

INDIAN RUBBER INSTITUTE
PGD-IRI EXAMINATION – 2019

Paper III

Date: 8th July 2019

Duration: 3 hr

Time: 10.00 – 13.00 hr

Full Marks: 100

Rubber Materials

Answers should be illustrated with sketches wherever necessary. Total Five questions to be answered. Each Question carries 20 marks.

Question No 1 is compulsory. Answer rest four questions, taking two from each group.

Group A

- I. Multiple choice type questions. Select the correct answer from the given alternatives.
 - i) TDAE type of oil is used in which polymer
a) BR b) NBR c) SBR 1712 d) SBR 1723
 - ii) What is the basis of gradation of Block Natural Rubber
a) Initial Plasticity b) Nitrogen Content c) Ash content d) Dirt Content
 - iii) In Latex Compounding the gelling agent used is
a) Ammonia b) Styrenated Phenol c) Zinc Oxide d) Sodium Silico Fluoride
 - iv) The Crumb Rubber is used in rubber compound to facilitate
a) Viscosity Control b) Dispersion c) Flow d) Reduce Mixing Time
 - v) The highest Heat Resistance Polymer is
a) HNBR b) ACM c) FKM d) EPDM
 - vi) A 100% Hydrogenated NBR is vulcanized with
a) Sulfur and Accelerator b) Metal Oxide c) Peroxide d) Resin
 - vii) The best flex life in a vulcanized rubber can be achieved when curing by
a) EV b) Conventional c) Semi EV d) None of the above
 - viii) Maximum Filler and Oil Loading is possible in which rubber
a) NBR b) EPDM c) BR d) NR
 - ix) The best gum strength is observed in case of
a) NR b) IIR c) CIIR d) CR
 - x) Aromatic oil can not be used in which type of rubber
a) NR b) IIR c) SBR d) BR
 - xi) The most widely used textile for V Belt manufacturing is

- a) Nylon 6 b) Polyester c) Aramid d) Steel
- xii) Peroxide curing is not technically recommended for :
 a) CR b) NR c) IIR d) SBR
- xiii) The polymer which shows best combination of heat and oil resistance
 a) EPDM b) NBR c) CR d) HNBR
- xiv) The suitable polymer blend for Rice Roller Compound is
 a) NR/BR b) IIR/EPDM c) NBR/PVC d) SBR/BR
- xv) DNPT is used in rubber compound as
 a) Peptiser b) Accelerator c) Retarder d) Blowing Agent
- xvi) The accelerator which can be used as curing agent in absence of sulfur is
 a) CBS b) MBTS c) ZDBC d) TMTD
- xvii) The ASTM grade for Cold non pigmented SBR is
 a) SBR 1958 b) SBR 1700 c) SBR 1500 d) SBR 1000
- xviii) The material DBD is used as
 a) Blowing agent b) Retarder c) Accelerator d) Peptiser
- xix) Which of the following filler has the highest specific gravity
 a) Precipitated silica b) China Clay c) Barium Sulfate d) Calcium Carbonate
- xx) Bonding of steel cord to rubber is achieved by using
 a) Zinc salts b) Cobalt salts c) Fatty Acids d) Ferrous salts
- 2) a) Starting from field latex describe with a flow diagram how technically specified natural rubber (ISNR / SMR) is produced.
 b) What is Technically Specified Rubber (TSR)? What are the different Technical Specifications are considered for these type of rubbers?
 c) What is Gutta Percha, explain with the repeat unit.
 d) What are the different advantages of TSRs with respect to Conventional Rubbers? How Conventional Rubbers are classified?
- $6+(2+4)+3+(3+2)=20$
- 3) a) Discuss the manufacturing process with a flow diagram of furnace grade carbon blacks from Carbon Black Feed Stock.
 b) Explain the ASTM Classification of N220 Black.
 c) What is meant by Surface Area and Structure of carbon black? Explain with suitable example.
 d) What are the differences in Vulcanisate Properties observed when compounded with N110 and N660 carbon Black.

e) Give examples of six numbers of non black fillers.

$$5+2+5+5+3=20$$

4) a) Calculate the ash content of the following formulation

SBR	100 phr
ZnO	4 "
St Acid	2 "
MgCO ₃	30 "
CaCO ₃	40 "
Silica	20 "
N330	30 "
Ar Oil	10 "
Sulfur	2.5 "
MBTS	1.2 "
TMTD	0.5 "

b) What is coupling agent? When and why it is used?

c) Mention the most suitable elastomer(s) for the following and give reasons why?

- i) Tyre Curing Bag
- ii) Nipple for Baby Feeding Bottle
- iii) Inner Tube for Petrol Pump Hose
- iv) Cable sheath
- v) LPG Tubing

$$6+4+5 \times 2=20$$

Group B

5) a) What is meant by following terms in case of Textiles:

i) Denier ii) Cord Count iii) Tenacity iv) Thermal Shrinkage

b) What are advantages of Aramid fiber with respect to steel cord?

c) Why Nylon 6 is preferred in Bias Tyres over Nylon 66?

d) Give the Carcass and Breaker / Belt Reinforcing materials for following products:

- i) Bias Truck Tyre
- ii) Passenger Radial Tyre
- iii) Truck / Bus Radial Tyre

e) Name an Ultra Accelerator and mention in which product it can be used.

$$4 \times 2 + 2 + 2 + 3 \times 2 + 2 = 20$$

6) a) Name the type of filler, vulcanizing agent and accelerator used for following

- i) Butyl Tube
- ii) Cycle tyre tread
- iii) Conveyor Cover for general purpose application

b) Which polymers you will select for cable insulation in case of power cables intended for use in the following voltage range. Explain with reason for your choice
i) Up to 1 KVA ii) 11 KVA to 33 KVA and iii) Up to 300 KVA

c) Give two examples of the following:

- i) Blowing Agent
- ii) Delayed action accelerators
- iii) Vulcanizing Agents

d) Give the major applications of Reclaimed Rubbers in Industries.

$$6+4+3 \times 2+4=20$$

7) a) Write down the composition of Natural Rubber Latex.

b) What are different considerations are important for latex compounding.

c) Give the compound formulation of a surgical glove.

d) Why is it necessary to concentrate Natural Rubber Latex? Name the different processes used for Latex Concentration.

$$4+6+5+5=20$$

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

a) Solution SBR

b) Insoluble Sulfur

c) Epoxidised Natural Rubber

d) Flame retardant and smoke depressant

e) Plasticizer and softener

f) Semi EV System

$$4 \times 5=20$$