

INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2013

Paper - III

Date : August 11, 2013
Duration : 3.00 hours

Time : 10.00 am. - 1.00 pm.
Full Marks : 100

Rubber Materials

Answers should be illustrated with sketches wherever helpful

Total FIVE questions are to be answered. Question No. 1 is compulsory. Answer FOUR from the remaining questions taking TWO from each group.

Group- A

Q. 1

(I) Choose the correct answer (write the letter code only):

- (i) Carboxylated nitrile rubber is better than conventional nitrile rubber in:
(A) Oil resistance
(B) Tear resistance
(C) Resistance to weather, ozone and sunlight
(D) Adhesion to fabric & metals
- (ii) All elastomers are:
(A) Resilient, highly resistant to sunlight & weathering
(B) Elastic, flexible, tough & relatively impermeable to water & air
(C) Unaffected by oils and solvents
(D) Highly resistant to abrasion & cut
- (iii) On vulcanization of the rubber:
(A) Elongation of the rubber compound increases
(B) Hardness increases
(C) Solubility in solvent increases
(D) None of these
- (iv) ISNR-5 has the PRI value of:
(A) 70
(B) 60
(C) 30
(D) 40
- (v) Guttapercha has the structure:
(A) 1:4 cis polyisoprene
(B) 1:4 trans polyisoprene

- (C) 1:2 and 3:4 polyisoprene
(D) None of these
- (vi) The T_g of raw NR is:
(A) -60°C
(B) -70°C
(C) -80°C
(D) -55°C
- (vii) SBR-1600 grade stands for:
(A) Cold oil master batches
(B) Cold black master batch with 14phr or less than 14phr oil
(C) Cold oil master batch with more than 14phr oil
(D) Miscellaneous dry polymer
- (viii) As compared to Neoprene-G (sulphur modified), the Neoprene-W (mercapto modified) has:
(A) Much better resistance to oil & gasoline
(B) More tackiness and faster cure rate
(C) Superior resistance to heat & compression
(D) None of these
- (ix) Because of its poor processability, Polybutadiene rubber is used primarily in blends with other elastomers to improve its:
(A) Resistance to abrasion, cut growth & flex cracking
(B) Resistance to oil & gasoline
(C) Resistance to sunlight & ozone
(D) None of the above
- (x) Neoprene AC has a trans content of:
(A) 80%
(B) 90%
(C) 100%
(D) 70%
- (xi) In EV system, sulphur is efficiently used because it has mostly:
(A) Monosulfidic cross links
(B) Disulfidic cross links
(C) Polysulfidic cross links
(D) Carbon-Carbon cross links

(xii) When precipitated CaCO_3 is burnt above 800°C , it leave an ash content of :

- (a) 0%
- (b) 40%
- (c) 60%
- (d) 80%

(xiii) What is the weight percent of chlorine in PVC?

- (a) 16%
- (b) 36%
- (c) 46%
- (d) 56%

(xiv) Which carbon black gives the best compression set resistance ?

- (a) HAF
- (b) ISAF
- (c) SRF
- (d) MT

(xv) Carbon black having the lowest BET surface area is:

- (a) N 110
- (b) N 219
- (c) N 339
- (d) N 990

II. Name at least one application of the following blends with justification: 1x15=15

- (A) NR/PP
- (B) EPDM/PP
- (C) NBR/PVC
- (D) NR/BR
- (E) NR/CIIR

1x5=5

Q.2. (a) What is the particle size of latex? What is the Rubber content in fresh latex & concentrated latex ?

3

(b) For compounding of latex, the ingredients are not added directly but in the form of dispersions and emulsions. Explain why and how dispersions and emulsions are formed?

2+5 =7

(c) What is VFA of natural rubber latex? How is it measured?

3

(d) Discuss the method of manufacture of condoms from the latex. Explain with figure wherever necessary.

Q.3. (a) What is Aniline point? With the help of aniline point how you will assess the type & quality of a plasticizer? 1 + 3 = 4

(b) (i) What is plasticity retention index? How will you determine it? Explain its significance. 1 + 2 + 1 = 4

(ii) Why acetone extraction of rubber compounds & vulcanizates are done? 2

(c) How will you assess the purity of the following additives in the laboratory? 5

(i) ZnO

(ii) Sulphur

(iii) Stearic Acid

(iv) CaCO_3

(v) MBTS

(d) How will you identify the following rubbers in the laboratory using chemical methods and/or analytical tools or both?

(i) NR

(ii) CR

(iii) NBR

(iv) EPDM

(v) Silicone rubber 5

Q.4. Write short notes on any **four**:

i) Superior processing rubbers

ii) Polystyrene grafted NR

iii) Epoxidised Natural Rubber

iv) Thermoplastic polyurethane

v) Polysulfide Rubbers

vi) Synthetic polyisoprene rubber (IR) 4x5= 20

Group- B

Q.5. (a) Discuss the synthesis of ethylene-octene copolymer and the basis for their gradation. 4+2=6

(b) Compare and contrast the salient features between ethylene octene copolymers and ethylene propylene rubbers. 4

(c) What are the criteria for designing a polymer blend? 5

(d) How can you overcome cure mismatch in a blend of NR/EPDM rubber? 5

Q.6.(a). Which polymers you will select for cable insulation in case of power cables intended for use in the following voltage range. Explain with reasons for your choice.

- i) Up to 1KVA
- ii) up to 11KVA
- iii) Up to 33KVA and
- iv) Up to 300KVA

2x4=8

(b), Explain how the selected polymers shall be cured after shaping and cite the mechanism of vulcanization. 6

© For FRLS cable sheathing compound which polymers or blends of polymers are selected? Give a formulation with the additives. 6

(a) Soluble EV systems are more effective during injection moulding of rubber compounds than normal EV systems. Explain with reasons & give a typical formulation.

(b) Discuss one of the methods of production of reclaimed butyl rubber from scrap rubber with its major applications.

(c) Discuss the preparation of polyurethane foam by single step process.

(d) Discuss the structure and morphology of styrene butadiene tri-block copolymers & compare with that of styrene butadiene rubbers..

5 x 4 = 20

Q.8. (i) How will you determine the moisture regain in a textile material? 3

(ii) Define tenacity of a fibre and highlight its significance in the textile industry. 3

(iii) Draw load-extension curves for the following fibres: Cotton, Polyester, Nylon, Rayon, Aramid and Glass. 6

(iv) Twist is an important parameter in defining a cord. Differentiate between Z & S twists of the yarns in a cord. 3

(v) Name the textile/cords used in the following applications; 1x5=5

- (A) Automotive tyres (Bias ply)
- (B) Cycle tyres
- (C) High pressure hoses
- (D) Conveyor belts
- (E) V-belts