

# INDIAN RUBBER INSTITUTE

DIRI EXAMINATION – 2010

Paper – III

Date : 30<sup>th</sup> June, 2010

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

Question number 1 is compulsory. Answer **four** from the remaining questions taking, **two** from each group.

## GROUP – A

1. (a) Write full form of the following :  
NR, SBR, CR, IIR, EPDM, ISAF, SRF, GPF, FEF, RFL. 1 x 10 = 10
- (b) Choose the right answers from the given alternatives:
- (i) Which of these SBR grades is high styrene grade.  
(i) SBR 1500 (b) SBR 1502 (c) SBR 1700 (d) SBR 1958
- (ii) Technically specified natural rubber ISNR10 is in the form of  
(a) Pellets (b) Slabs (c) Crumbs (d) Sheets
- (iii) Which of these fillers is most widely used in tyre tread  
(a) China clay (b) HAF Carbon black (c) Whiting (d) Calcium silicate
- (iv) Which metal oxide is commonly used as an activator for rubber compound  
(a) Lead oxide (b) Titanium dioxide (c) Magnesium oxide (d) Zinc oxide
- (v) Which of these blends would give good abrasion & low heat build up  
(i) NR-SBR (ii) NR – BR (iii) BR – SBR (iv) IIR-SBR
- (vi) Bonding agent used for metal-rubber bonded product is.  
(a) Chemlok (b) Wood resin (c) PF resin (d) CI resin
- (vii) Which of these fillers have the lowest specific gravity.  
(a) Carbon black (b) Calcium carbonate (c) Aluminium Silicate  
(d) Barium sulphate
- (viii) For stabilization of latex useful material is  
(a) NaCl (b) H<sub>2</sub>SO<sub>4</sub> (c) NH<sub>3</sub> (d) CaCO<sub>3</sub>
- (ix) Most suitable elastomer for tyre curing bladder is .....  
(a) Silicone (b) Butyl (c) Polybutadiene (d) EPDM
- (x) Cord used in car tyre body ply  
(a) Steel (b) Carbon (c) Nylon (d) Cotton 1 x 10 = 10

2. (a) Describe the method for production of Natural Rubber (any grade).  
 (b) Name a few important grades of natural rubber  
 (c) Define Plasticity Retention Index (PRI).  
 (d) Select grade of natural rubber for truck tyre and cycle tyre. 10+4+3+3 = 20
3. (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
4. Write short notes on the following rubber compounding and processing materials:
- (a) Accelerator  
 (b) Curing agent  
 (c) Plasticizer  
 (d) Mould releasing agent  
 (e) Dusting material 4 x 5 = 20

**GROUP - B**

5. (a) Design a compound for good quality car tyre tread.  
 (b) Give reasons for the choice of polymer and ingredients for the same.  
 (c) What will you do if you have to reduce the price of this tread compound? 8+7+5 = 20
6. A compound is given below:

<u>Ingredients</u>	<u>phr</u>	<u>Specific gravity</u>	<u>Cost (Rs. per kg)</u>
NR	100	0.92	90
ZnO	5	5.5	80
Stearic acid	3	0.85	60
Antioxidant TMQ	2	1.1	200
N330 black	40	1.8	50
Aromatic oil	8	0.98	40
CBS	0.6	1.3	300
Sulphur	2.5	2	20

Suggest what changes would you make to:

- (a) Improve the abrasion resistance of the tread.  
 (b) Improve the scorch safety of the compound.  
 (c) Improve the ozone and weathering resistance of the tread.

Calculate the specific gravity of the compound and the cost per unit weight and volume. 4+4+4+(4+4)=20

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

- (a) Tyre curing bag
- (b) Steam hose oil seal
- (c) Inner liner for tubeless tyre
- (d) Aerotyre
- (e) High voltage cable insulator
- (f) Automobile tube
- (g) Hawai sandle
- (h) Shoe soles
- (i) Brake liner
- (j) Inner liner for tube less tyre

10 x 2 = 20

8. Write short notes on : (**any four**) :

- (a) Tackifier
- (b) Rubber blends
- (c) Reclaim rubber
- (d) Bonding agents for rubber to metal adhesion
- (e) Blowing agent
- (f) Cord dipping material.
- (g) Different textile materials used in rubber industry

4 x 5 = 20