PART 1 – PHYSICS

Section – I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
  Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0 If none of the bubbles is darkened.
  Negative Marks : –1 In all other cases

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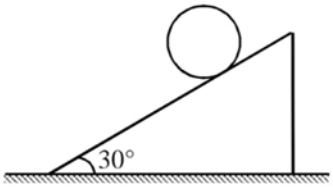
1. The electric field inside a sphere having charge density related to the distance from the centre as $\rho = \alpha r$ (α is a constant) is:

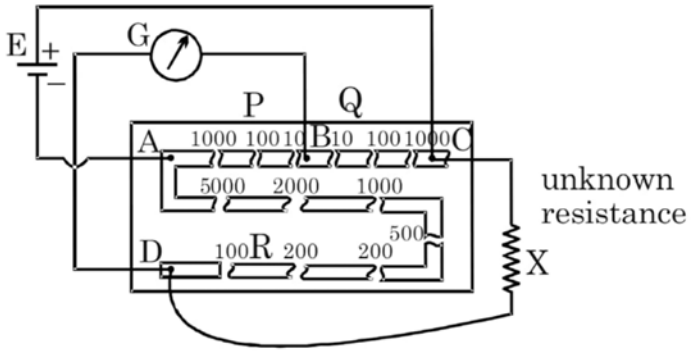
(a) $\frac{\alpha r^3}{4\in_0}$ (b) $\frac{\alpha r^2}{4\in_0}$ (c) $\frac{\alpha r^2}{3\in_0}$ (d) none of these

2. A uniform disc of mass 2kg and radius 50mm is released form rest on a smooth incline plane as shown. If the length of incline equals 160cm, the time taken by the disc to arrive at bottom equals



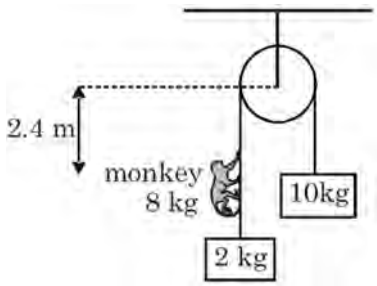
(a) 1 s (b) 0.8 s (c) 0.6 s (d) 0.5 s

3. In the figure shown below, the maximum and minimum possible unknown resistance (X), that can be measured by the post office box are X_{max} and X_{min} respectively. Then the ratio of these two resistances is: (In this experiment, we take out only one plug in arm AB and only one plug in arm BC, but in arm AD we can take any no. of plugs):



(a) 3×10^5 (b) 5×10^5 (c) 7×10^5 (d) 9×10^5

4. Two blocks of mass 10kg and 2ktg respectively are connected by an ideal string passing over a fixed smooth pulley as shown in figure. A monkey of 8kg started climbing the string with constant acceleration $2ms^{-2}$ with respect to string at t = 0. Initially the monkey is 2.4m from the pulley. Find the time taken by the monkey to reach the pulley.

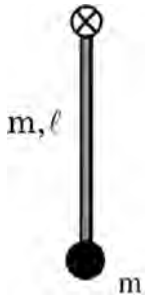


(a) 1 sec (b) 2 sec (c) 4 sec (d) 8 sec

5. Which of the following transitions of He^+ ion will give rise to spectral line which has same wavelength as some spectral line in hydrogen atom?

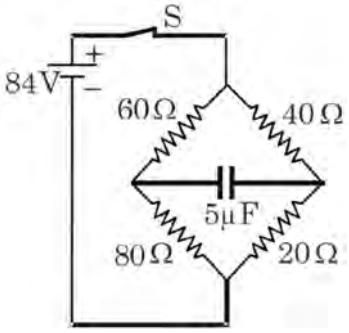
(a) n = 4 to n = 2 (b) n = 6 to n = 5 (c) n = 6 to n = 3 (d) None of these

6. A particle is attached to the lower end of a uniform rod which is hinged at its other end as shown in the figure. Another identical particle moving horizontally, collides inelastically and sticks to it. The minimum speed of moving particle so that the rod with particles performs circular motion in a vertical plane will be: [length of rod is ℓ, consider masses of both particles and rod to be same]



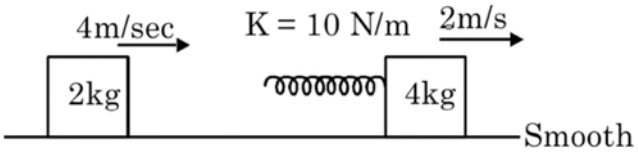
(a) $\sqrt{10g\ell}$ (b) $\sqrt{20g\ell}$ (c) $\sqrt{\frac{70}{3}g\ell}$ (d) $\sqrt{\frac{175}{3}g\ell}$

7. The circuit shown in the figure is in steady state for a long time. The connection to battery is suddenly broken (switch S is opened up). What is the charge (in μC) on the capacitor after 0.001 sec.?



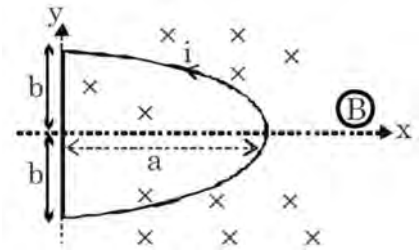
(a) 100 (b) 100 e^{-2} (c) 100 e^{-4} (d) 0

8. Figure shown two blocks A and B having mass 2kg and 4kg moving with a speed 4 m/sec and 2 m/sec respectively. The maximum compression in the spring and final velocity of 2kg block and respectively.



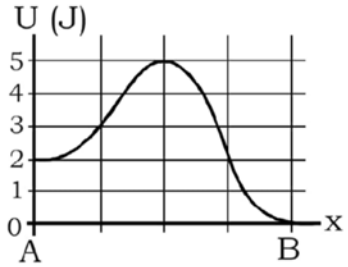
(a) $\sqrt{\frac{24}{45}}$m, 3 m/s (b) $\sqrt{\frac{24}{25}}$m, 3 m/s (c) $\sqrt{\frac{24}{45}}$m, 4/3 m/s (d) $\sqrt{\frac{24}{25}}$m, 8/3 m/s

9. In the figure, there is a conducting wire having current i and which has a shape of closed half ellipse $\left[\frac{x^2}{a^2}+\frac{y^2}{b^2}=1\right]$ is kept in a uniform magnetic field B as shown. The magnitude of magnetic dipole moment of loop and torque acting on it are-



(a) π abi,0 (b) π a bi, π abiB (c) $\frac{\pi abi}{2}, \frac{\pi abiB}{2}$ (d) $\frac{\pi abi}{2}$,0

10. What minimum speed does a 100g particle need At point B to reach point A? The graph shows potential energy versus position.

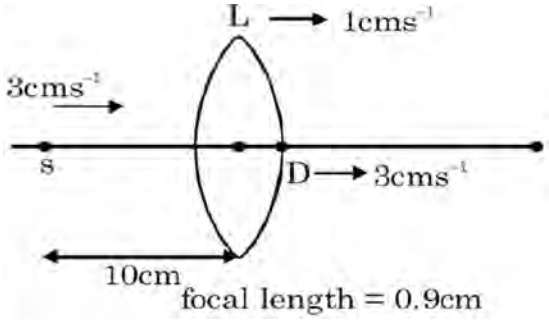


(a) $\sqrt{40}$ m/s (b) $\sqrt{60}$ m/s (c) 10 m/s (d) 5 m/s

11. A parallel beam of monochromatic light is incident on a narrow rectangular slit of width 1mm. When the diffraction pattern in seen on a screen placed at a distance of 2m, the width of principal maxima is found to be 2.5mm. The wavelength of light is

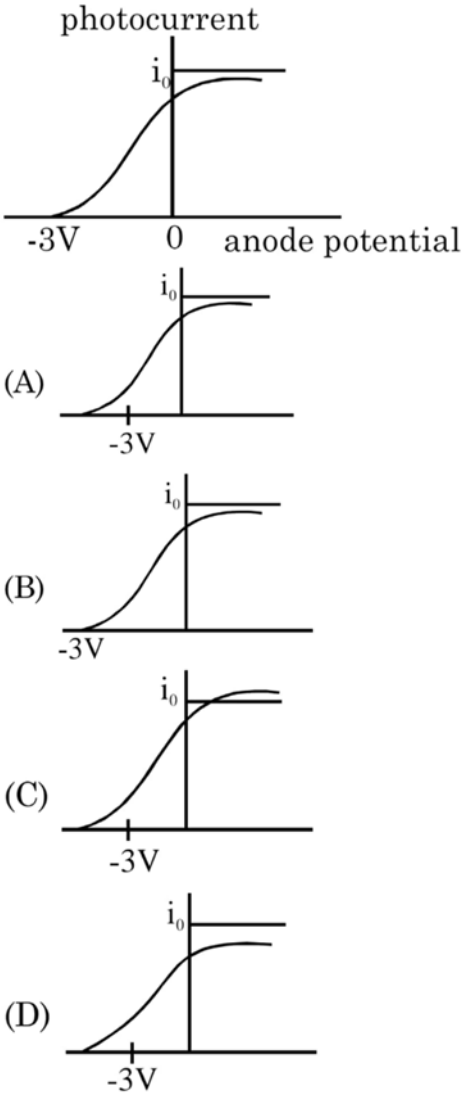
(a) 6250 Å (b) 6200 Å (c) 5890 Å (d) 6000 Å

12. The figure shows the initial position of a point source of light s, a detector D and lens L. Now at t = 0, all three starts moving towards right with different velocity as shown in figure. The times at which detector receives the maximum light, is (Assume that the detector is initially just touching the lens).



(a) 5s and 10s (b) 0.5s and 4.5s (c) 2s and 3s (d) Only 10s

13. Figure shows the anode potential vs photo-current graph when photons of 6 eV are incident on cathode in a photoelectric experiment set-up. In the same experimental set-up, if photons of 8 eV and same intensity are incident on cathode, then anode-potential vs photo-current graph will be (assume 100% efficiency of photons to eject photo-electrons in both cases)

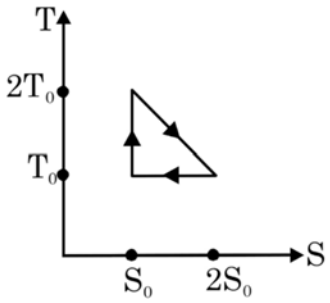


14. A sound source is located somewhere along the x-axis. Experiment shows that the same wavefront simultaneously reaches listeners at x = −10m and x = +4.0m. A third listener is

positioned along the positive y-axis. What is y-coordinate (in m) if the same wavefront reaches at him at the same instant it does the first two listeners?

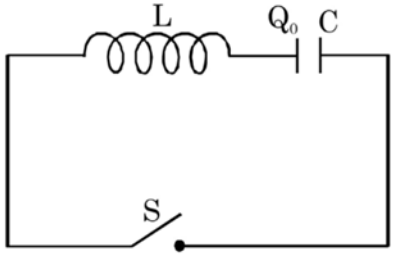
(a) $\sqrt{40}$ (b) 3 (c) 7 (d) $\sqrt{30}$

15. The temperature-entropy diagram of a reversible engine cycle is given in the figure. Its efficiency is:



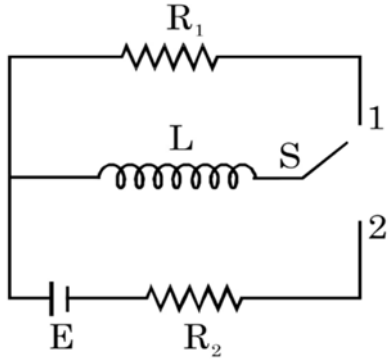
(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{1}{3}$ (d) $\frac{2}{3}$

16. At t < 0, the capacitor is charged and the switch is opened. At t = 0 the switch is closed. The shortest time T at which the charge on the capacitor will be zero is given by:



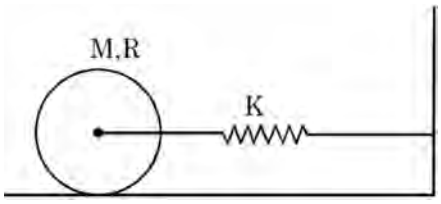
(a) $\pi\sqrt{LC}$ (b) $\frac{3}{2}\pi\sqrt{LC}$ (c) $\frac{\pi}{2}\sqrt{LC}$ (d) $2\pi\sqrt{LC}$

17. In the circuit shown swith S is connected to position 2 for a long time and then joined to position 1. The total heat produced in resistance R_1 is:



(a) $\frac{LE^2}{2R_2}$ (b) $\frac{LE^2}{2R_1^2}$ (c) $\frac{LE^2}{2R_1R_2}$ (d) $\frac{LE^2(R_1+R_2)^2}{2R_1^2R_2^2}$

18. A solid cylinder attached to horizontal massless spring can roll without slipping along horizontal surface. Find time period of oscillation.



(a) $2\pi\sqrt{\frac{M}{2k}}$ (b) $\pi\sqrt{\frac{3M}{2k}}$ (c) $\pi\sqrt{\frac{2M}{3k}}$ (d) $2\pi\sqrt{\frac{3M}{2k}}$

19. Assuming the sun to be a spherical body (e = 1) of radius R at a temperature of T K, evaluate the total radiant power, incident on Earth having radius r_0, at a distance r from the Sun, where r_0 is the radius of the earth and σ is Stefan's constant.

(a) $\frac{\pi r_0^2 R^2 \sigma T^4}{r^2}$ (b) $\frac{r_0^2 R^2 \sigma T^4}{4\pi r^2}$ (c) $\frac{R^2 \sigma T^2}{r^2}$ (d) $\frac{4\pi r_0^2 R^2 \sigma T^4}{r^2}$

20. The minimum and maximum distance of a satellite from the centre of the earth are 2R and 4R, respectively, where R is the radius of earth and M is the mass of earth. The radius of curvature at the point of maximum distance is

(a) $\frac{8R}{3}$ (b) $\frac{4R}{3}$ (c) $\frac{3R}{8}$ (d) $\frac{3R}{4}$

SECTION-II: (Maximum Marks: 20)

- This section contains **TEN** questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777….. then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
  For Example: If answer is –77.25, 5.2 then fill the bubbles as follows.
- Answer to each question will be evaluated according to the following marketing scheme: *Full Marks* : +4 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases

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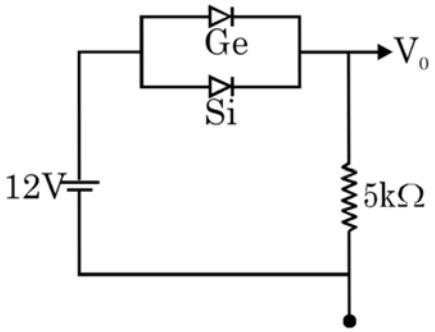
1. A plastic circular disc of radius 10cm is placed on a thin oil film of thickness 2mm, spread over a flat horizontal surface. The torque (N-m) required to spin the disc about its central vertical axis with a constant angular velocity 8 rad/sec is (coefficient of viscosity of oil is 1.0 kg/m-s) (take π = 3.14)

2. Calculate the value of output voltage V_0 (in V) if the Si diode and Ge diode conduct at 0.7V and 0.3V respectively as shown in figure.

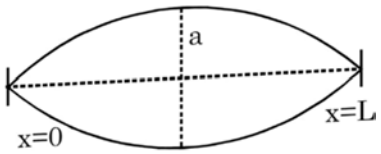


3. In Young's double slit experiment, the wavelength of red light is 7800 Å and that of blue light is 5200 Å. minimum value of n for which n^{th} bright band due to red light coincides with $(n + 1)^{th}$ bright band due to blue light, is:

4. A railway track (made of iron) is laid in winter when the average temperature is 18°C. The track consists of sections of 12.0m placed on after the other. How much gap (in cm) should be left between two such sections so that there is no compression during summer when the maximum temperature goes to 48°C? Coefficient of linear expansion of iron = 11×10^{-6} /°C.

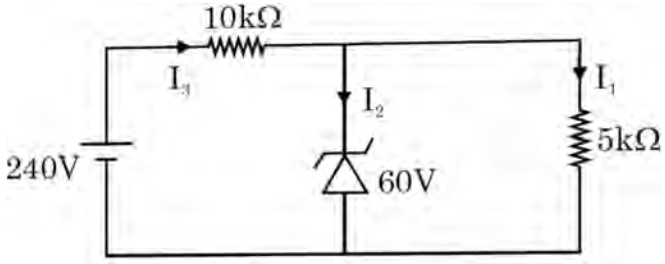
5. A string of mass per unit length μ is clamped at both ends such that one end of the string is at x = 0 and the other end at x = L. When string vibrates in fundamental mode, amplitude of the midpoint of string is a and tension is string is F. Find the total oscillation energy (in J) stored in the string.

(Use L = 1m, F = 10 N, a = $\frac{1}{\pi}$m)



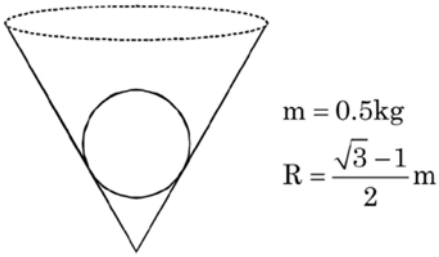
6. A massless metal plate is placed on a horizontal tabletop lubricated with oil. The sheet is a square of side length $\ell = 1.0$m and the oil layer has thickness h = 1.0mm. Initially one edge of the sheet coincides with one edge of the table. The sheet is pulled outwards without rotation with a constant force F = 15 N. If coefficient of viscosity of the oil is $\eta = 0.2$ N-s/m^2, how long (in second) will it take to pull half of the sheet out of the table?

7. Write the value of current i_3 (in mA) in the circuit shown in the figure.



8. A monochromatic light of wavelength 6500 Å is used in YDSE. Now both slits are covered by two thin slab of refractive index 3.2 and 2.7 respectively. By doing so central bright fringe shifts to original 7th bright fringe. If both slabs have same thickness then thickness of slab is $(\text{in } \mu\text{m})$.

9. A hollow sphere (mass m, radius R) is put inside a hollow cone (mass m, radius 3R and semi-angle $30°$) as shown in the figure. The whole arrangement is rigidly fixed to the ground at the apex of the cone. Both the sphere and the cone are made of the same material ($\alpha = 10^{-4}/°C$). Considering that major changes in dimensions could happen only due to heating effects, find the increase in potential energy (in Joule) of the system if it's temperature is increased by $100°C$.



$m = 0.5kg$

$R = \dfrac{\sqrt{3}-1}{2}m$

10. A rod is clamped at both of its ends and stationary longitudinal waves are produced in it. In first experiment, the rod has a total of 4 nodes with amplitude of each anti-node to be 1mm. In other experiment, the rod has a total of 6 nodes with amplitude of each anti node to be 2mm. The energy of vibrations in the rod in two case is E_1 and E_2 respectively. Write value of $\dfrac{E_1}{E_2}$.

PART 1 – CHEMISTRY

Section – I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
  Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0 If none of the bubbles is darkened.
  Negative Marks : –1 In all other cases

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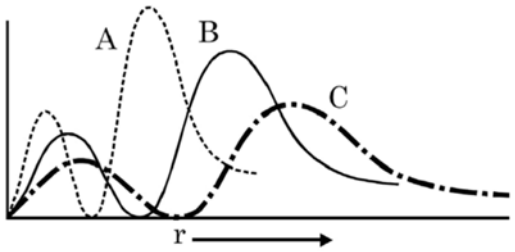
1. Incorrect statement among the following is:
(a) Ethoxymethyl chloride reacts with Nucleophiles 10 times faster than 1–Chlorobutane
(b) Ethoxymethyl chloride follows S_N1 mechanism when reacts with Nucleophiles
(c) 2-Phenylthioethyl chloride reacts with water 600 times as fast as 1-chloropropane
(d) Higher rate of 2-Phenylthioethyl chloride is because the neighboring group participation by phenyl ring.

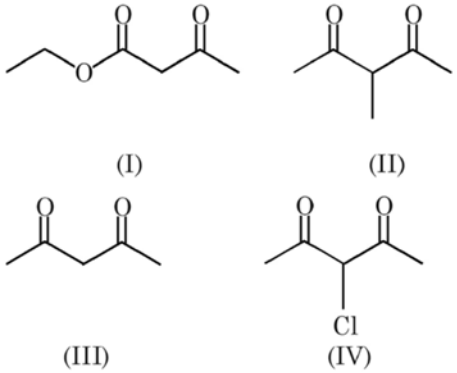
2. Which of the following ionic species has maximum ionization energy?
(a) O^- (b) S^- (c) Se^- (d) Te^-

3. Out of the following, which is the correct match for radial probability of finding the electron of 2s orbital?



(a) A-H, B–He^+, C-Li^{2+} (b) A–He^+, B–H, C–Li^{2+} (c) A–Li^{2+}, B–He^+, C–H (d) Can't say

4. Correct acidic strength order of the given carbonyl compound is ~



(a) IV > I > II > III (b) IV > II > III > I (c) IV > III > II > I (d) IV > I > III > II

5. Which of the following is correct:
(a) $S_3O_9 \rightarrow$ contains no S–S linkage

(b) $HNO_4 \rightarrow$ contains no O-O linkage

(c) $(HPO_3)_3 \rightarrow$ contains P–P linkage

(d) $S_2O_8^{2-} \rightarrow$ contains S–S linkage

6. At 373 K, a gaseous reaction

$A(g) \rightarrow 2B(g) + C(g)$ is found to be of first order. Starting with pure A, the total pressure at the end of 10 min was 176 mm Hg and after a long time when A was completely dissociated, it was 270 mm Hg. Then pressure of A at the end of 10 minutes was:

(a) 94mm (b) 47mm (c) 43mm (d) 90mm

7. Incorrectly matched among the following is:

	Column I (Reaction)	Column II (Major product)
(A)	$2CH_3-\overset{\overset{O}{\|\|}}{C}-CH_3 \xrightleftharpoons{Ba(OH)_2}$ (in soxhlet apparatus)	$(CH_3)_2C(OH)CH_2COCH_3$ Diacetone alcohol
(B)	$2CH_3COCH_3 \xrightleftharpoons{HCl}$	$(CH_3)_2C{=}CHCOCH_3$ Mesityl oxide
(C)	$2CH_3COCH_3 \xrightleftharpoons[(ii)\ CH_3COCH_3]{(i)\ HCl}$	$(CH_3)_2C{=}CHCOCH{=}C(CH_3)_2$ Phorone
(D)	$CH_3CHO + CH_3COCH_3 \xrightleftharpoons{NaOH}$	$CH_3CH(OH)CH_2COCH_3$ 4-Hydroxypentan-2-one

8. If Hund's rule is violated, then which among the following will become diamagnetic from paramagnetic

(a) C_2 (b) CN^- (c) N_2^{-2} (d) BN

9. Which one is false in the following statements?

(a) A catalyst is specific in its action

(b) A very small amount of the catalyst alters the rate of a reaction

(c) The number of free vacancies on the surface of the catalyst increases on sub-division

(d) Nickel is used as a catalyst in the manufacture of ammonia

10. In which of the following reaction 1° amine is not obtained as a major product.

(A) $R-\overset{\overset{O}{\|\|}}{C}-NH_2 \xrightarrow{NaOH + Br_2}$

(B) $R-\overset{\overset{O}{\|\|}}{C}-OH \xrightarrow{N_3H/H^+}$

(C) $Ph-\overset{\overset{O}{\|\|}}{C}-H \xrightarrow[(ii)\ H_2/Ni]{(i)\ R-NH_2}$

(D) $R-C{\equiv}N \xrightarrow{LiAlH_4}$

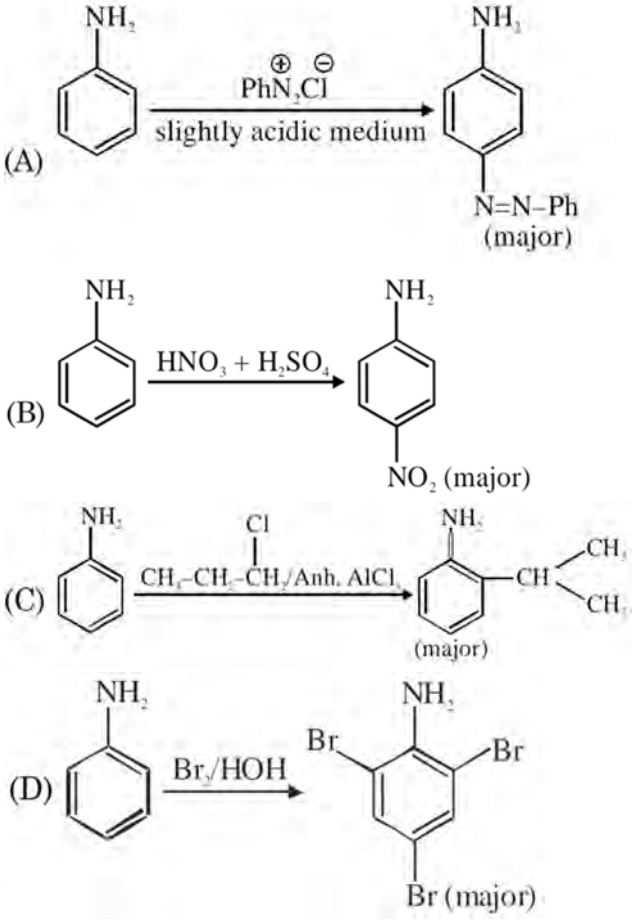
11. The compound Na_2IrCl_6 reacts with triphenylphosphine in diethyleneglycol in an atmosphere of CO to give $[IrCl(CO)(PPh_3)_2)]$, known as 'Vaska's compound'. (Atomic number of Ir = 77)
Which of the following statements is correct?
(a) The IUPAC name of the complex is carbonylchlorideobis (triphenylphosphine) iridium(III)
(b) The hybridization of the metal ion is sp^3
(c) The magnetic moment (spin only) of the complex is zero
(d) The complex shows geometrical as well as ionization isomerism

12. The cell shown below generates a potential of 0.643 V at 300K. Find (log K_{sp}) for AgBr:

$$Ag\left|AgBr(s)\right|NaBr(0.1\ M)\left|\ \right|AgNO_3(0.1\ M)\left|Ag\right.\quad\left[\text{Take}\frac{2.303\ RT}{F}=0.06\right]$$

(a) −30.2 (b) −15.6 (c) −12.71 (d) −8.9

13. Incorrectly matched reaction among the following is:



14. Choose the incorrect statement from the following:
(a) The slag obtained during extraction of iron is heavy and has lower melting point than that of metal.
(b) At temperature below 983 K(approx) CO is chief reducing agent in blast furnance.
(c) In zone refining impurities moves in the direction of water.
(d) Electrolytic reduction of Al_2O_3 is known as Hall-Heroult process.

15. We have taken a saturated solution of AgBr. K_{sp} of AgBr is 12×10^{-14}. If 10^{-7} mole of $AgNO_3$ are added to 1 litre of this solution find conductivity (specific conductance) of this solution in terms of 10^{-7} S m^{-1} units.

Given: $\lambda^{\circ}_{(Ag^+)} = 6 \times 10^{-3}\ Sm^2\ mol^{-1}$

$\lambda^{\circ}_{(Br^-)} = 8 \times 10^{-3}\ Sm^2\ mol^{-1}$

$\lambda^{\circ}_{(NO_3^-)} = 7 \times 10^{-3}\ Sm^2\ mol^{-1}$

(a) 55 (b) 75 (c) 65 (d) 45

16. Incorrect order of Rate of Reduction among the following is:

(A) $R-\overset{O}{\overset{\|}{C}}-OH > R-\overset{O}{\overset{\|}{C}}-Cl$ – Reduction with Borane

(B) $R-\overset{O}{\overset{\|}{C}}-H > R-\overset{O}{\overset{\|}{C}}-OH$ – Reduction with LiAlH

(C) $R-C\equiv C-R > R-CH=CH-R$ – Reduction with H_2/Ni

(D) $R-\overset{O}{\overset{\|}{C}}-Cl > R-\overset{O}{\overset{\|}{C}}-OH$ – Reduction with DiBAL-H

17. Which of the following cation produces ppt. with only one of the given condition

(I) In aqueous solution produce ppt with dil. HCl

(II) In acidic aqueous solution produce ppt with H_2S

(a) Pb^{+2} (b) Hg_2^{2+} (c) Ag^+ (d) Sn^{+2}

18. Select the incorrect statement.

(a) Three moles of phenylhydrazine and one mole of aldose required to produce phenylosazone

(b) Glucose form gluconic acid with Br_2/HOH

(c) Glucose form Glucaric acid with HNO_3

(d) Lowering in carbon chain can be done by Kiliani Fischer method.

19. Select the INCORRECT statement:

(a) At Boyle's temperature a real gas behaves like an ideal gas irrespective of pressure.

(b) At Boyle's temperature; $z = 1 + \dfrac{b^2}{V_m(V_m - b)}$

(c) On increasing the temperature four times, collision frequency (Z_1) becomes double at constant volume.

(d) At high pressure Vander Waals constant 'b' dominated over 'a'.

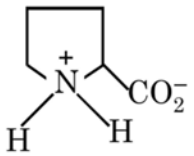
20. $HO_2C-(CH_2)_3-CH_2CO_2H \xrightarrow[(2)\ NH_3\ (eq.)]{(1)\ 1\ eq.\ of\ SOCl_2} P_1 \xrightarrow[+KOH]{Br_2} P_2 \xrightarrow[/redP]{Br_2} P_3 \xrightarrow{intra\ molecular\ S_N2} P_4$

How many statements are correct?

(i) P_1 is $H_2N - CO(-CH_2)_3 - CH_2CO_2H$

(ii) P_2 is $H_2N - (CH_2)_3 - CH_2CO_2H$

(iii) P_3 is $H_2N - (CH_2)_3 - CH(Br) - CO_2H$

(iv) P_4 is 

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

SECTION-II: (Maximum Marks: 20)

- This section contains **TEN** questions. Attempt any 5 questions. First 5 attempted questions will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, −0.33, −.30, 30.27, −127.30, if answer is 11.36777….. then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.
  For Example: If answer is −77.25, 5.2 then fill the bubbles as follows.
- Answer to each question will be evaluated according to the following marketing scheme: *Full Marks* : +4 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases

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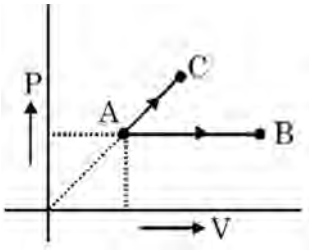
1. Among the following the total number of elements which produce H_2 gas with NaOH is Zn, Al, Sn, Pb, P, S

2. What volume in ml of 5 M H_2SO_4 should be added to 150ml of 1 M H_2SO_4 to obtain a solution of molarity = 2.5 M, if upon mixing volume of solution decreases by 10%?

3. An organic compound P contains 62.07% carbon and 10.34% hydrogen and rest oxygen. Its vapour density is 29. This compound does not react with sodium meta, but its 2.9g combine with Xg of bromine (to give dibromo addition product). Find out value of (Y−X). (Where Y is total number of possible isomers of given organic compound P)
[Atomic mass : Br = 80]

4. How many of the following reagent/s will liberate at least one oxide of nitrogen as a product?
(i) Ag + conc. HNO_3
(ii) Sn + dil., HNO_3 (20%)
(iii) Cu + conc. HNO_3
(iv) C + conc. HNO_3
(v) Zn + conc. HNO_3
(vi) Zn + dil. HNO_3 (20%)
(vii) P_4 + conc. HNO_3
(viii) S_8 + conc. HNO_3
(ix) Cu + dil. HNO_3 (20%)

5. One mole ideal monoatomic gas is heated in two different processes according to path AB and AC. If temperature of state B and state C are equal. Calculate $\frac{q_{AC}}{q_{AB}}$

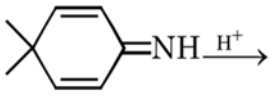


6. In white phosphorous (P_4) if x is total number of triangle y is total number of plane of symmetry z is total number of P–P bond then calculate value of $\frac{(y+z)}{x}$.

7. Total number of species in which atleast one atom have same hybridization as in central atom of azide ion.

N_2O, C_2H_2, CO_2, C_3O_2, BeF_2, NO_2, PF_3

8. What is the molecular weight of the final product in the following reaction sequence



fasdfjaskldfjlsadjfalksjflaksdjfklasdjflksadjflksdajflkasdjflkasdjflkas

9. An ionic compound (A^+B^-) crystallizes in rock salt structure. If the ionic radii of A^+ and B^- is 200pm and 400pm respectively, then calculate distance between nearest anions in Å.

10. 6.84gm $Al_2(SO_4)_3$ is needed to coagulate 2.5 L of As_2S_3 sol completely in 2.0 hrs. The coagulation value of $Al_2(SO_4)_3$ in terms of millimoles per litre is:

[Atomic Mass : Al = 27, S = 32].

PART 1 – MATHEMATICS

Section – I : (Maximum Marks : 80)

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
  Full Marks : +4 If only the bubble corresponding to the correct option is darkened.
  Zero Marks : 0 If none of the bubbles is darkened.
  Negative Marks : -1 In all other cases

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1. The series of natural numbers is divided into groups as (1), (2, 3, 4), (3, 4, 5, 6, 7), (4, 5, 6, 7, 8, 9, 10) ……. . If sum of elements in the 20th group is ℓ, then ℓ is equal to

(a) 1368 (b) $(38)^2$ (c) $(39)^2$ (d) 38 ×39

2. The lines L_1 : x = y = z, L_2 : $x = \frac{y}{2} = \frac{z}{3}$ and a line L_3 is passing through (1, 1, 1) form a triangle of area $\sqrt{6}$ units, (1, 1, 1) being one of the vertices of the triangle. Then the point of intersection of the L_3 with L_2 is

(a) (1, 2, 3) (b) (2, 4, 6) (c) $\left(\frac{4}{3}, \frac{8}{3}, 4\right)$ (d) (1, 5, 7)

3. The combined equation of 2 altitudes of an equilateral triangle is $x^2 - 3y^2 - 4x + 6\sqrt{3}y - 5 = 0$. The third altitude has equation.

(a) x + 2 = 0 (b) $y = \sqrt{3}$ (c) x = 2 (d) None of these

4. The mean marks of students of a school is 56. The mean marks of girls is 60 and that of boys is 50. If number of boys and girls are n and m respectively, then $\frac{9n}{m}$ equals

5. C_1 and C_2 are two circles whose equations are given as $x^2 + y^2 = 25$ and $x^2 + y^2 + 10x + 6y + 1 = 0$. Now C_3 is a variable circle which cuts C_1 and C_2 orthogonally. Tangents are drawn from the centre of C_3 to C_1, if the locus of the mid point of the chord of contact of tangents is $ax + 3y + \frac{13}{b}\left(x^2 + y^2\right) = 0$, (where a, b $\in Z^+$, and a and b are relative prime), then $\frac{b}{a}$ is

(a) 1 (b) 2 (c) 4 (d) 5

6. A line is drawn from a point P(x, y) on curve y = f(x), making an angle in anti-clockwise with the +ve x-axis which is supplementary to the one made by the tangent to the curve at P(x, y). The line meets the x-axis at A. Another line perpendicular to the first, is drawn from P(x, y) meeting the y-axis at B. If OA = OB, where O is the origin, then the curve which passes through (1, 1).

(a) $x^2 - y^2 + 4xy = 4$ (b) $x^2 - y^2 - 2xy + 2 = 0$ (c) $x^2 - y^2 + 2xy = 2$ (d) $x^2 - y^2 - 4xy + 4 = 0$

7. Let p : Sindhu plays to win q : Sindhu gets Bharath Ratna

Then the contrapositive of "$\sim(\sim q \wedge p)$" is

(a) If Sindhu plays to win then she gets Bharath Ratna

(b) If Sindhu gets Bharat Ratna then she plays to win

(c) If Sindhu does not plays to win then she does not gets Bharat Ratna

(d) If Sindhu does not get Bharat Ratna then she does not plays to win

8. Let A and B are non-singular matrices of order 3 such that $|A| = 5$ and $A^{-1}B^2 + AB = 0$, then $A^2\left|A^2\right| -$ adj (adjB) is equal to

(a) null matrix (b) $25A^2 - 5B$ (c) $25A^2$ (d) $50A^2$

9. Number of points of non-differentiability of $f(x) = \left||x|-1\right| + |\cos \pi x|;\ -2 < x < 2$ is

(a) 7 (b) 6 (c) 5 (d) 4

10. If $C_0, C_1, \ldots\ldots, C_{2012}$ are binomial coefficients in the expansion of $(1 + x)^{2012}$ and $a_0, a_1, \ldots\ldots, a_{2012}$ are real numbers in arithmetic progression then value of

$a_0C_0 - a_1C_1 + a_2C_2 - a_3C_3 + \ldots\ldots + a_{2012}C_{2012}$ is a

(a) Even Number (b) Odd number (c) Natural number (d) Prime number

11. In a set of real numbers a relation R is defined as x R y such that $|x| + |y| \le \frac{1}{2}$, then relation R is

(a) reflexive and symmetric but not transitive (b) symmetric but not transitive and reflexive

(c) transitive but not symmetric and reflexive (d) none of reflexive, symmetric and transitive

12. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three mutually perpendicular unit vectors and $\vec{d}$ is a unit vector which makes equal angles with $\vec{a}, \vec{b}$ and $\vec{c}$ then the value of $\left|\vec{a}+\vec{b}+\vec{c}+\vec{d}\right|^2$

(a) $4 + 2\sqrt{2}$ (b) $4 + 2\sqrt{3}$ (c) $2 + \sqrt{5}$ (d) $3 + \sqrt{5}$

13. Let the area enclosed by the curve $y = 1 - x^2$ and the line $y = a$, where $0 \le a \le 1$, be represented by A(a). If $\frac{A(0)}{A\left(\frac{1}{2}\right)} = k$, then

(a) $1 < k < \frac{3}{2}$ (b) $\frac{3}{2} < k < 2$ (c) $2 < k < \frac{5}{2}$ (d) $\frac{5}{2} < k < 3$

14. If system of linear equations $(a - 1)x + z = \alpha$, $x + (b - 1)y = \beta$ and $y + (c - 1)z = \gamma$ where $a, b, c \in I$ and $\alpha, \beta, \gamma \in R$, does not have a unique solution, then maximum possible value of $|a+b+c|$ is

(a) 5 (b) 1 (c) 3 (d) 4

15. ABCD is a rectangular field. A vertical lamp post of height 12m stands at the corner A. If the angle of elevation of its top from B is $60°$ and from C is $45°$, then the area of the field is

(a) $48\sqrt{2}$ sq. meter (b) $48\sqrt{3}$ sq. meter (c) 48 sq. meter (d) $12\sqrt{2}$ sq. meter

16. Smallest positive x satisfying the equation $\cos^3 3x + \cos^3 5x = 8\cos^3 4x \cdot \cos^3 x$ is

(a) $15°$ (b) $18°$ (c) $22.5°$ (d) $30°$

17. The set of values of x satisfying simultaneously the inequalities $\frac{\sqrt{(x-8)(2-x)}}{\log_{0.3}\left(\frac{10}{7}(\log_2 5 - 1)\right)} \ge 0$

and $2^{x-3} - 31 > 0$ is:

(a) a singleton set (b) an empty set

(c) an infinite set (d) a set consisting of exactly two elements

18. A bag contains 2 white and 4 black balls. A ball is drawn 5 times, each being replaced before another is drawn. The probability that atleast 4 of the balls drawn are white is:

(a) $\frac{4}{81}$ (b) $\frac{10}{243}$ (c) $\frac{11}{243}$ (d) None

19. The modulus of the complex number z such that $|z+3-i|$ = 1 and arg(z) = π is equal to

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

20. Let J = $\int_0^{e-1} \frac{1}{x+1} \exp.\left(\frac{x^2+2x-1}{2}\right) dx$ and K = $\int_1^e x\ell n\, x \exp.\left(\frac{x^2-2}{2}\right) dx$. The value of (J + K) is equal to

(a) $\left(\sqrt{e}\right)^{e^2+1}$ (b) $\left(\sqrt{e}\right)^{e^2-1}$ (c) 0 (d) $\left(\sqrt{e}\right)^{e^2-2}$

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  For Example: If answer is -77.25, 5.2 then fill the bubbles as follows.
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1. If a, b are odd integers then number of integral root, of equation $x^{10} + ax^9 + b = 0$ is equal to

2. If the number of distinct positive rational numbers $\frac{p}{q}$ smaller than 1, where p, q $\in \{1, 2, 3 \ldots\ldots, 6\}$ is k then k is

3. If two distinct chords of a parabola $y^2 = 4ax$ passing through (a, 2a) are bisected on the line x + y = 1, then the sum of integral values of the length of possible latus rectums is equal to

4. If the value of $\lim\limits_{x\to 0}\left\{\sin^2\left(\frac{\pi}{2-3x}\right)\right\}^{\sec^2\left(\frac{\pi}{2-5x}\right)}$ is e^{-A} then 'A' is

5. If $\bar{a}, \bar{b}, \bar{c}$, such that $\bar{a}\times\left(\bar{a}\times\bar{c}\right)+3\bar{b}=0$, if θ is the angle between $\bar{a}$ and $\bar{c}$, then $\cos^2\theta$ is equal to

6. If $\lim\limits_{x\to\infty}\frac{(2x+1)^{40}(4x-1)^5}{(2x+3)^{45}}=L$, then of $\frac{L}{128}$ is

7. If the function $f(x)=\begin{cases}1+\sin\frac{\pi x}{2}, & x\le 1\\ ax+b, & 1<x<3\\ 6\tan\frac{\pi x}{12}, & 3\le x<6\end{cases}$ is continuous in the interval $(-\infty, 6)$ then value of $\left(\frac{a-b}{8}\right)$ is

8. Value of $\int_0^{1.5}\left[x^2\right]dx$ is equals to (where [.] denotes greatest integer function)

9. If the area bounded by curve $x + |y| = 1$ and the y-axis is k, then $\frac{k}{4}$ is equals to

10. If value of $\frac{\left\{\left(\vec{a}-\vec{b}\right)\times\left(\vec{a}-\vec{b}-\vec{c}\right)\right\}.\left(\vec{a}+2\vec{b}-\vec{c}\right)}{\left[\vec{a}\,\vec{b}\,\vec{c}\right]}$ is k then $\frac{k}{4}$ is