

INDIAN RUBBER INSTITUTE

DIRI EXAMINATION - 2016

Paper - III

Date: 23.07.2016

Time: 10.00-13.00 hrs.

Duration: 3 Hours

Full Marks : 100

Rubber Materials, Rubber Compounding and Reinforcement

Answers should be illustrated with sketches wherever helpful

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

GROUP - A

I. Choose the correct answer from the given alternatives :

- i) Which of these SBR grades is a non-staining type?
a) SBR 1500 b) SBR 1502 c) SBR 1708 d) SBR 1958 ✓
- ii) Technically specified natural rubber (ISNR) is in the form of
a) Pellets b) Slabs ✓ c) Crumbs d) Sheets
- iii) Dry rubber content of centrifuged natural latex is approximately
a) 60% ✓ b) 50% c) 70% d) 45%
- iv) Ozone protection in diene rubbers can be obtained with antioxidant based on
a) Diphenylamines b) Paraphenylene diamines ✓ c) Naphthylamines d) Bisphenols.
- v) Which of these fillers is the most widely used in tyre tread
(a) China clay (b) HAF Carbon black ✓ (c) Whiting (d) Calcium silicate
- vi) Bonding agent used for metal-rubber bonded product is.
✓ (a) Chemlok (b) Wood resin (c) PF resin (d) CI resin
- vii) For stabilization of latex useful material is
(a) NaCl (b) H_2SO_4 (c) NH_3 ✓ (d) $CaCO_3$
- viii) Cord used in car tyre body ply
(a) Steel (b) Carbon (c) Nylon ✓ (d) Cotton
- ix) Which of the following rubbers possesses the highest self protection against ozone?
(a) CR (b) NBR (c) SBR (d) EPDM ✓
- x) Which of these rubbers has the best low temperature flexibility?
(a) SBR (b) ECO ✓ (c) MVQ (d) FKM

[Turn Over]

- xi) Which of these accelerators has the maximum delaying action?
 (a) MBT (b) CBS ✓ (c) ZDC (d) MBTS
- xii) Dry bonding agent used for textile-rubber bonded product is?
 (a) Chemlok (b) Isocyanate (c) Brass (d) Hexa + Resorcinol ✓
- xiii) Which rubber provides the maximum abrasion resistance?
 (a) NR (b) SBR (c) BR (d) PU ✓
- xiv) Which polymer exhibits the maximum heat resistance properties?
 (a) CR (b) NBR (c) BR (d) IIR ✓
- xv) ZnO is used as a curing agent for :
 (a) EPDM (b) BR (c) NBR (d) CR ✓
- xvi) Best flame resistant rubber is :
 (a) BR (b) IIR (c) Silicone (d) CR ✓
- xvii) Which of these rubbers has the maximum air impermeability?
 (a) CR (b) CPE (c) Hypalon (d) IIR ✓
- xviii) Paraffinic oil is the most suitable plasticizer for :
 (a) NBR (b) SBR (c) Fluoroelastomers (d) EPDM ✓
- xix) Most suitable elastomer for steam hose
 (a) Silicone (b) Butyl (c) Polybutadiene (d) EPDM ✓
- xx) Which one is the heaviest filler in rubber compounds?
 (a) Carbon black (b) China clay (c) Silica (d) Barytes ✓
- 1 x 20 = 20
2. (a) Describe the method for producing Indian Standard Natural Rubber (ISNR).
 (b) What are the advantages of ISNR over traditional smoked sheets?
 (c) Define plasticity Retention Index (PRI).
 (d) What is the viscosity of CVNR?
- 10+4+3+3=20
3. (a) Design a compound for a typical oil seal for industrial application.
 (b) Give reasons for the choice of polymer and ingredients for the same.
 (c) What would be the expected physical properties before and after ageing in a standard oil like IRM No.903 or ASTM Oil No.3 ?
- 7+7+6 = 20
4. Select suitable curing systems for the following rubbers/blends giving reasons for the same :
 (answer Any Five)
- (a) Butyl rubber for tyre curing bladders.

- (b) V-belt compound based on sulfur-modified polychloroprene rubber.
- (c) Truck inner tube compound based on chlorobutyl-natural rubber blend.
- (d) Surgical gloves based on NR latex
- (e) Oil seal based on fluorocarbon rubber.
- (f) High heat resistant EPDM compound

5 X 4 = 20

GROUP - B

5. (a) Describe the method for production of Natural Rubber (any grade).
 (b) Name a few important grades of natural rubber
 (c) What is reversion?
 (d) Select grade of natural rubber for truck tyre and cycle tyre.

10+4+3+3 = 20

6. (a) What are different grades of carbon black used in tyre industry ?
 (b) Arrange these grades in order of increasing surface area.
 (c) Name a few important non-black fillers.
 (d) What properties will improve due to addition of carbon black to rubber compound?

6+3+3+8 = 20

7. Select suitable rubber/rubber blends to the following applications giving reasons for the same :

- (a) Tyre curing bag : *IIR*
- (b) Steam hose : *EPDM*
- (c) Inner liner for tubeless tyre : *CIIR / S / BIIR*
- (d) Aerotyre *NR*
- (e) High voltage cable insulator *SILICONE / OR / EPDM*
- (f) Automobile tube *IIR*
- (g) Hawaii sandle *NR*
- (h) Shoe soles *SBR / OR / BU*
- (i) Brake liner *SBR*
- (j) Inner liner for tubeless tyre *CIIR / S / BIIR*

10 x 2 = 20

8. Write short notes on : (Any Four)

- (a) Flame retardants
- (b) Silica based reinforcing filler
- (c) Cotton vs. nylon as textile material for rubbers
- (d) Manufacture of crumb rubber
- (e) Facticees
- (f) Pre-vulcanised latex

(4 x 5) = 20