INDIAN RUBBER INSTITUTE

PGD-IRI EXAMINATION – 2010

Paper - III

Date : 30th June, 2010 **Time: 10.00-13.00 hrs.**
Duration : 3 Hours **Total Marks : 100**

Rubber Materials

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. Select the correct answer from the given alternatives:

(i) Which of these dienes is present in EPDM
(a) Dicyclopentadiene (b) Cyclohexadiene
(c) Chlorobutadiene (d) Hexamethylenetetramine

(ii) Which is the cleanest grade of technically specified NR.
(a) SMR 10 (b) SMR 20
(c) SMR 5 (d) SMR L

(iii) Which rubber is the most suitable for a steam hose.
(a) EPDM (b) FKM
(c) VMQ (d) ACM

(iv) Which of these rubbers can not made by emulsion polymerization.
(a) IIR (b) CR
(c) SBR (d) NBR

(v) The accelerator which gives the best delaying action is
(a) Thiuram (b) Thiazole
(c) Sulphenamide (d) Dithiocarbamate

(vi) Bonding of steel cords to rubber compounds is achieved by the addition of
(a) Cobalt salts (b) Zinc salts
(c) Copper compounds (d) Fatty acids

(vii) In textiles, the term "denier" is an indication of
(a) Strength of the fiber (b) Gauge of the fabric
(c) Twist of the cord (d) Modulus of the yarn

(viii) Which of these thermoplastic elastomers has the best oil resistance
(a) TPO (b) TPU
(c) SEBS (d) SBS

(ix) Blooming in rubber compounds can be prevented by use of
(a) Colloidal sulfur (b) Insoluble sulfur
(c) Oil-coated sulfur (d) Soluble sulfur

(x) Which of these fillers are necessary for halogen-free flame retardant products
(a) Magnesium oxide (b) Magnesium carbonate
(c) Magnesium sulphate (d) Magnesium hydroxide

(xi) Acrylic rubber has inferior resistance to
(a) Oxidation (b) Water and steam
(c) Gasoline (d) Ozone and sunlight

(xii) Polyurethane rubber has outstanding resistance to
(a) Abrasion and tear (b) Hot water
(c) Acids and solvents (d) None of the above

(xiii) 100% hydrogenated NBR can be vulcanized by
(a) Sulphur and accelerators (b) Peroxides
(c) Metal oxides (d) None of the above

(xiv) Which of the following chemicals is an excellent antiozonant
(a) Styrenated phenol (b) TMQ
(c) 6PPD (d) Micro crystalline wax

(xv) Which filler has the highest specific gravity
(a) Ppt $CaCO_3$ (b) Silica
(c) Barytes (d) China clay

(xvi) Select a cure system for best flex life of cured product
(a) Semi EV (b) EV (c) Peroxide (d) Conventional

(xvii) Among the following rubbers which rubber can take maximum filler and oil loading
(a) NR (b) CR
(c) SBR (d) EPDM

(xviii) The oil content of SBR 1712 is
(a) 37.5% (b) 50%
(c) 17% (d) None of the above

(xix) Adhesive recommended to bond leather to PVC is
(a) CR based (b) NR based
(c) PU based (d) None of the above

(xx) The additives used for compounding of high moisture absorbing capacity
(a) Zinc oxide (b) Mica
(c) Carbon black (d) Calcium oxide

1 x 20 = 20

2. (a) Describe briefly the manufacture of natural rubber.
(b) What are the basis of grading natural rubber.
(c) Which grades of natural rubber gives the highest tensile strength. Name one product where use of such grade is necessary.
(d) What are the advantages of technically specified rubber over conventional rubber in sheet form.
(e) Explain the significance of plasticity retension index of natural rubber.

8+2+3+3+4 = 20

3. (a)

	Parts by wt.	Specific gravity
Rubber	100	0.93
Zinc Oxide	5	5.6
Stearic Acid	2	0.9
HAF black	40	1.8
Aromatic Oil	10	0.84
Accelerator	0.5	1.5
Antioxidant	1.0	1.06
Sulphur	2.5	2.1

(i) What is the specific gravity of the compound?
(ii) The cost/kg of the compound is Rs.50. What will be the volume cost?
(iii) Calculate the amount by weight of china clay (specific gravity 2.60) necessary to reduce
the rubber content of the above mix to 30% by volume.
(iv) What would be the specific gravity of the compound after addition of china clay?

5+2+5+3=15

(b) Specify the rubber chemicals added to improve the following:
(i) Smoke suppression and flame retardency
(ii) Tack
(iii) Ozone resistance in static condition
(iv) LOI
(v) Antistatic characteristics.

5 x 1 = 5

4. Explain with proper reason of the following:
(a) The most preferred polymer for microwave cured profile for car is EPDM although it is not a polar polymer – Why?
(b) Natural rubber needs to be masticated whereas no mastication is required for SBR, NBR, Polybutadiene – Why?
(c) In bridge bearing pad polychloroprene rubber is widely used – Why?
(d) In XLPE cable EVA is a preferred polymer in conductor and semi conductor compound – Why?
(e) In NBR based compound higher dosage of SRF type black and oil is used to improve volume swell in mineral oil – Why?

5 x 4 = 20

GROUP – B

5. (a) State what is meant by the following applied to textiles:
(i) Denier (ii) Tex (iii) Yarn count (iv) Thermal shrinkage

(b) What is the advantage of aramid over steel?

(c) Why polyester is preferred over nylon in V-belt.

(d) Name three products where nylon 6 is used.

(e) Why post cure inflation (PCI) in nylon reinforced truck tyre is recommended? Mention the procedure of PCI.

8+2+2+3+5 = 20

6. (a) What are Thermoplastic Elastomers and how are they different from thermoset elastomers.

(b) Mention different types of thermoplastic elastomers available and their main applications.

(c) What is the difference between TPOs and TPVs.

6+10+4=20

7. (a) Name the feed stocks used for manufacturing thermal blacks, channel blacks and furnace blacks.

(b) What are the main differences between furnace blacks and thermal blacks?

(c) What is the approximate particle size of N330 and N990?

(d) Among the range of commercially available furnace blacks, which grade has the largest surface area, and which has the smallest surface area.

(e) What is the special about conductive blacks?

6+4+4+4+2=20

8. Write short notes on **any four** of the following:

(a) Dry bonding agents for steel cord bonding.

(b) Blowing agents for open and closed cell sponges.

(c) Dispersing and emulsifying agents for latex compounding.

(d) Tackifiers for synthetic rubbers.

(e) Textiles used for hose manufacturing.

(f) Oil extended synthetic rubbers.

4 x 5 = 20