reduce:

- friction
- wear and tear
- heat generation

between surfaces.

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# Functions of Lubricants

## 1. Reduce Friction

Lubricants reduce direct contact between moving surfaces.

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## 2. Reduce Wear and Tear

Protects machine parts from damage.

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## 3. Cooling

Lubricants absorb heat generated during motion.

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## 4. Prevent Corrosion

Protects metal surfaces from rusting.

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## 5. Cleaning Action

Removes dust and metal particles.

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# Examples of Lubricants

- Engine oil
  - Grease
  - Graphite
  - Petroleum oils
  - Silicone oils
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# Mechanism of Lubrication

Lubrication mechanism explains how lubricants reduce friction.

Main mechanisms are:

1. Fluid Film Lubrication
  2. Boundary Lubrication
  3. Extreme Pressure Lubrication
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# 1. Fluid Film Lubrication

## Definition

A thick layer of lubricant separates moving surfaces completely.

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## Working

- Surfaces do not touch each other directly.
  - Friction occurs between lubricant layers.
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## Advantages

- Very low friction
  - Less wear
  - Smooth operation
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## Applications

- Turbines
  - High-speed machines
  - Electric motors
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# 2. Boundary Lubrication

## Definition

A thin layer of lubricant exists between moving surfaces.

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## Working

- Partial contact occurs.
  - Used under high load and low speed.
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## Applications

- Gears
  - Bearings
  - Heavy machinery
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## 3. Extreme Pressure Lubrication

### Definition

Used under very high pressure and temperature conditions.

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### Working

Special additives react chemically with metal surfaces and form protective films.

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### Applications

- Cutting tools
  - Heavy-duty machinery
  - Automobile gear systems
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## Classification of Lubricants

Lubricants are classified into:

1. Liquid Lubricants
  2. Semi-solid Lubricants
  3. Solid Lubricants
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# 1. Liquid Lubricants

## Examples

- Mineral oils
- Petroleum oils

## Advantages

- Easy circulation
  - Cooling effect
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# 2. Semi-Solid Lubricants

## Example

Grease

## Uses

- Bearings
  - Heavy load machinery
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# 3. Solid Lubricants

## Examples

- Graphite
- Molybdenum disulphide

## Uses

Used at very high temperatures.

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# Viscosity

## Definition

Viscosity is the resistance offered by a liquid to flow.

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## Importance of Viscosity

- Determines lubricant quality
  - Controls thickness of oil film
  - Affects machine efficiency
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## High Viscosity Oil

- Thick oil
  - Better for heavy loads
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## Low Viscosity Oil

- Thin oil
  - Suitable for high-speed machines
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## Units of Viscosity

- Poise
  - Centipoise
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## Viscosity Index (VI)

### Definition

Viscosity Index indicates how viscosity changes with temperature.

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## High VI

Small change in viscosity with temperature.

Better lubricant.

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## Low VI

Large change in viscosity.

Poor lubricant.

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## Importance of Viscosity Index

- Important for engine oils
  - Improves lubrication at different temperatures
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## Numerical Problem – Viscosity Index

### Question

Oil sample has viscosity:

At 100°F = 100 SUS

At 210°F = 50 SUS

Find viscosity behavior.

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### Solution

Higher change in viscosity indicates lower viscosity index.

Therefore:

Oil has low viscosity index.

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# Flash Point

## Definition

Lowest temperature at which oil gives vapors that ignite momentarily.

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## Importance

- Indicates fire hazards
  - Determines safe storage temperature
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# Fire Point

## Definition

Lowest temperature at which oil burns continuously for at least 5 seconds.

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## Difference Between Flash & Fire Point

Flash Point	Fire Point
Temporary ignition	Continuous burning
Lower temperature	Higher temperature

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# Cloud Point

## Definition

Temperature at which oil becomes cloudy due to wax formation.

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## Importance

Important for cold weather lubrication.

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# Pour Point

## Definition

Lowest temperature at which oil can flow.

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## Importance

Determines use of oil in winter conditions.

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## Difference Between Cloud & Pour Point

Cloud Point	Pour Point
Oil becomes cloudy	Oil stops flowing
Due to wax crystals	Due to solidification

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# Aniline Point

## Definition

Lowest temperature at which equal volumes of aniline and oil become completely miscible.

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## Importance

- Indicates aromatic content
  - Determines rubber compatibility
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## High Aniline Point

Low aromatic content.

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## Low Aniline Point

High aromatic content.

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## Acid Number

### Definition

Amount of KOH required to neutralize acid present in 1 gram of oil.

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### Importance

- Indicates acidic impurities
  - Measures oxidation level
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### Formula

Acid Number = mg of KOH / gram of oil

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## Saponification Number

### Definition

Amount of KOH required to saponify 1 gram of oil.

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### Importance

Used to determine molecular weight of fatty acids.

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# Steam Emulsification Number

## Definition

Ability of oil to form emulsion with water under steam conditions.

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## Importance

Important in steam turbine oils.

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# Numerical Problem – Acid Number

## Question

0.5 g oil required 2 mL of 0.1N KOH.

Find acid number.

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## Formula

Acid Number =  $(56.1 \times N \times V) / W$

Where:

- N = Normality
  - V = Volume of KOH
  - W = Weight of oil
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## Solution

$$= (56.1 \times 0.1 \times 2) / 0.5$$

$$= 22.44$$

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# Final Answer

Acid Number = 22.44

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## Viva Questions

### Q1. What is viscosity?

Resistance offered by liquid to flow.

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### Q2. What is flash point?

Lowest temperature at which vapors ignite momentarily.

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### Q3. What is fire point?

Temperature at which oil burns continuously.

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### Q4. Which lubricant is used at high temperatures?

Solid lubricant.

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### Q5. What is viscosity index?

Measure of viscosity variation with temperature.

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## Most Important 14 Marks Questions

1. Explain mechanism of lubrication.
2. Explain classification of lubricants.
3. Explain viscosity and viscosity index.
4. Differentiate flash point and fire point.
5. Explain cloud and pour points.
6. Explain aniline point.
7. Explain acid number and saponification number.
8. Explain steam emulsification number.

9. Numerical problems on viscosity index.
  10. Numerical problems on acid number.
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## Most Repeated Short Notes

- Flash point
  - Fire point
  - Viscosity index
  - Pour point
  - Cloud point
  - Acid number
  - Boundary lubrication
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## Quick Revision Sheet

### Mechanisms of Lubrication

- Fluid film lubrication
  - Boundary lubrication
  - Extreme pressure lubrication
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### Important Properties

- Viscosity
  - Flash point
  - Fire point
  - Cloud point
  - Pour point
  - Aniline point
  - Acid number
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## Important Formula

### Acid Number

Acid Number =  $(56.1 \times N \times V) / W$

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