

# INDIAN RUBBER INSTITUTE

DIRI EXAMINATION – 2015

Paper - III

Date: 18th July, 2015

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. Choose the correct answer from the given alternatives
  - i) The lowest particle size black is :
    - a) N774
    - b) N234
    - c) N990
    - d) N110
  - ii) Among the following accelerators which is the safest one:
    - a) CBS
    - b) DCBS
    - c) NOBS
    - d) TBBS
  - iii) Gutta Percha has the structure:
    - a) 1,4 Cis Polyisoprene
    - b) 1,4 Trans Polyisoprene
    - c) 1,2 Cis Polyisoprene
    - d) None of the above
  - iv) Tg of Raw Natural Rubber is:
    - a) - 60°C
    - b) - 70°C
    - c) - 55°C
    - d) - 80°C
  - v) One of the major drawback of Polybutadiene Rubber is :
    - a) High Rebound Resilience
    - b) Resistance to Polar solvents
    - c) Poor Processability
    - d) None of the above
  - vi) ZDC is used as an accelerator in:
    - a) Latex Products
    - b) Tennis Ball
    - c) Footwear
    - d) Power transmission belts
  - vii) Wood rosin is used in Rubber compounds as:
    - a) Peptiser
    - b) Tackifier
    - c) Crosslinking agent
    - d) Accelerator
  - viii) Excessive remilling of SBR compound may lead to:
    - a) Softening
    - b) Gelling
    - c) High tack
    - d) None of the above

[Turn Over]

- ix) Colloidal dispersion of Sulfur is used as crosslinking agent in :
- a) Tyre
  - b) Metal to Rubber Bonding
  - c) Tank Lining
  - d) Latex Products
- x) EPDM is a :
- a) Homopolymer
  - b) Copolymer
  - c) Terpolymer
  - d) None of the above
- xi) Dicumyl Peroxide (DCP) is used as:
- a) Peptiser
  - b) Cross Linking Agent
  - c) Accelerator
  - d) None of the above
- xii) A very good weather resistant polymer is :
- a) NR            b) SBR
  - c) NBR         d) EPDM
- xiii) Silicone emulsions are used as:
- a) Mould release agent
  - b) Reinforcing agent in silica filled compound
  - c) Emulsifying agent in emulsion polymerization
  - d) None of the above
- xiv) RFL dipping on textile fabric is done to:
- a) Improve tensile strength of fabric
  - b) Improve tensile strength of rubber compound
  - c) Improve adhesion strength between rubber and fabric
  - d) Improve flowability of rubber compound
- xv) Nylon is a:
- a) Polyester
  - b) Polyamide
  - c) Polyimide
  - d) Polycarbonate
- xvi) Which polymer will swell least in petrol:
- a) NR
  - b) SBR
  - c) EPDM
  - d) CSM

xvii) Which of the following oils will have lowest aniline point:

- a) Aromatic oil
- b) Paraffinic oil
- c) Napthenic oil
- d) Vegetable oil

xviii) The best flame resistant rubber is:

- a) NR            b) SBR
- c) Q             d) CR

xix) What is basis of gradation of ISNR :

- a) Viscosity
- b) Ash Content
- c) Volatile Material content
- d) Dirt content

xx) ZnO is a curing agent for :

- a) IIR            b) EPDM
- c) CR            d) SBR

20x1=20

2. a) Calculate the specific gravity and cost per kg of the following compound.

<u>Material</u>	<u>phr</u>	<u>Specific gravity</u>	<u>Cost per Kg (Rs)</u>
NR	100.00	0.92	120
ZnO	5.00	5.57	90
Stearic Acid	3.00	0.85	60
TMQ	1.50	1.10	250
Carbon Black	50.00	1.80	70
Aromatic Oil	4.00	0.98	40
CBS	0.6	1.30	300
Sulfur	2.5	2.00	30

- b) What changes would you make to improve tear of the above compound?
- c) How would you improve ozone and weather resistance of the compound?
- d) How would you improve the reversion resistance of the compound?
- e) Calculate the hardness of the above compound

(10+2+2+2+4)= 20

3.a) Define the following terminologies for a textile material

- i) Filament    ii) Denier    iii) Tex    iv) EPI    v) Tenacity

[Turn Over]

( 4 )

- b) Calculate the linear density and tenacity of a yarn when 500 cm of that yarn weighs 5 gm and its breaking load is 10 gm.
- c) Select textile material for
- i) Cycle tyre      ii) Radial car tyre      iii) Bias truck tyre      iv) V-belt

(10+6+4) = 20

4. a) Give the different classifications of Natural Rubber.

- b) What is Gutta percha and show the structure of its repeat unit
- c) What is Initial Plasticity Number and Plasticity Retention Index? Explain the significance of both terms with regard to Natural Rubber.
- d) Nitrogen content of NR has impact on what property of rubber compound?
- e) What will be the impact if dirt content is increased in NR.

(6+5+5+2+2) = 20

### GROUP B

5. a) Give the ASTM numbers of following carbon blacks

i) SAF      ii) ISAF      iii) HAF      iv) FEF      v) GPF

b) Explain in short the following terms in carbon black;

- i) Particle size
- ii) Structure
- iii) Ash content
- iv) Toluene discolouration
- v) pH

c) Give one example of each of the following terms:

- i) Antioxidant
- ii) Peptiser
- iii) Accelerator activator
- iv) Non-black reinforcing filler
- v) Blowing agent
- vi) Tackifier
- vii) Antiozonant
- viii) Crosslinking agent
- ix) Plasticizer
- x) Accelerator

(5+5+10)= 20

[Turn Over]

6. a) What are thermoplastic elastomers (TPE) and how they are different from thermoset elastomers (TPV)?
- b) Give the different benefits of use of thermoplastic elastomers
- c) What do you understand by SBS, SIS and SEBS
- d) What do you understand by TPO and give an example.

(6+5+6+3) = 20

7. a) Mention few important properties of following rubber / blends and also give at least one application.
- i) NBR-PVC
  - ii) NR-CIIR
  - iii) IIR-EPDM
  - iv) NR-BR
  - v) CR
  - vi) Q
  - vii) EPDM
  - viii) OESBR
  - ix) CSM
  - x) IIR

(10x2)=20

8. Write short notes on any Four of the following :

- i) Reclaim Rubber
- ii) Factice
- iii) Non-staining antioxidants
- iv) Flame retardants
- v) Butyl Curing Agents
- vi) Rubber Process Oils

(4x5)=20