

# ALL JE / AE Exams



## शुरुआत selection की

### CIVIL ENGINEERING

### Pavement materials BITUMEN

### ZERO TO HERO SERIES



By Pramod sir

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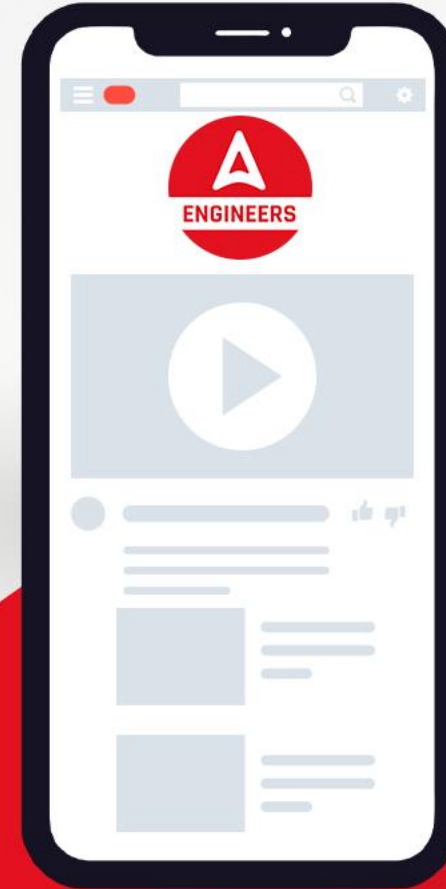
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NOTHING  
IMPOSSIBLE  
TO THEY WHO  
WILL TRY."  
— ALEXANDER  
THE GREAT



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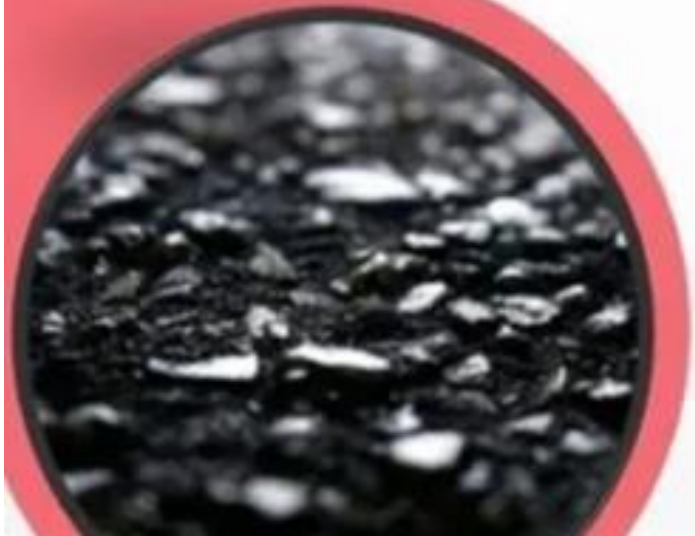




● **Bitumen** is distilled from crude oil and suitable for binding other materials

● **Asphalt** is a mixture of bitumen and sand, used for road construction

● **Tar** is a viscous black liquid that is distilled from coal or wood



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## BITUMEN

Bitumen is a noncrystalline solid or viscous material derived from petroleum, by natural or refinery process and substantially soluble in carbon disulphide. It is asphalt in solid state and mineral tar in semi fluid state. Bitumen is brown or black in colour.

The main constituent is petrolene—a yellowish oily substance, an excess of which makes bitumen to melt at low temperature and, asphaltene—hard black substance, an excess of which makes bitumen brittle and non-plastic.

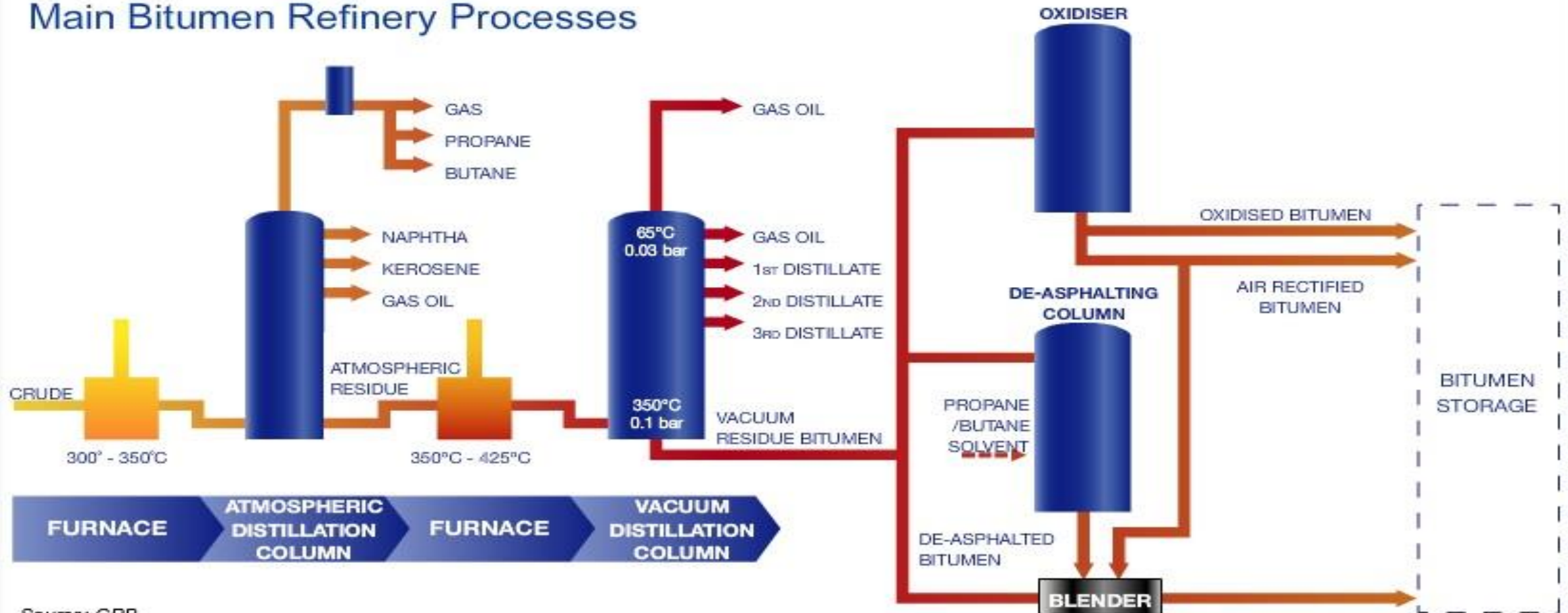
Its compositions is carbon 87 per cent, hydrogen 11 percent and oxygen 2 per cent.

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### Main Bitumen Refinery Processes



Bitumen is not affected by light, air or water individually, but in combination they can make it brittle, porous and susceptible to oxidation forming blisters and cracks.

It becomes soft at temperatures between  $30^{\circ}\text{--}100^{\circ}\text{C}$  (no sharp melting point), and therefore must be protected from exposure to heat.

It is insoluble in water and fairly resistant to most acids. Although bitumen is combustible, composite products, such as mastic asphalt, are not readily ignited. Physical and chemical requirements of bitumen for use in buildings is given



## FORMS

### BITUMEN EMULSION

is a liquid product containing bitumen to a great extent in an aqueous medium. The bitumen which is in a very finely divided state (globules of about 2 micron diameter) is kept suspended in the aqueous medium with the help of some suitable stabilizing agents.

Depending upon the stability of the protective coating of the emulsifying agent, the emulsions are classed as rapid setting (RS), medium setting (MS) and slow setting (SS). These emulsions are always stored in air tight drums.

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### BLOWN BITUMEN

is obtained by passing air under pressure at a higher temperature through the bitumen. It can be used as roofing and damp-proofing felts, in the manufacture of pipe asphalts and joint fillers, as heat insulating material, etc.

### CUT BACK BITUMEN

is obtained by fluxing asphaltic bitumen in presence of some suitable liquid distillates of coal tar or petroleum. It is mainly used in road construction and in soil stabilization (2–4%). Cut-backs are commercially manufactured in the following three groups

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1. Rapid curing (RC) cut-backs containing naphtha or gasoline.
2. Medium curing (MC) cut-backs containing kerosene.
3. Slow curing (SC) cut-backs containing light oils as fluxing agents.

Each of the above group of cut-backs is further subdivided into six categories from 0 to 5.

The six different viscosities are named by numbers 0 to 5 in the increasing order of viscosity.

### PLASTIC BITUMEN

consists of bitumen, thinner and a suitable inert filler. The amount of inert filler is about 40 to 45 per cent. It is used for filling cracks in masonry structures, for stopping leakage, etc.

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## PROPERTY OF BITUMEN

The various properties are viscosity, ductility and softening point.

### VISCOSITY

depends greatly on temperature. At lower temperature, bitumen has great viscosity and acquires the properties of a solid body, while with increase in temperature the viscosity of bitumen decreases and it passes into liquid state.

?

### DUCTILITY

depends upon temperature, group composition and nature of structure. Viscous bitumens, containing solid paraffins at low temperatures are very ductile.

SOFTING POINT

is related to viscosity. Bitumen needs sufficient fluidity before specific application.

— 35 - 40°





## TAR

It is a dark (deep black) viscous liquid produced by destructive distillation of organic material such as coal, oil, lignite and wool.

Depending upon the source of origin it is classified as coal tar, wood tar and mineral tar.

Tar is restraint to petroleum-based solvents. It has very low bitumen content.

RT-1 : For surface painting under exceptionally cold weather conditions, hill roads at very high elevations.

RT-2 : For standard surface painting under normal climatic conditions.

RT-3 : For surface painting and renewal coats and is also used for premixing chips in topcourses.

RT-4 : For premixing tar macadam (base course).

RT-5 : For grouting.

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The minimum ductility range prescribed for bitumen to be used in pavement construction is:

- (a) 75-100 cm
- (b) 50-75 cm
- (c) 50-60 cm
- (d) 5-60 cm

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**Toughness property of an aggregate can be tested by adopting:**

- (a) Aggregate crushing strength test**
- (b) Aggregate Impact test**
- (c) Los Angeles Abrasion test**
- (d) Angularity number**

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The unit standard load, in  $\text{kg}/\text{cm}^2$ , for a standard penetration of 2.5 mm in CBR test setup is:

- (a) 1370
- (b) 2055
- (c) 70
- (d) 105

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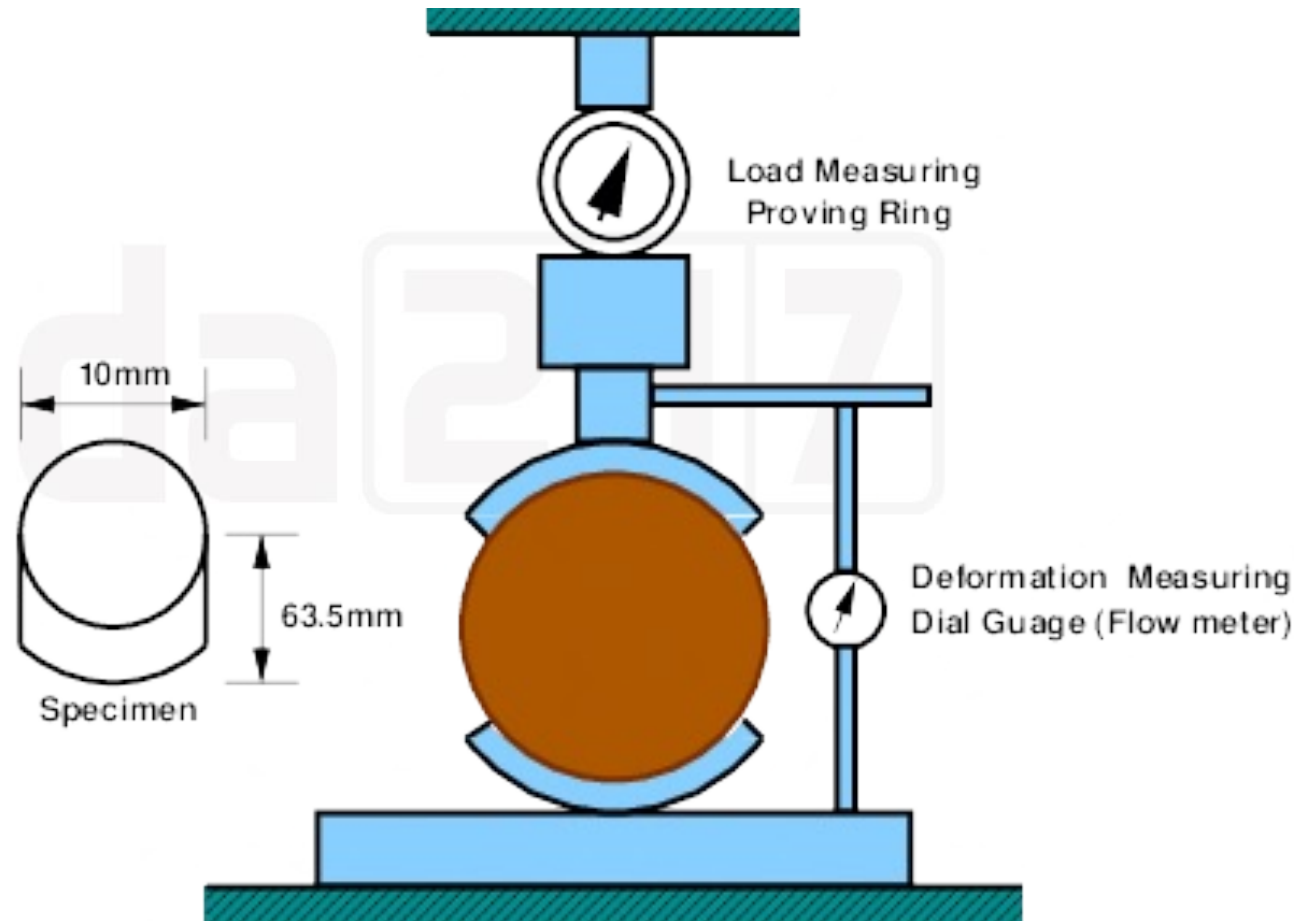
The desirable thickness of the bituminous mix specimen to be subjected to Marshall Stability Testing is:

- (a) 63.5 mm
- (b) 65.3 mm
- (c) 68.3 mm
- (d) 63.8 mm

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The minimum desired Marshall Stability value for a dense bituminous mix to be used in bituminous concrete surface course is:

- (a) 900 kg
- (b) 500 kg
- (c) 700 kg
- (d) 800 kg

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**Bitumen is soluble in:**

- (a) Diesel
- (b) Water
- (c) Petrol
- (d) Carbon disulphide

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In CBR test, if the CBR value at 5 mm is greater than that at 2.5 mm:

- (a) The higher value should be chosen
- (b) The test should be repeated
- (c) Average value of the two should be used
- (d) None of these

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In tack coat, bitumen is used at the rate of .....

- (a)  $5 \text{ kg/m}^2$
- (b)  $0.5 \text{ kg/m}^2$
- (c)  $1 \text{ kg/m}^2$
- (d)  $10 \text{ kg/m}^2$

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The specific gravity of pure bitumen is in the range of .....

- (a) 0.97-1.02
- (b) 0.82-0.95
- (c) 0.8-0.9
- (d) 1.10-1.25

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Which of the following tests is used to determine the rate of wear of stones?

- (a) Crushing test
- (b) Attrition test
- (c) Impact test
- (d) Abrasion

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\_\_\_\_\_ is used as a solvent in making 'cut back' bitumen.

- (a) Petrol
- (b) Diesel
- (c) Kerosene
- (d) Turpentine

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Which of the following test is used for the bitumen?

- (a) Slump test
- (b) Abrasion test
- (c) Penetration test
- (d) Fineness test

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Which of the following property of bitumen is related to the pensky-Marten test?

- (a) Ductility
- (b) Softening point
- (c) Flash and fire point
- (d) Viscosity

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Bitumen is generally obtained from

- (a) Petroleum product
- (b) Organic material
- (c) Coal
- (d) Synthetic material

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**Bitumen emulsion is:**

- (a) Liquid containing bitumen is suspension.**
- (b) Paint**
- (c) Used as anti-corrosive paint**
- (d) All the above**

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Mastic asphalt is generally used for:

- (a) Damp proof course and water proof layer
- (b) Water proof layer
- (c) Damp proof course
- (d) Partition walls

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**Bitumen in**

- (a) Solid state is called asphalt**
- (b) Semifluid state is called mineral tar**
- (c) Fluid state is called petroleum**
- (d) All of the above**

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What is the purpose of conducting marshall stability test?

- (a) For bituminous mix design
- (b) For cement concrete pavement Design
- (c) For strength of subgrade
- (d) For suitability of bitumen

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This is generally used for pre-mixing tar macadam in base course:

- (a) RT-1
- (b) RT-2
- (c) RT-3
- (d) RT-4

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**California Bearing Ratio (CBR)**

- (a) Is a measure of soil strength**
- (b) Is a procedure for designing flexible pavements**
- (c) Is a method of soil identification**
- (d) Is a measure to indicate the relative strength of paving materials**



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Charpy test is:

- (a) A bending test
- (b) An impact test
- (c) A fatigue test
- (d) A hardness test

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Most suitable material for highway embankments is

- (a) Granular soil
- (b) Organic soil
- (c) Silts
- (d) Clays

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