Max. Marks: 60   **Date: 24.09.2022**

ABHIMANYU BATCH
PHYSICS : DCT
Topics: Ray Optics and Wave Motion

1. The refractive index of a prism for a monochromatic wave is $\sqrt{2}$ and its refracting angle is 60°. For minimum deviation, the angle of incidence will be

   (a)   30°   (b)   45°   (c)   60°   (d)   75°

2. The angle of minimum deviation for a prism is 40° and the angle of the prism is 60°. The angle of incidence in this position will be

   (a)   30°   (b)   60°   (c)   50°   (d)   100°

3. The angle of minimum deviation measured with a prism is 30° and the angle of prism is 60°. The refractive index of prism material is

   (a) $\sqrt{2}$ (b)   2   (c)   3/2   (d)   4/3

4. A ray of light passes through an equilateral glass prism in such a manner that the angle of incidence is equal to the angle of emergence and each of these angles is equal to 3/4 of the angle of the prism. The angle of deviation is

   (a)   45°   (b)   39°   (c)   20°   (d)   30°

5. When light of wavelength λ is incident on an equilateral prism kept in its minimum deviation position, it is found that the angle of deviation equals the angle of the prism itself. The refractive index of the material of the prism for the wavelength λ is, then

   (a) $\sqrt{3}$ (b) $\dfrac{\sqrt{3}}{2}$ (c)   2   (d) $\sqrt{2}$

6. A ray incident at 15° on one refracting surface of a prism of angle 60°, suffers a deviation of 55°. What is the angle of emergence

   (a)   95°   (b)   45°   (c)   30°   (d)   None of these


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7. A ray of light is incident at $60°$ on one face of a prism of angle $30°$ and the emergent ray makes $30°$ with the incident ray. The refractive index of the prism is

   (a)   1.732   (b)   1.414   (c)   1.5   (d)   1.33

8. A prism of refractive index n and angle A is placed in the minimum deviation position. If the angle of minimum deviation is A, then the value of A in terms of n is

   (a) $\sin^{-1}\left(\dfrac{n}{2}\right)$ (b) $\sin^{-1}\sqrt{\dfrac{n-1}{2}}$ (c) $2\cos^{-1}\left(\dfrac{n}{2}\right)$ (d) $\cos^{-1}\left(\dfrac{n}{2}\right)$

9. A ray of light incident at an angle θ on a refracting face of a prism emerges from the other face normally. If the angle of the prism is $5°$ and the prism is made of a material of refractive index 1.5, the angle of incidence is

   (a) $7.5°$ (b) $5°$ (c) $15°$ (d) $2.5°$

10. A glass prism has a right – triangular cross section ABC with $\angle A = 90°$. A ray of light parallel to the hypotenuse BC and incident on the side AB emerges grazing the side AC. Another ray again parallel to the hypotenuse BC, incident on the side AC suffers total internal reflection at the side AB. Which one of the following must be true about the refractive index μ of the material of the prism.

    (a) $\sqrt{\dfrac{3}{2}} < \mu < \sqrt{2}$ (b) $\mu < \sqrt{3}$ (c) $\mu < \sqrt{\dfrac{3}{2}}$ (d) $\sqrt{2} < \mu < \sqrt{3}$

11. You are given four sources of light each one providing a light of a single colour – red, blue, green and yellow. Suppose the angle of refraction for a beam of yellow light corresponding to a particular angle of incidence at the interface of two media is $90°$. Which of the following statements is correct if the source of yellow light is replaced with that of other lights without changing the angle of incidence

    (a)   The beam of red light would undergo total internal reflection

    (b)   The beam of red light would bend towards normal while it gets refracted through the second medium

    (c)   The beam of blue light would undergo total internal reflection

   (d)   The beam of green light would bend away from the normal as it gets refracted through the second medium


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12. White light is incident on face AB of a glass prism. The path of the green component is shown in the figure. If the green light is just totally internally reflected at face AC as shown, the light emerging from face AC will contain
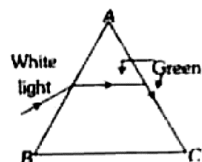
(a)   Yellow, orange and red colours   (b)   Violet, indigo and blue colours

(c)   All colours   (d)   All colours except green

13. A ray of light incident normally on an isosceles right angled prism travels as shown in the figure. The least value of the refractive index of the prism must be
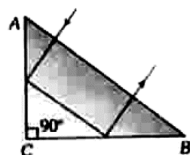
(a) $\sqrt{2}$ (b) $\sqrt{3}$ (c)   1.5   (d)   2.0

14. In the figure, an air lens of radii of curvature 10 cm ($R_1 = R_2 = 10$ cm) is cut in a cylinder of glass ($\mu = 1.5$). The focal length and the nature of the lens is
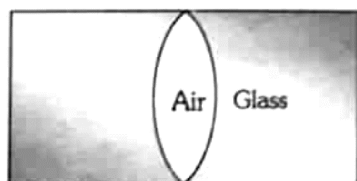
(a)   –15 cm, concave   (b)   15 cm, convex

(c) ∞, neither concave nor convex   (d)   0, concave

15. A thin equiconvex lens is made of glass of refractive index 1.5 and its focal length is 0.2 m, if it acts as a concave lens of 0.5 m focal length when dipped in a liquid, the refractive index of the liquid is

(a)   17/8   (b)   15/8   (c)   13/8   (d)   9/8

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ABHIMANYU BATCH
CHEMISTRY: DCT TEST
Topic: Nitrogen Compound

16.　　Aniline on treatment with excess of bromine water gives
　　(a)　　Aniline bromide　　　　　　　　　　(b)　　o-bromoaniline
　　(c)　　p-bromoaniline　　　　　　　　　　(d)　　2,4,6-tribromoaniline

17.　　The reaction,　$RNH_2 + CHCl_3 + 3KOH \rightarrow RNC + 3KCl + 3H_2O$ is called
　　(a)　　Curtius reaction　　　　　　　　　　(b)　　Hofmann-bromamide reaction
　　(c)　　Cope reaction　　　　　　　　　　(d)　　Carbylamine reaction

18.　　The following compound can be classified as N, N-dimethyl propanamine, N-methyl Ethanamine and aniline
　　(a)　　Primary, secondary, tertiary　　　　　(b)　　Primary, tertiary, secondary
　　(c)　　Tertiary, secondary, primary　　　　　(d)　　Tertiary, primary, secondary

19.　　Urea
　　(a)　　Is an amide of carbonic acid　　　　　(b)　　It is diamide of carbonic acid
　　(c)　　Gives carbonic acid on hydrolysis　　　(d)　　Resembles carbonic acid

20.　　Which of the following compound will not undergo azo coupling reaction with benzene diazonium chloride
　　(a)　　Aniline　　　　(b)　　Phenol　　　　(c)　　Anisole　　　　(d)　　Nitrobenzene

21.　　Which of the following compounds gives carbylamine test?
　　(a)　　N-methyl-o-methyl aniline　　　　　(b)　　N, N-dimethyl aniline
　　(c)　　2 4-diethyl aniline　　　　　　　　(d)　　p-methyl-N-methyl benzylamine

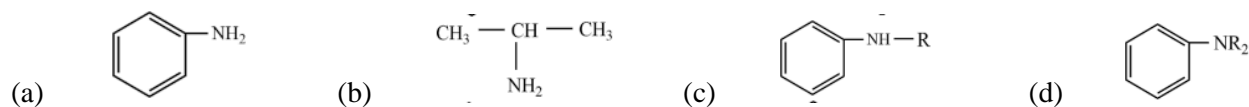22.　　The major product (B) of the following reaction is
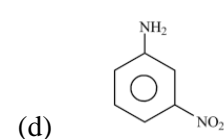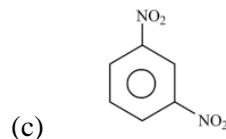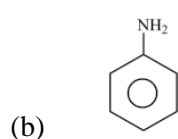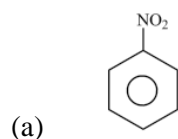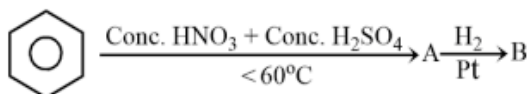
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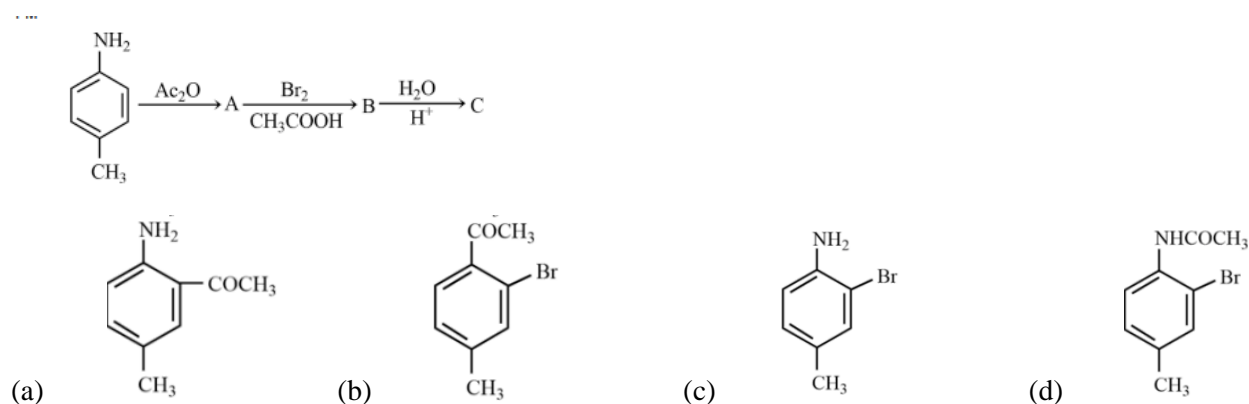23. The correct order of basic strength of the following are

I — $NHCOCH_3$

II — $C(=O)NHCH_3$

III — $C(=O)-CH_2NH_2$

IV — NH_2, $COCH_3$
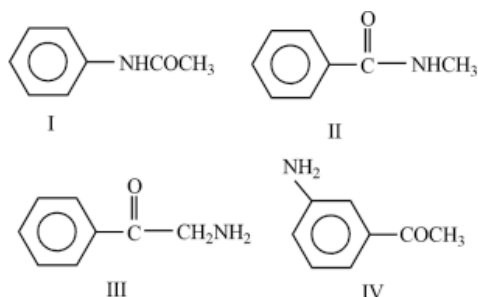
(a)   I > II > IV > III   (b)   IV > III > II > I   (c)   II > III > IV > I   (d)   III > IV > II > I

24. Which of the following amines can give N-nitrosoamine on treatment with HNO_2?

(a) $-NH_2$ (b) $CH_3-CH-CH_3$, NH_2 (c) $-NH-R$ (d) $-NR_2$

25. The final product C, obtained in this reaction would be

$\xrightarrow[CH_3COOH]{Ac_2O} A \xrightarrow{Br_2} B \xrightarrow[H^+]{H_2O} C$

(a) NH_2, $COCH_3$, CH_3 (b) $COCH_3$, Br, CH_3 (c) NH_2, Br, CH_3 (d) $NHCOCH_3$, Br, CH_3

26. Which of the following is most basic in nature?

(a) NH_3 (b) CH_3NH_2 (c) $(CH_3)_2NH$ (d) $C_6H_5N(CH_3)_2$

27. Reaction of acetamide with bromine water and KOH gives

(a) CH_3COOH (b) $CH_3CH_2NH_2$ (c) CH_3COONH_4 (d) CH_3NH_2

Space for Rough Work

28. When aniline reacts with $NaNO_2$ and dil. HCl at 0°–5°C, the product formed is

    (a)   Nitroaniline   (b)   Trinitroaniline

    (c)   Benzene   (d)   Benzene diazonium chloride

29. Which of the following amines can be prepared by Gabriel phthalimide reaction ?

    (a)   n- butylamine   (b)   Aniline   (c)   t-butylamine   (d)   triethylamine

30. Identify the incorrect test to distinguish between the following amines

    (a)   Methylamine and dimethylamine: $C_6H_5SO_2Cl$ followed by KOH

    (b)   Aniline and Benzylamine: $CHCl_3$ + KOH

    (c)   N,N dimethyl Methanamine and N-methyl Methanamine : $NaNO_2$+ HCl

    (d)   Ethyl amine and Acetamide : $CHCl_3$ + KOH

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ABHIMANYU BATCH
PHYSICS : DCT ANSWER KEY
Topics: Ray Optics and Wave Motion

1.	(b)	2.	(c)	3.	(a)	4.	(d)	5.	(a)
6.	(d)	7.	(a)	8.	(c)	9.	(a)	10.	(a)
11.	(c)	12.	(a)	13.	(a)	14.	(a)	15.	(b)

ABHIMANYU BATCH
CHEMISTRY: DCT ANSWER KEY
Topic: Nitrogen Compound

16.	(d)	17.	(d)	18.	(c)	19.	(b)	20.	(d)
21.	(c)	22.	(b)	23.	(d)	24.	(c)	25.	(c)
26.	(c)	27.	(d)	28.	(d)	29.	(a)	30.	(b)