

**UNIT- V**  
**ENGINEERING MATERIALS**  
**PART-A**

**1. Define RUL test?**

The temperature at which the refractory deforms by 10% is called refractories under load(RUL)

**2. How is RUL test carried out?**

RUL test is conducted by applying a constant load of 3.5 or 1.75 kg/cm<sup>2</sup> to the test refractory specimen of size base 5cm<sup>2</sup> and height 75cm and heating in a furnace at a standard rate of 10<sup>0</sup>C per minute

**3. What is meant by pyrometric cone equivalent of a refractory?**

PCE is the number which represents the softening temperature of a refractory specimen of standard dimension and composition

**4. Define Moh's scale**

Moh's scale is a scale in which common abrasives are arranged in the order of their increase in hardness

**5. Define porosity of a refractory**

Porosity is defined as the ratio of its pore volume to the bulk volume. Thus,

$$\text{Porosity} = \frac{W-D}{W-A} \times 100$$

**6. Define lubricant**

Lubricant is a substance used in between two moving surfaces to reduce the friction

**7. Define viscosity index**

Viscosity index is defined as the average decrease in viscosity of an oil per degree rise in temperature between 100<sup>0</sup> and 210<sup>0</sup>F

**8 . What are carbon nanotubes?**

Carbon nanotubes are allotropes of carbon with a nanostructure having a length-to-diameter ratio greater than 1,000,000. When graphite sheets are rolled into a cylinder, their

edges joined and form carbon nanotubes.

#### **9. What are abrasives**

Abrasives are hard substances used for polishing, shaping, grinding operations. They are characterized by high melting point, high hardness and chemically inactive.

#### **10. Explain the lubrication action of graphite**

The adjacent layers of graphite are held together by weak van der Waals forces. Since the distance between the adjacent layers is high ( $3.41 \text{ \AA}$ ), the layers can slide easily one over the other with little friction. As a result, graphite possesses a very low coefficient of friction. This property makes use of graphite as a lubricant.

#### **11. Define flash point**

Flash point is the lowest temperature at which the oil gives off enough vapour that ignites for a moment, when a small flame is brought near it.

#### **12. Define fire point**

Fire point is a lowest temperature at which the vapour of the oil burns continuously for at least 5 seconds when a small flame is brought near it.

#### **13. Define cloud point**

When an oil is cooled slowly the temperature at which the oil becomes cloudy in appearance is called cloud point.

#### **14. Define thermal spalling**

Thermal spalling is the property of breaking, cracking, or peeling off a refractory material under high temperature.

#### **15. What is meant by dimensional stability?**

Dimensional stability is the resistance of a refractory to any volume changes, when exposed to high temperature over a prolonged time.

**16. What is hardness of an abrasives**

It is the ability of an abrasive to grind or scratch away other materials.

**17. Mention the function of a lubricant**

1. It prevents the direct contact between the moving surfaces and reduces wear, tear and surface deformation
2. It reduces wastage of energy so that efficiency of the machine is enhanced.
3. It reduces frictional heat and thus prevents the expansion of metals.

**18. What are extreme pressure additives? Give example.**

They react with metal surface forming surface film of lower shear strength  
And high melting point.

Ex: Sulphur, organic chlorine

**19. What are greases? How are they classified?**

Greases are semi-solid lubricants obtained by thickening of lubricating oil by the addition of metallic soap. They are classified as soda-base grease, lime-base grease, barium-soap grease, lithium-soap grease, aluminium-soap grease.

**20. Why is graphite used as a lubricant where as other allotropes of carbon are not?**

The carbon layers are held together by weak Vander Waals forces. Since the distance between adjacent layers is high and possess very low co-efficient of friction, it act as a lubricant.

But other allotropes of carbon do not have such properties.

**PART B**

1. What are the important properties required for a good refractory.
2. What are abrasives? How are they classified?

3. Explain the mechanisms of lubrication.
4. What are lubricants? Discuss the different types of lubrication.
5. What are carbon nanotubes? Explain the properties and applications of carbon nanotubes.