FIITJEE INTERNAL TEST

RANK BOOSTER TEST SERIES – VIII

Batches: AII1719 (R & W)

IIT- JEE 2019

QP CODE: 119988

Time: ***3 hours*** **Maximum Marks: 282**

- ***Please read the instructions carefully. You are allotted 5 minutes specially for this purpose.***
- ***You are not allowed to leave the examination hall before end of the test.***
- ***Use Blue/Black Ball Point Pen only*** *for writing particulars on* ***Side–1 and Side–2*** *of the Answer Sheet.* ***Use to Pencil is strictly prohibited.***

Instructions

Note:

1. The question paper contains 3 sections (Sec-1, Chemistry, Sec-II, Physics & Sec-III, Mathematics.)
2. Each section is divided into two parts, **PART-A and PART-C**.
3. **PART – A** contains 20 questions which are further divided as follows:

- **Q. 1 – 10** are multiple choice questions. Each question has four choices (A), (B), (C) and (D), out of which **only one is correct**.
- **Q. 11 – 20** are multiple correct answer type questions. Each question has four choices (A), (B), (C) and (D), out of which **one or more answer(s) is/are correct**.

4. **PART–C** contains 6 Numerical Based questions with Single Digit Integer as answer, ranging from 0 to 9.

Marking Scheme

1. For each question in the group **Q. 1 – 10** to **PART – A** you will be awarded **3 marks** if you have darkened only the bubble corresponding to the answer and zero marks if no bubble is darkened. In all other cases, **minus two (–2) mark will be awarded.**
2. For each question in the group **Q. 11 – 20** to **Part – A**, contains 8 Multiple Choice Questions which have **One or More Correct** answer.

   For each question in the group **Q. 11 – 20** of **PART – A** you will be awarded
   Full Marks: **+4** If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
   Partial Marks: **+1** For darkening a bubble corresponding **to each correct option,** provided NO incorrect option is darkened.
   Zero Marks: **0** If none of the bubbles is darkened.
   Negative Marks: **–2** In all other cases.

   For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **–2** marks, as a wrong option is also darkened.

3. **PART-C (1 – 6)** contains 6 Numerical Based questions with Single Digit Integer as answer, ranging from 0 to 9 and each question carries **+4 marks** for correct answer and **–1 mark** for wrong answer.

Name of the Candidate **:** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Enrolment Number **:** ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Section – I (Chemistry)

PART – A

(Single Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which only **ONE** option is be correct.

1. A hydrogen electrode place in a buffer solution of sodium cyanide and HCN in the ratio of x:y and y:x has reduction electrode potential value a and b volts, respectively at 25°C. If the difference a – b = 35.52 mV. What is the ratio of y : x.

   (A) 1 : 1 (B) 2 : 1 (C) 1 : 2 (D) $\frac{0.3}{1}$

2. In a adsorption experiment, a graph between $\log\left(\frac{x}{m}\right)$ versus log P was found to be linear with slope of 45°. The intercept on $\log\left(\frac{x}{m}\right)$ axis was found to be 0.3010. Calculate the amount of the gas adsorbed per gram of charcoal under a pressure of 0.5 atm.

   (A) 1 (B) 2 (C) 3 (D) 1.5

3. Standard electrode potential of two half-reaction are given below:

   $Fe^{2+} \rightleftharpoons Fe \qquad E^o = -0.44V$

   $Fe^{3+} \rightleftharpoons Fe^{2+} \qquad E^o = +0.77V$

   If Fe^{2+}, Fe^{3+} and Fe are kept together:

   (A) the concentration of Fe^{3+} increases (B) the concentration of Fe^{3+} decreases
   (C) the mass of Fe increases (D) the concentration of Fe^{2+} decreases

4. The standard electrode potential of a metal-metal ion ($Ag|Ag^+$) and metal-sparingly soluble salt anion ($Ag|AgCl|Cl^-$) are related as:

   (A) $E^o_{Ag^+|Ag} = E^o_{Cl^-|AgCl|Ag} + \frac{RT}{F} \ln K_{sp}$ (B) $E^o_{Cl^-|AgCl|Ag} = E^o_{Ag^+|Ag} + \frac{RT}{F} \ln K_{sp}$

   (C) $E^o_{Cl^-|AgCl|Ag} = E^o_{Ag^+|Ag} - \frac{RT}{F} \ln \frac{[Cl^-]}{K_{sp}}$ (D) $E^o_{Cl^-|AgCl|Ag} = E^o_{Ag^+|Ag} - \frac{RT}{F} \ln \frac{K_{sp}}{[Cl^-]}$

5. Which of the following is amphoteric oxide?

   Mn_2O_7, CrO_3, Cr_2O_3, CrO, V_2O_5, V_2O_4

   (A) V_2O_5, Cr_2O_3 (B) Mn_2O_7, CrO_3 (C) CrO, V_2O_5 (D) V_2O_5, V_2O_4

6. Choose the correct order for Δ_0 for the following complexes

   (I) $[Co(H_2O)_6]^{+2}$ (II) $[Co(H_2O)_6]^{+3}$ (III) $[Fe(H_2O)_6]^{+3}$ (IV) $[Fe(CN)_6]^{-3}$

   (A) I < II < III < IV (B) I < III < II < IV (C) I < II ≡ III < IV (D) I < II < IV < III

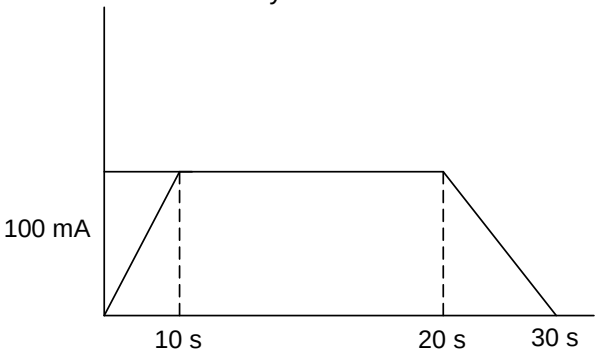
7. The correct order of C – C bond length in the following compound is_____

   (I) C_2F_4 (II) C_2H_4 (III) $K[PtCl_3(C_2H_4)]$

   (A) I > II > III (B) I < II < III (C) I > III > II (D) I > II ≡ III

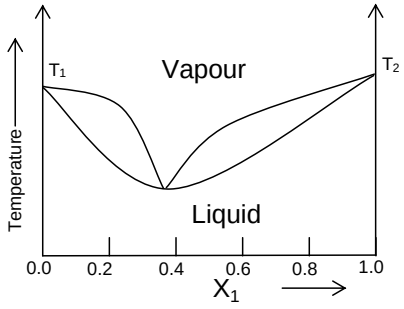
space for rough work

8. In a Cu voltameter mass deposited in 30 sec. is 100 gms. Carefully analyze the current time graph shown below identically the incorrect statement:

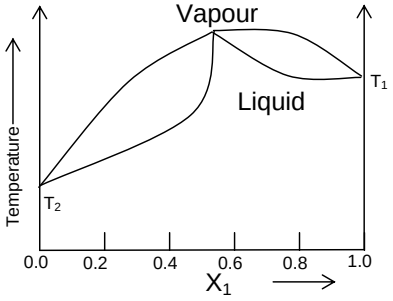


(A) electrochemical equivalent for Cu is 50
(B) a constant current of 66.66 mA would also discharge the same amount in same time.
(C) 33.33 grams got discharge in 10 secs
(D) 50 gms got discharged in 15 secs

9. The following two graphs are plotted between the temperature and mole fraction of the components of two different azeotropic mixture. (X_1 = mole fraction of solvent).



Graph – A



Graph – B

Choose the correct options
(A) Graph A represents minimum boiling and maximum vapour pressure
(B) Graph B represents maximum boiling and maximum vapour pressure
(C) Graph A represents maximum boiling and minimum vapour pressure
(D) Graph B represents minimum boiling and maximum vapour pressure

10. Which of the following can decrease the freezing point of water by maximum extent?
(A) $[Cr(NH_3)_3Cl_3]$ (B) $[Cr(NH_3)_4Cl_2]Cl$ (C) $[Cr(NH_3)_5Cl]Cl_2$ (D) $[Cr(NH_3)_6]Cl_3$

space for rough work

(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

11. Δ_M^∞ and $\Delta_{eq.}^\infty$ are molar and equivalent conductivities at infinite dilution; λ is ionic conductivity at infinite dilution, then for potash alum:

(A) Δ_M^∞(potash alum) = $2\times\lambda_{K^+}^\infty + 2\times\lambda_{Al^{3+}}^\infty + 4\times\lambda_{SO_4^{2-}}^\infty$

(B) $\Delta_{eq.}^\infty$ (potash alum) = $\frac{1}{8}\times\Delta_M^\infty$(potash alum)

(C) $\Delta_{eq.}^\infty$ (potash alum) = $\frac{1}{4}\times\lambda_{K^+}^\infty + \frac{1}{4}\times\lambda_{Al^{3+}}^\infty + \frac{1}{2}\times\lambda_{SO_4^{2-}}^\infty$

(D) Δ_M^∞(potash alum) = $\lambda_{K^+}^\infty + \lambda_{Al^{3+}}^\infty + \lambda_{SO_4^{2-}}^\infty$

12. Which statement is correct about electrolysis of $CuSO_4$?
(A) At cathode Cu will deposit and at anode O_2 will be produced using Pt-electrode.
(B) At cathode Cu will not deposit but Cu dissolve at anode using Cu-electrode.
(C) At cathode Cu will deposit and at anode O_2 will be produced using Cu-electrode.
(D) At cathode Cu will deposit and at anode Cu will dissolve using Cu-electrode.

13. For the reduction of NO_3^- ion in an aqueous solution, E^o is + 0.96 V. Values of E^o for some metal ions are given below

$V^{2+}(aq) + 2e^- \longrightarrow V \qquad E^o = -1.19V$

$Fe^{3+}(aq) + 3e^- \longrightarrow Fe \qquad E^o = -0.04V$

$Au^{3+}(aq) + 3e^- \longrightarrow Au \qquad E^o = +1.40V$

$Hg^{2+}(aq) + 2e^- \longrightarrow Hg \qquad E^o = +0.86V$

The pair(s) of metals that is/are oxidized by NO_3^- in aqueous solution is/are

(A) V and Hg (B) Hg and Fe (C) Fe and Au (D) Fe and V

14. In a binary and ideal liquid mixture.
(A) Partial pressure of each component various directly with it's respective mole fraction in the solution.

(B) $H_{solution} = H_A + H_B$

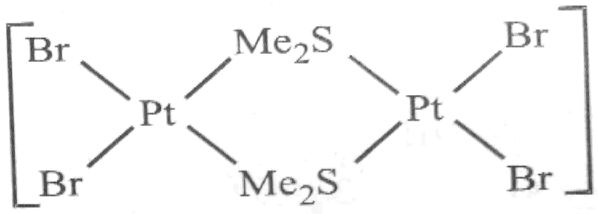
(C) $H_{solution} = G_A + G_B$

(D) $S_{solution} = S_A + S_B$

15. The electrode potential of an electrochemical cell can be increased by
(A) adding water in the anode compartment (B) removing water from cathode compartment
(C) increasing temperature (D) increasing the value of reaction quotient

space for rough work

16. Select the correct IUPAC name for the following complex



(A) Di bromidoplatinum(II) bis-μ-(dimethylthioether) dibromidoplatimum(II)
(B) Bis {μ(dimethylthioether)dibromidoplantium(II)}
(C) Bis-μ-dimethylthioethertetrabromidodiplantium(II)
(D) Bis-μ-dimethylthioethertetrabromidodiplantinate(II)

17. A d-block element forms octahedral complex, but its spin magnetic moment remains same either in strong field or in weak field ligand. Which of the following is/are correct?
(A) Element always form colorless compounds
(B) Number of electrons in t_{2g} orbitals are higher than in e_g orbital
(C) It can have either d^3 and d^8 configuration
(D) It can have either d^7 and d^8 configuration

18. For a cell reaction represented by the equation $Cu(s) + 2Ag^+(aq) \longrightarrow Cu^{2+}(aq) + 2Ag(s)$. The value of ΔG^o could be obtained by
(A) setting up Cu(s)/Cu^{2+}(aq) and Ag(s)/Ag^+(aq) half-cells (using molar solution and measuring the emf of the resulting cell)
(B) adding powdered copper to a solution of Ag^+ ions and determining the enthalpy change, repeating this experiment at different temperatures
(C) setting up Cu(s)/Cu^{2+}(aq) and Ag(s)/Ag^+(aq) half-cells and determining the molarities of the ions which gives an emf of zero for the cell
(D) setting up Cu(s)/Cu^{2+}(aq) and Ag(s)/Ag^+(aq) half-cells, using the resultant emf to drive a motor and measuring the work which it can do

19. Which of the following statements is/are true about an azeotropic mixture?
(A) An azeotropic mixture boils at consatant temperature
(B) The composition of an azeotropic mixture changes on distillation
(C) An azeotropic solution of two liquids has a boiling point lower than that of either of them when it shows positive deviation from the Raoult's law
(D) An azeotropic solution of two liquids has a boiling point higher than that of either of them if it shows positive deviation from Raoult's law

20. Which of the following statement (s) is(are) correct with reference to the ferrous and ferric ions?
(A) Fe^{3+} gives brown colour with potassium ferricyanide
(B) Fe^{2+} gives blue precipitate with potassium ferricyanide
(C) Fe^{3+} give red colour with potassium thiocyanate
(D) Fe^{2+} give brown colour with ammonium thiocyanate

space for rough work

PART – C

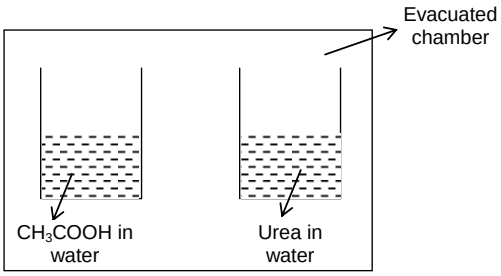
This section contains 06 **multiple choice questions**. The answer to each question is a single digit integer, ranging from 0 to 9 (both inclusive)

1. The radiator of a car contains 50.5 g water. If 6.2 g of glycol ($HOCH_2CH_2OH$) is added to it, the solution freezes at –4°C. How many gram of ice will be separated in the process?
   [K_f = 1.86 K kg mol^{-1}]

2. 25g urea (NH_2CONH_2) and 25g thiourea (NH_2CSNH_2) were mixed with 500g of chloroform. If the boiling point of the solution is $(11 \times y)^oC$, what is the value of y?
   [Boiling point of pure chloroform = 60.58°C and K_b of chloroform is 3.63 $K.m^{-1}$]

3. The coagulation of 100 mL of a colloidal sol of gold is completely prevented by addition of 0.03 g of Haemoglobin to it before adding 1 mL of 10% NaCl solution. Calculate the gold number of Haemoglobin.

4. Two aqueous solutions as shown, are put in an evacuated chamber. When equilibrium is attained, it is found that one solution contains 0.01% of CH_3COOH and other 0.014% of urea be weight. It degree of dissociation is 'α' then what is the value of 10α.



5. Number of pair of enantiomer of $[Ma_2b_2cd]$ is _____.

6. Find the number of ligand(s) which is/are not-classical ligand
   CO, NO, C_2H_4, $C_3H_5^-$, H^-

space for rough work

Section – II (Physics)

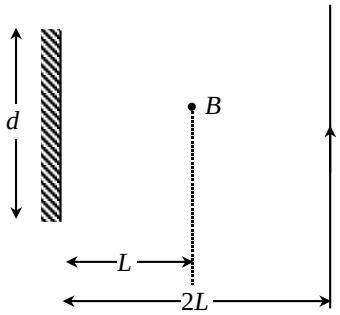
PART – A

(Single Correct Choice Type)

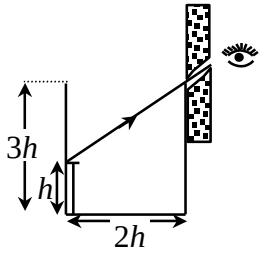
This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which only **ONE** option is be correct.

1. A monochromatic beam of light passes form a denser medium to a rarer medium. As a result:
(A) its speed increases. (B) its speed decreases.
(C) its frequency decreases. (D) its wavelength decreases.

2. A point source of light B is placed at a distance L in front of the centre of a mirror of width d hung vertically on a wall. A man walks in front of the mirror at a distance 2L from its as shown. The greatest distance over which he can see the image of the light source in the mirror is
(A) d/2 (B) d
(C) 2d (D) 3d



3. An observer can see through a pinhole the top end of a thin rod of height h, placed as shown in the figure. The beaker height is 3h and its radius h. When the beaker is filled with a liquid upto a height 2h, he can see the lower end of the rod. Then the refractive index of the liquid is
(A) 5/2 (B) $\sqrt{5/2}$
(C) $\sqrt{3/2}$ (D) 3/2



4. If an object is placed unsymmetrically between two plane mirrors inclined at an angle of 72°, then the total number of images formed is
(A) 5 (B) 4 (C) 2 (D) infinite

5. A ray of light falls normally on a refracting face of a prism of refractive index 1.5. If the ray just fails to emerge from the prism. Then the angle of prism is
(A) $\sin^{-1}\left(\frac{2}{3}\right)$ (B) $\cos^{-1}\left(\frac{2}{3}\right)$ (C) $\sin^{-1}\left(\frac{1}{2}\right)$ (D) $\sin^{-1}\left(\frac{1}{3}\right)$

6. On introducing a thin sheet of mica (thickness 12×10^{-5} cm) in path of one of the interfering beams in Young's double slit experiment, the central fringe is shifted through a distance equal to the spacing between successive bright fringes. The refractive index of mica is (wavelength of light used $\lambda = 6 \times 10^{-5}$ cm)
(A) 1.33 (B) 1.5 (C) 2.5 (D) 1.478

space for rough work

7. In a Young's experiment, two coherent sources are placed 0.90 mm apart and the fringes are observed one meter away. If it produces the second dark fringe at a distance of 1 mm from the central fringe, the wavelength of monochromatic light used would be
(A) 60×10^{-4} cm (B) 10×10^{-4} cm (C) 10×10^{-5} cm (D) 6×10^{-5} cm

8. In a Young's double slit experiment, the fringe width is found to be 0.4 mm. If the whole apparatus is immersed in water of refractive index (4/3), without disturbing the geometrical arrangement, the new fringe width will be
(A) 0.30 mm (B) 0.40 mm (C) 0.53 mm (D) 450 microns

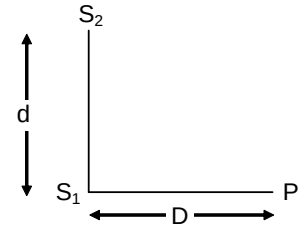
9. The maximum intensity in Young's double slit experiment is I_0. Distance between the slits is $d = 5\lambda$, where λ is the wavelength of monochromatic light used in the experiment. What will be the intensity of light in front of one of the slits on a screen at a distance $D = 10d$?
(A) $\frac{I_0}{2}$ (B) $\frac{3I_0}{4}$ (C) I_0 (D) $\frac{I_0}{4}$

10. In a double slit experiment, instead of taking slits of equal widths, one slit is made twice as wide as the other. Then in the interference pattern
(A) the intensities of both the maxima and minima increase
(B) the intensity of the maxima increases and the minima has zero intensity
(C) the intensity of the maxima decreases and that of minima increases
(D) the intensity of the maxima decreases and the minima has zero intensity

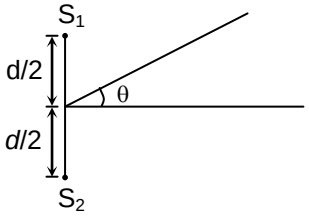
(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

11. Two coherent sources S_1 and S_2 are emitting light of wavelength 5000 Å are placed at 0.1 mm apart, as shown in the figure. A detector is moved along a line perpendicular to S_1S_2 and passing through S_1. Then choose the correct option(s)
(A) The position of farthest maxima from S_1 is approximately at a distance of 1 cm.
(B) The total number of maxima be 399.
(C) The total number of minima be 398.
(D) The total number of minima be 399.



12. In an interference arrangement, similar to Young's double slit experiment, the slits S_1 and S_2 are illuminated with coherent microwave sources, each of frequency 10^6 Hz. The sources are synchronized to have zero phase difference. The slits are separated by distance d = 150.0 m. The intensity $I_{(\theta)}$ is measured as a function of θ, where θ is defined as shown in the figure. If I_0 is maximum intensity, then $I_{(\theta)}$ for $0 \le \theta \le 90$ is given by

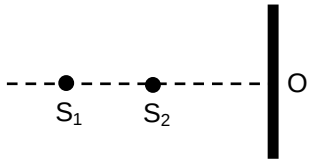


(A) $I_{(\theta)} = I_0$ for $\theta = 0°$ (B) $I_{(\theta)} = (I_0 / 2)$ for $\theta = 30°$
(C) $I_{(\theta)} = (I_0 / 4)$ for $\theta = 90°$ (D) $I_{(\theta)}$ is constant for all values of θ

space for rough work

13. A thin film of thickness *t* and index of refraction 1.33 coats a glass with index of refraction 1.50. Which of the following thickness *t* will not reflect normally incident light (from air to film) with wavelength 640 nm in air?
(A) 120 nm (B) 240 nm (C) 360 nm (D) 600 nm

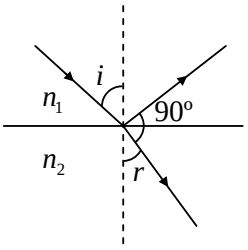
14. Two monochromatic and coherent point sources of light of wavelength λ are placed on the dotted line in front of an finite screen. The source emit waves in phase with each other. The distance between S_1 and S_2 is *d* while their distance from the screen is much larger. Then



(A) If $d = 7\lambda/2$, *O* will be a minima
(B) If $d = 4.3\ \lambda$, there will be a total of 8 minima on screen
(C) If $d = 7\ \lambda$, *O* will be a maxima
(D) If $d = \lambda$, there will be only one maxima on the screen

15. The distance between a screen and an object is 120 cm. A convex lens is placed closed to the object and is moved along the line joining object and screen, towards the screen. Two sharp images of the object are found on the screen. The ratio of magnification of two real images is 1 : 9. Then,
(A) focal length of the lens is 22.5 cm. (B) smaller image is brighter than the larger one.
(C) larger image is brighter than the smaller one (D) brightness of both the images is same.

16. Light incident on a surface separating two media is partly reflected and partly refracted as shown in the figure [θ_c is critical angle and $n_1 < n_2$], then

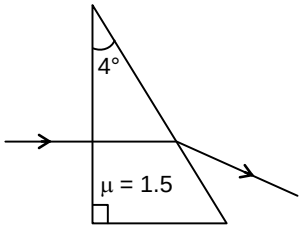


(A) $\sin i = \dfrac{n_2}{(n_1^2 + n_2^2)^{1/2}}$ (B) $\tan i = \dfrac{n_1}{n_2}$
(C) $\sin\theta_c = \cot i$ (D) $\sin\theta_c = \sec i$

17. Mark the correct option(s).
(A) If the incident rays are converging then the object may be real.
(B) If the incident rays are converging then the object may be virtual.
(C) If the incident rays are diverging then the object may be real.
(D) If the incident rays are diverging then the objet may be virtual.

18. The parallel rays at different colours fail to converse at a point after going through a converging lens, then choose the correct options(s).
(A) This defect is called chromatic aberration.
(B) The refractive indices of the lens with respect to its surrounding are different for different colour of light.
(C) the focal length of the lens for different colour of light are different.
(D) none of these

19. As situation shown in figure. Then choose the correct option(s)
(A) The angle of deviation suffered by the length ray is 2° (nearly).
(B) The ray in side the prism is parallel to the base of the prism.
(C) It is the case of minimum deviation.
(D) None of these.



20. Laws of reflection are valid for
(A) plane surface (B) curved surface (C) zigzag surface (D) none of these

space for rough work

PART – C

This section contains 06 **multiple choice questions**. The answer to each question is a single digit integer, ranging from 0 to 9 (both inclusive)

1. In YDSE experiment if the screen is shifted by a distance of 0.5 m away from the slit, 3rd maxima is shifted by 3×10^{-4} m. If the slit width is 2×10^{-3}m, if the wavelength used in the experiment is 100 n mm then find the value of 'n'.

2. The sun (diameter d) subtends an angle θ radians at the pole of a concave mirror of focal length f. If the diameter of the image of the sun formed by the mirror is θ^n f then find the value of 'n'.

3. In a Young's double-slit experiment, the slits are 2 mm apart and are illuminated with a mixture of two wavelengths λ = 750 nm and λ' = 900 nm. At what minimum distance (in mm) from the common central bright fringe on a screen 4m from the slits will a bright fringe from one interference pattern coincide with a bright fringe from the other?

4. A man of height 'h' is walking away from a street lamp with a constant speed 'v'. The height of the street lamp is 3h. The rate at which the length of the man's shadow is increasing when he is at a distance 10h from the base of the street lamp is $\frac{v}{n}$ then find the value of 'n'.

5. A concave mirror of focal length 10 cm and a convex mirror of focal length 15 cm are placed facing each other 40 cm apart. A point object is placed between the mirrors, on their common axis and 15 cm from the concave mirror. Find the distance (in cm) between image and convex mirror. If the image produced by the successive reflections, first at concave mirror and then at convex mirror.

6. The intensity of the light coming from one of the slits in a Young's double slit experiment is four times the intensity from the other slit. Find the ratio of the maximum intensity to the minimum intensity in the interference fringe pattern observed.

space for rough work

Section – III (Mathematics)

PART – A

(Single Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which only **ONE** option is be correct.

1. The area enclosed by the curve $[x+3y]=[x-2]$ where $x\in[3,4)$ is:
(where [.] denotes greatest integer function).
(A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) $\frac{1}{4}$ (D) 1

2. $\int_{-1/2}^{1/2}\left(\sin^{-1}\left(3x-4x^3\right)+\cos^{-1}\left(4x^3-3x\right)\right)dx$
(A) $\frac{\pi}{2}$ (B) $\frac{-\pi}{2}$ (C) $-\pi$ (D) π

3. Let f be one to one continuous function such that $f(2)=3,\ f(5)=7, \int_2^5 f(x)=17$ then $\int_3^7 f^{-1}(x)dx=$
(A) 17 (B) 12 (C) 29 (D) 35

4. $\lim\limits_{n\to\infty} n\int_0^{\pi/2}\left(1-\sqrt[n]{\sin x}\right)dx=$
(A) $\pi\ell n2$ (B) $\frac{\pi}{2}\ell n2$ (C) $\frac{-\pi}{2}\ell n2$ (D) $-\pi\ell n2$

5. The value of $\int_0^1\prod_{r=1}^{n}(x+r)\left(\sum_{k=1}^{n}\frac{1}{x+k}\right)dx=$
(A) $\underline{|n+1}$ (B) $n\underline{|n+1}$ (C) $n\underline{|n}$ (D) $\underline{|n}$

6. Area enclosed by the figure described by the equation $x^4+1=2x^2+y^2$, is:
(A) 2 (B) $\frac{16}{3}$ (C) $\frac{8}{3}$ (D) $\frac{4}{3}$

7. Let $f(x)$ be a differentiable function such that $f(x)=x^2+\int_0^x e^{-t}f(x-t)dt$, then $\int_0^1 f(x)dx=$
(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) $\frac{7}{12}$ (D) $\frac{5}{12}$

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8. If $f(\theta)=\frac{4}{3}\left(1-\cos^6\theta-\sin^6\theta\right)$, then $\lim_{n\to\infty}\frac{1}{n}\left[\sqrt{f\left(\frac{1}{n}\right)}+\sqrt{f\left(\frac{2}{n}\right)}+\sqrt{f\left(\frac{3}{n}\right)}+.....+\sqrt{f\left(\frac{n}{n}\right)}\right]=$

(A) $\frac{1-\cos1}{2}$ (B) $1-\cos2$ (C) $\frac{\sin2}{2}$ (D) $\frac{1-\cos2}{2}$

9. $\int\left(\frac{\cos6x+6\cos4x+15\cos2x+10}{10\cos^2x+5\cos x\cos3x+\cos x\cos5x}\right)dx=f(x)+C$, then $f(10)$ is equal to:

(A) 20 (B) 10 (C) $2\sin10$ (D) $2\cos10$

10. The value of definite integral $\int_0^\infty\frac{dx}{(1+x^9)(1+x^2)}$ equals to:

(A) $\frac{\pi}{16}$ (B) $\frac{\pi}{8}$ (C) $\frac{\pi}{4}$ (D) $\frac{\pi}{2}$

(Multiple Correct Choice Type)

This section contains 10 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

11. If $I_n=\int(\sin x)^n dx;n\in N$, then $5I_4-6I_6$ is equal to:

(A) $\sin x.(\cos x)^5+C$ (B) $\sin2x\cos2x+C$

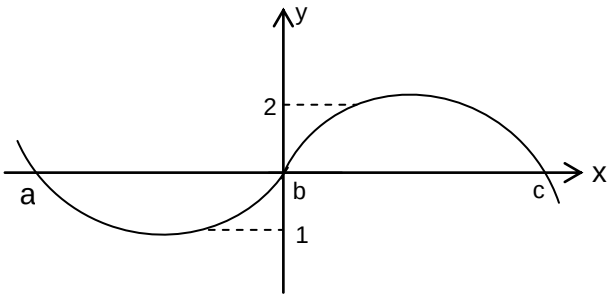
(C) $\frac{\sin2x}{8}\left[1+\cos^2 2x-2\cos2x\right]+C$ (D) $\frac{\sin2x}{8}\left[1+\cos^2 2x+2\cos2x\right]+C$

12. Let $f(x)$ is differentiable function such that $f(x)=\int_0^x e^t\sin(x-t)dt$ and $g(x)=f''(x)-f(x)$ then

(A) $g(x)=\sqrt{2}\sin\left(x+\frac{\pi}{4}\right)$ (B) $g(x)=\left|\sqrt{2}\sin\left(x+\frac{\pi}{4}\right)\right|$

(C) Range of $g(x)=\left[-\sqrt{2},\sqrt{2}\right]$ (D) Range of $g(x)=\left[0,\sqrt{2}\right]$

13 Let $f(x)$ be a polynomial function of degree 3 where $a<b<c$ and $f(a)=f(b)=f(c)$. If the graph of $f(x)$ is as shown, which of the following statements are INCORRECT? (Where $c>|a|$)



(A) $\int_a^c f(x)dx=\int_b^c f(x)dx+\int_a^b f(x)dx$

(B) $\int_a^c f(x)dx<0$

(C) $\int_a^b f(x)dx<\int_c^b f(x)dx$

(D) $\frac{1}{b-a}\int_a^b f(x)dx>\frac{1}{c-b}\int_b^c f(x)dx$

space for rough work

14. If $\int_{-\alpha}^{\alpha}\left(e^x+\cos x \ln\left(x+\sqrt{1+x^2}\right)\right)dx > \frac{3}{2}$, then possible value of α can be:

(A) 1 (B) 2 (C) 3 (D) 4

15. The number of values of x satisfying the equation:

$$\int_{-1}^{x}\left(8t^2+\frac{28t}{3}+4\right)dt = \frac{\frac{3}{2}x+1}{\log_{(x+1)}\sqrt{x+1}},\ \text{is:}$$

(A) 0 (B) 1 (C) 2 (D) 3

16. Which of the following function(s) is/are even?

(A) $f(x)=\int_0^x \ln\left(t+\sqrt{1+t^2}\right)dt$ (B) $g(x)=\int_0^x \frac{\left(2^t+1\right)t}{2^t-1}dt$

(C) $h(x)=\int_0^x\left(\sqrt{1+t+t^2}-\sqrt{1-t+t^2}\right)dt$ (D) $I(x)=\int_0^x \ln\left(\frac{1-t}{1+t}\right)dt$

17. Let $J=\int_{-1}^{2}\left(\cot^{-1}\frac{1}{x}+\cot^{-1}x\right)dx; K=\int_{-2\pi}^{7\pi}\frac{\sin x}{|\sin x|}dx$. Then which of the following alternative (s) is/are correct?

(A) $2J+3K=8\pi$ (B) $4J^2+K^2=26\pi^2$ (C) $2J-K=3\pi$ (D) $\frac{J}{K}=\frac{2}{5}$

18. If $A_n=\int_0^{\pi/2}\frac{\sin(2n-1)}{\sin x}dx,\ B_n=\int_0^{\pi/2}\left(\frac{\sin nx}{\sin x}\right)^2 dx \forall n\in N$

(A) $A_{n+1}=A_n$ (B) $B_{n+1}=B_n$ (C) $A_{n+1}-A_n=B_{n+1}$ (D) $B_{n+l}-B_n=A_{n+1}$

19. Let $\int x\sin x.\sec^3 x\,dx=\frac{1}{2}\left(x.f(x)-g(x)\right)+k$, then:

(A) $f(x)\notin(-1,1)$ (B) $g(x)=\sin x$ has 6 solution for $x\in[-\pi, 2\pi]$

(C) $g'(x)=f(x), \forall x\in R$ (D) $f(x)=g(x)$ has no solution

20. $\int\frac{dx}{\left(1+\sqrt{x}\right)^8}=\frac{1}{3\left(1+\sqrt{x}\right)^{k_1}}+\frac{2}{7\left(1+\sqrt{x}\right)^{k_2}}+C$, then:

(A) $k_1=5$ (B) $k_1=6$ (C) $k_2=7$ (D) $k_2=8$

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PART – C

This section contains 06 **multiple choice questions**. The answer to each question is a single digit integer, ranging from 0 to 9 (both inclusive)

1. $\lim\limits_{n\to\infty}\left({}^{2n}C_n\right)^{\frac{1}{n}} =$

2. $\lim\limits_{x\to\infty}\dfrac{\left(\int_0^x e^{t^2}dt\right)^2}{\int_0^x e^{2t^2}dt} =$

3. $\int_0^6 x(x-1)(x-2)(x-3)(x-4)(x-6) =$

4. Let $\int\limits_0^1 \dfrac{4x^3\left(1+\left(x^4\right)^{2010}\right)}{\left(1+x^4\right)^{2012}}dx = \dfrac{\lambda}{\mu}$ where λ and μ are relatively prime positive integers. Find unit digit of μ.

5. Let $I_n = \int\limits_0^{\pi} \dfrac{\sin\left(n+\frac{1}{2}\right)x}{\sin\left(\frac{x}{2}\right)}dx$ where $n \in W$. If $I_1^2 + I_2^2 + I_3^2 + ... + I_{20}^2 = m\pi^2$, then find the largest prime factor of m.

6. Let $I_n = \int\limits_{-1}^{1} |x|\left(1 + x + \dfrac{x^2}{2} + \dfrac{x^3}{2} + ... + \dfrac{x^{2n}}{2n}\right)dx$. If $\lim\limits_{n\to\infty} I_n$ can be expressed as rational $\dfrac{p}{q}$ in its lowest form, then find the value of $\dfrac{pq(p+q)}{10}$.

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