

INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2015

Paper - III

Date: 18th July, 2015

Time: 10.00-13.00 hrs.

Duration: 3 Hours

Full Marks : 100

RUBBER MATERIALS

Answer should be illustrated with sketches wherever helpful

Total Five questions are to be answered. Each question carries 20 marks.

Question No. 1 is compulsory. Answer Four questions from the remaining taking Two from each group.

GROUP – A

- I. Multiple choice Questions: Select the correct answer from the given alternatives.
- i) Which rubber has the widest temperature range of application?
 - a) Poly Sulphide
 - b) EPDM
 - c) Chloro Sulphonated Poly ethylene (CSPE)
 - d) Silicone
 - ii) Increasing acrylonitrile content, the property which decreases is:
 - a) Heat resistance
 - b) Heat Build Up
 - c) Glass transition temperature
 - d) Resilience
 - iii) Good stabilizing agent for NR Latex

(a) Formic acid (b) Ammonia (c) Hydrochloric acid (d) Calcium Carbonate
 - iv) Rubber which shows best gum strength

a) EPDM (b) BR (c) NR (d) SBR
 - v) The basis for grading ISNR is:

a) Dirt content (b) Ash content (c) Viscosity (d) Nitrogen content
 - vi) Amongst following rubbers, which rubber can take maximum fillers and oil loading

a) EPDM (b) NR (c) PU (d) SBR
 - vii) Paraffin mineral oil is the most compatible with
 - a) Butyl rubber
 - b) Poly Chloroprene Rubber
 - c) Natural rubber
 - d) Nitrile rubber

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- viii) PF Resin curing is the most suitable for
 (a) NR (b) BR (c) IIR (d) NBR
- ix) Curing system for best flex life of cured product
 (a) EV (b) conventional (c) Semi EV (d) Peroxide
- x) The most widely used textile for reinforcement of V-belt
 (a) Aramid (b) Polyester (c) Nylon (d) Rayon
- xi) A rubber compound contains 25% carbon and 50% rubber : Calculate the phr of carbon black
 a) 25 b) 50 c) 75 d) Cannot be calculated
- xii) In latex processing the chemical used as gelling agent is
 a) Ammonia b) ZnO c) Sodium silicofluoride d) ZDEC
- xiii) Which of these elastomers has low Mass per Volume
 a) SBR b) CR c) BR d) EPDM
- xiv) The best filler for Acid Resistant Tank Lining
 (a) ZnO (b) BaSO₄ (c) Calcium Silicate (d) China clay
- xv) Polymer suffers from cold Flow
 (a) CR (b) NR (c) SBR (d) NBR
- xvi) The most delayed action accelerator is:
 (a) MBT (b) MBTS (c) TBSI (d) NOBS
- xvii) Peroxide curing is not technically recommended for:-
 a) NR b) IIR c) CR d) NBR
- xviii) Polymer is having highest impermeability of air
 a) HDPE b) BIIR c) NR d) IIR
- xix) Rubber hot water bottle is made from:
 (a) BR (b) IIR (c) SBR (d) Silicone Rubber
- xx) Polymer which shows the best combination of heat and oil resistance:
 (a) EPDM (b) VMQ (c) HNBR (d) CR

2. Explain with proper reason of the following (any Four)

20 x 1 = 20

- a. The most preferred polymer for microwave cured profile for car is EPDM although it is not a polar polymer.

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- b. Natural rubber needs to be masticated where as no mastication is required for SBR, NBR, Polybutadiene.
- c. In bridge bearing pad, poly-chloroprene rubber is widely used.
- d. In XLPE cable EVA is a preferred polymer in conductor and semi conductor compound
- e. In NBR based compound higher dosage of SRF type black and oil is used to improve volume swell in mineral oil
- f. Green Strength of NR is higher than synthetic Polyisoprene.

4 x 5 = 20

- 3.(a) Describe briefly the manufacturing of both smoked sheet rubber and Technically Specified rubber.
- (b) Explain how both the above rubbers (RSS & TSR) are graded ?
- (c) Explain what is the significance of PRI test values ?

10 + 7 + 3 = 20

- 4. i) Design a rubber compound based on natural which will have a hardness of 65 shore A, tensile strength of 23 MPa, elongation at break of 700% Calculate the density and cost (both per kg and per volume) of the compound.

(Given density of NR = 0.92, ZnO = 5.57, St.acid = 0.85, S = 2.07, carbon black = 1.80, Accelerator = 1.27 or 1.37 or 1.28, A.O = 1.14 or 1.2 or 1.0). (all densities are in gm/cc). Justify your choice.

- ii) Which rubbers/rubber blends you will choose for the following applications :
Give reasons for your selection.
 - a) Tyre tread compound with good skid resistance.
 - b) V-belt base compound for use in oil contaminated area.
 - c) Mining boot soles.
 - d) Radiator hose.
 - e) Seals and 'O' rings for space vehicles.
 - f) Dock fender
 - g) Cable sheath
 - h) Inner liner for hoses carrying corrosive chemicals
 - i) Rubberized roll in the paper industry
 - j) Engine mountings.

(4+3+3)+1x10=20

GROUP - B

- 5. (a) What is carbon black ? Write briefly the manufacturing process of furnace carbon black.
- (b) What are the important properties of carbon blacks? What is meant by "Structure" of carbon blacks?
- (c) What is the ASTM Nomenclature of N-219 stands for ? Write a Table on the effect of changes in particle size and structure on rubber compound properties.

8 + 4 + 8 = 20

- 6. (a) What do you understand by Recycling. State the importance of recycling of tire with respect to was control in manufacturing unit, preservation of environment & society and producing value added product
- (b) Outline the different technologies of recycling. of tires. Compare the different recycle material produced o of these technologies.

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1 x 1 = 20
 1 = 20
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- (c) Recycle material can be used as one of significant material to be used as compounding ingredients for cost reduction in product manufacturing – Justify.

7. (a) Write the most suitable elastomers for each of the following and give reasons why? $(2+3 \times 2) + (4+4) + 4 = 20$

- (i) White sidewall for passenger car tyre
- (ii) Inner tube for oil filled Hose
- (iii) Flame Retardant cover compound for conveyor belt.
- (iv) High voltage cable Insulation.
- (v) Tyre curing bag for Automobile Tyre.

(b) What is Aniline point? How the value of Aniline point helps to assess the type & quality of a plasticizer?

(c) How the mechanical stability of latex is tested and what is its significance.

(d) Write briefly the comparison amongst conventional, EV and semi EV Systems.

8. Write short notes on **any five** :

$$8 + 4 + 4 + 4 = 20$$

- (a) Fluorocarbon Rubbers.
- (b) Polysulphide Rubber
- (c) Tackifiers
- (d) Flame retardants and smoke depressant.
- (e) Solution SBR
- (f) Reinforcing white fillers
- (g) Ester Plasticizers
- (h) Epoxide Natural rubber

$$5 \times 4 = 20$$