

Highway Materials

- Q.1 Bituminous macadam construction is a type of
 (a) surface dressing
 (b) interface treatment
 (c) grouted construction
 (d) premix

- Q.2 Bituminous materials are used in highway construction primarily because of their
 (a) cementing and water proofing properties
 (b) load bearing capacity
 (c) high specific gravity
 (d) black colour which facilitates road marking

- Q.3 Consider the following statements:
 Selection of the type and grade of the bituminous binder is made on the basis of
 1. cost of the binder material
 2. climatic conditions of the area and the construction technique
 3. degree of importance of road
 4. thickness of pavement layer to be constructed.

Which of these statements is/are correct?

- (a) 1 only (b) 2 only
 (c) 1, 2 and 4 (d) 1, 2 and 3

- Q.4 Which one of the following premix method is used for base course?
 (a) Bituminous carpet
 (b) Mastic asphalt
 (c) Sheet asphalt
 (d) Bituminous bound macadam

- Q.5 Which of the following is the correct statements?
 Penetration to know bitumen grade is measured in
 (a) one-hundredth of mm
 (b) one tenth of mm

- (c) one-tenth of an inch
 (d) one micron

- Q.6 The phenomenon of reflection cracking is observed in which one of the following?

- (a) Bituminous overlays provided over cracked cement concrete or bituminous pavements
 (b) Cement concrete overlays provided over cracked bituminous pavements
 (c) Bituminous overlays constructed in cold weather
 (d) Cement concrete overlays provided over cement concrete pavements

- Q.7 Match List-I (Properties of aggregate) with List-II (Test associated with the property) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Strength	1. Impact
B. Hardness	2. Soundness
C. Toughness	3. Stripping
D. Durability	4. Crushing
	5. Abrasion

Codes:

- | A | B | C | D |
|-------|---|---|---|
| (a) 4 | 5 | 1 | 2 |
| (b) 5 | 4 | 1 | 3 |
| (c) 4 | 1 | 5 | 3 |
| (d) 5 | 1 | 4 | 3 |

- Q.8 Match List-I (Material) with List-II (Property) and select the correct answer using the codes given below the lists:

List-I	List-II
A. Asphalt	1. Impact
B. Cutback bitumen	2. Soundness
C. Bitumen emulsion	3. Stripping
D. Tar	4. Crushing

List-II

- Coal distilled in the absence of air.
- Bitumen dissolved in aqueous medium
- Bitumen with volatile diluent
- Bitumen along with some proportion of minerals

Codes:

- | A | B | C | D |
|-------|---|---|---|
| (a) 2 | 3 | 4 | 1 |
| (b) 4 | 1 | 2 | 3 |
| (c) 2 | 1 | 4 | 3 |
| (d) 4 | 3 | 2 | 1 |

- Q.9 Match List-I with List-II and select the correct answer by using the codes given below the lists:

List-I

- Penetration test
- Marshall test
- Ring and ball test
- Benkelman beam test

List-II

- Design of bituminous concrete mix
- Overlay design
- Gradation of asphalt cement
- Determination of softening point

Codes:

- | A | B | C | D |
|-------|---|---|---|
| (a) 3 | 2 | 4 | 1 |
| (b) 3 | 1 | 4 | 2 |
| (c) 2 | 3 | 1 | 4 |
| (d) 4 | 2 | 3 | 1 |

- Q.10 Match List-I with List-II and select the correct answer by using the codes given below the lists:

List-I

- Disintegration of aggregates due to weathering
- The removal of material from the surface of the road by grinding action
- Mutual rubbing or grinding within the mass under the action of traffic
- Breaking up of road surface layer through cracking into irregular shaped areas.

List-II

- Attrition
- Crazing
- Soundness

4. Abrasion

5. Disintegration

Codes:

- | A | B | C | D |
|-------|---|---|---|
| (a) 3 | 1 | 5 | 2 |
| (b) 2 | 5 | 1 | 4 |
| (c) 3 | 4 | 1 | 2 |
| (d) 1 | 4 | 3 | 5 |

- Q.11 The angularity number for aggregate to be used in road construction should be between

- (a) 10 to 20 (b) 15 to 25
 (c) 0 to 11 (d) 8 to 18

- Q.12 A good quality aggregate to be used in base course should not have crushing value

- (a) more than 45 (b) more than 75
 (c) less than 45 (d) less than 100

- Q.13 The maximum allowable Los Angeles abrasion value for high quality surface course is

- (a) 50% (b) 30%
 (c) 25% (d) 60%

- Q.14 If in a Dorry abrasion test, the loss in weight is 18 grams, the coefficient of hardness is

- (a) 15 (b) 13
 (c) 14 (d) 9

- Q.15 Bitumen of grade 30/40 means

- (a) its penetration value is 3 to 4 mm
 (b) its penetration value is 30 to 40 mm
 (c) its penetration value is 3 mm
 (d) its penetration value is 4 mm

- Q.16 The most suitable surfacing material for bridge deck slabs is

- (a) rolled asphalt
 (b) bituminous carpet
 (c) mastic asphalt
 (d) none of the above

- Q.17 RC-2, MC-2 and SC-2 correspond to

- (a) same viscosity
 (b) viscosity in increasing order from RC-2 to SC-2
 (c) viscosity in decreasing order from RC-2 to SC-2
 (d) none of the above

Q.18 With reference to the Marshall mix design criteria for highways, which one of the following pairs is not correctly matched?

- (a) Stability value (kg)... 340 minimum
(b) Flow value ... 8-16
(c) VFB ... 50-75
(d) Percent Air voids ... 3-5

Q.19 Rapid curing cutback bitumen is produced by blending bitumen with

- (a) kerosene (b) benzene
(c) diesel (d) petrol

Q.20 Which of the following tests are used to ascertain the amount of stripping?

1. Static immersion test
2. Chemical immersion test
3. Immersion mechanical test
4. Coating test

The correct answer is

- (a) Both 1 and 3 (b) Both 2 and 4
(c) 1, 3 and 4 (d) 1, 2, 3 and 4

Q.21 Consider the following statements:

1. Mastic asphalt is a mixture of hard grade bitumen or blown bitumen mineral filler and fine aggregates.
2. Percentage of binder content in the mastic asphalt is 17-20% by weight of the aggregates.

Which of the statements given above is/are correct?

- (a) 1 only (b) 2 only
(c) Both 1 and 2 (d) Neither 1 nor 2

Q.22 A Marshall specimen is prepared for bituminous concrete with a bitumen content of 5% by weight of total mix. The theoretical and the measured unit weights of the mix are 2.442 g/cm^3 and 2.345 g/cm^3 respectively. The bitumen has a specific gravity of 1.02. The percent voids in mineral aggregate filled with bitumen (VFB) are

- (a) 34.55 (b) 35.9
(c) 73.55 (d) 74.3

Q.23 If the modulus of sub-grade reaction of a standard plate of 30 cm diameter is 16 kg/cm^3 , the K-value for a standard plate of 75 cm diameter is

- (a) 6.4 kg/cm^3 (b) 7.4 kg/cm^3
(c) 8.0 kg/cm^3 (d) 9.3 kg/cm^3

Q.24 In a bituminous concrete mix bitumen and aggregates by weight are 5% and 95% respectively. Specific gravity of bitumen and aggregates are 1 and 2.5 respectively. Theoretical unit weight of the mix will be

- (a) 2857 kg/cum (b) 2630 kg/cum
(c) 2325 kg/cum (d) 2208 kg/cum

Q.25 Matching List-I with List-II and select the correct answer using the codes given below the lists:

List-I (Test on Bitumen)

- A. Penetration test
B. Float test
C. Ring and Ball Test
D. Pensky-Martens Test

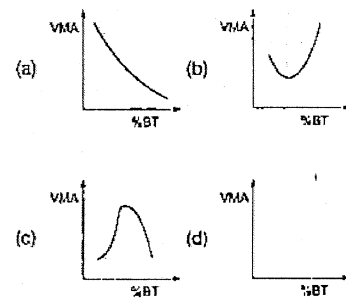
List-II (Properties)

1. Fire point
2. Degree of hardness
3. Softening point
4. Consistency

Codes:

- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 2 | 3 | 4 | 1 |
| (b) | 4 | 2 | 3 | 1 |
| (c) | 2 | 4 | 3 | 1 |
| (d) | 2 | 4 | 1 | 3 |

Q.26 Which one of the following diagram illustrates the relationship between VMA and percent bitumen content (BT) in Marshall test?



Q.27 Consider the following statements:

The failure of sub-grade of a flexible pavement is mainly attributed to

1. inadequate stability
2. loss of binding action

3. loss of base course materials

4. excessive stress concentration

Which of the statements are correct?

- (a) 1 and 2 (b) 1 and 4
(c) 2 and 4 (d) 2 and 3

Answers Highway Materials

1. (d) 2. (a) 3. (d) 4. (d) 5. (b) 6. (a) 7. (a) 8. (d) 9. (b) 10. (c)
11. (c) 12. (a) 13. (b) 14. (c) 15. (a) 16. (c) 17. (a) 18. (c) 19. (d) 20. (d)
21. (a) 22. (a) 23. (a) 24. (c) 25. (c) 26. (b) 27. (d)

Explanations Highway Materials

11. (c)

The degree of packing of particles of single sizes aggregates depends on the shape and angularity of the aggregate. The higher the number, more angular is the aggregate. The range of angularity number for aggregates used in construction is 0 to 11.

12. (a)

The aggregate crushing value for good quality aggregate to be used in base course shall not exceed 45 percent and the value for surface course shall be less than 30 percent.

13. (b)

The Los angles abrasion value of good aggregate acceptable for cement concrete, bituminous concrete and either high quality pavement material should be less than 30 percent. Values upto 50 percent are allowed in base courses like water bound and bituminous macadam.

14. (c)

Coefficient of hardness

$$= 20 - \frac{\text{Loss in weight}}{3}$$

$$= 20 - \frac{18}{3} = 14$$

17. (a)

The cutback with the lowest viscosity is designated by numeral 0 such RC-0, MC-0 and SC-0. Increasing numerals designate progressively thicker or more viscous cutback. This number indicates a definite viscosity irrespective of the type of cutback.

18. (c)

Voids filled with bitumen, VFB(%) = 75-85

19. (d)

Rapid curing cutback are bitumens, fluxed or cutback with a petroleum distillate such as naphtha or gasoline.

23. (a)

$$K_1 a_1 = K_2 a_2$$

$$16 \times 30 = K \times 75$$

$$K = \frac{16 \times 30}{75} = 6.4 \text{ Kg/cm}^3$$

24. (c)

Unit weight of mix.

$$= \frac{100}{5 + \frac{95}{2.5}} \times 1000 = 2325.58 \text{ kg/m}^3$$