

FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS

JEE Main 2019 Mock Test-2 (Additional)

Code : 100383.1

Time Allotted: 3 Hours

Maximum Marks: 360

- Do not open this Test Booklet until you are asked to do so.
- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

Important Instructions:

- Immediately fill in the particulars on this page of the Test Booklet with *Blue / Black Ball Point Pen*. Use of pencil is strictly prohibited.
- The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
- The test is of **3 hours** duration.
- The Test Booklet consists of **90** questions. The maximum marks are **360**.
- There are **three** parts in the question paper A, B, C consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for correct response.
- Candidates will be awarded marks as stated above in instruction No.5 for correct response of each question. $\frac{1}{4}$ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 6 above.
- Use **Blue / Black Ball Point Pen only** for writing particulars / marking responses on **Side-1** and **Side-2** of the Answer Sheet. **Use of pencil is strictly prohibited.**
- No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination hall / room.
- On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room / Hall. **However, the candidates are allowed to take away this Test Booklet with them.**
- Do not fold or make any stray marks on the Answer Sheet.**

Atomic No.: H=1, He=2, Li=3, Be=4, B=5, C=6, N=7, O=8, F=9, Na=11, Mg=12, Al = 13, Si = 14, P = 15, S = 16, Cl = 17, Ar =18, K=19, Ca=20, Cr=24, Mn=25, Fe=26, Co=27, Ni=28, Cu=29, Zn=30, As=33, Br = 35, Ag = 47, Si = 21, Sn = 50, Ti = 22, I = 53, Xe = 54, Ba = 56, Pb = 82, U = 92, V = 50.

Atomic masses: H =1, He=4, Li=7, Be=9, B=11, C=12, N=14, O=16, F=19, Na=23, Mg=24, Al=27, Si=28, P=31, S=32, Cl=35.5, K=39, Ca=40, Cr=52, Mn=55, Fe=56, Co=59, Ni=58.7, Cu=63.5, Zn = 65.4, As = 75, Br = 80, Ag = 108, Sn = 118.7, I = 127, Xe = 131, Ba = 137, Pb = 207, U = 238.

Name of the Candidate (in Capital Letters) : _____

Enrolment Number : _____

Batch : _____ Date of Examination : _____

Physics

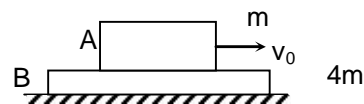
PART – I

SECTION – A

(Only One Option Correct Type)

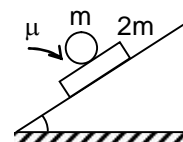
This section contains **30 multiple choice** questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. A block of mass m is placed over a rough plank of mass $4m$. The plank is placed over a smooth surface as shown in the figure. At $t = 0$, A is given a velocity v_0 in horizontal direction let v_1 and v_2 be the velocities of A and B at same time t , then correct relation between v_1/v_2 and t is



- (A) \bar{v}_2 is always lesser in magnitude than \bar{v}_1
 (B) $\bar{v}_1 \cdot \bar{v}_2 > 0$ for any value of t
 (C) $\bar{v}_1 \cdot \bar{v}_2 < 0$ for a specific value of t
 (D) there is no work done by friction on system.

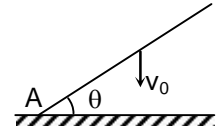
2. A sphere of mass m is placed on a rough plank of mass $2m$ which in turn is placed over a rough inclined plane. The coefficient of friction between plank and sphere is μ and friction is absent between plank and inclined plane. The minimum value of μ so as to ensure pure rolling of sphere is.



- (A) $\frac{8}{3}$ (B) $\frac{8}{3 \cos \theta}$
 (C) $\frac{7}{3 \cos \theta}$ (D) Pure rolling is not possible for any value of μ

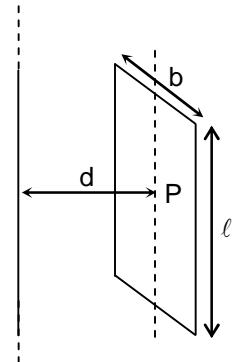
Space for Rough work

3. A rod of length ℓ and mass m strikes a smooth horizontal surface at an angle θ as shown in the figure. The velocity of COM of rod just before striking is v_0 and no angular velocity is present. Assuming impact at A is perfectly elastic, the speed of point A just after impact is



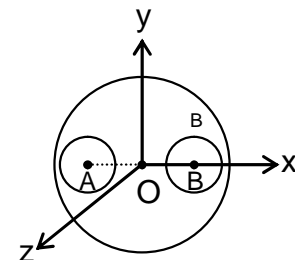
- (A) $\frac{12v_0 \cos \theta}{(1+3\cos^2 \theta)}$ (B) $\frac{2v_0 \sin^2 \theta}{(1-\cos 2\theta)}$
 (C) $\frac{3v_0 \cos \theta}{(1+3\cos^2 \theta)}$ (D) $\frac{6v_0 \cos \theta}{(1+3\cos^2 \theta)}$

4. The electric flux passing through wire frame ABCD of length ℓ and breadth b whose centre is d distance away from an infinite line charge of linear density λ is (consider plane of frame is perpendicular to line OP).



- (A) $\frac{2\lambda\ell}{\pi\epsilon_0} \tan^{-1}\left(\frac{b}{2d}\right)$ (B) $\frac{\lambda\ell}{\pi\epsilon_0} \tan^{-1}\left(\frac{2b}{d}\right)$
 (C) $\frac{\lambda\ell}{\pi\epsilon_0} \tan^{-1}\left(\frac{b}{2d}\right)$ (D) $\frac{\lambda\ell}{\pi\epsilon_0} \tan^{-1}\left(\frac{b}{d}\right)$

5. A solid sphere of uniform density and radius 4 units is located with its centre at the origin O of coordinate system. Two spheres of equal radii 1 unit, with their centres at A (-2, 0, 0) and B(2, 0, 0) respectively are taken out of solid leaving behind spherical cavities as shown in the figure. Then incorrect ones are

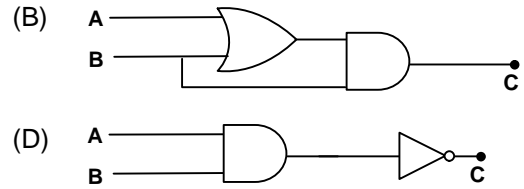
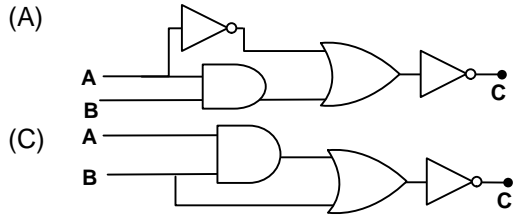


- (A) The gravitational field at origin is zero.
 (B) The gravitational field at the point B(2, 0, 0) is zero
 (C) The gravitational potential is same at all points of the circle $y^2 + z^2 = 36$
 (D) The gravitational potential is same at all points on the circle $y^2 + z^2 = 4$.

Space for Rough work

6. Which of the following circuits correctly represents the following truth table?

A	B	C
0	0	0
0	1	0
1	0	1
1	1	0



7. A hollow sphere is made of two hemisphere having surface charge densities σ_1 and σ_2 then electric field at its centre will be ($\sigma_1 > \sigma_2$)

(A) $\frac{1}{4\epsilon_0}(\sigma_1 - \sigma_2)$

(B) $\frac{1}{4\epsilon_0}(\sigma_1 + \sigma_2)$

(C) $\frac{1}{2\epsilon_0}(\sigma_1 + \sigma_2)$

(D) $\frac{1}{2\epsilon_0}(\sigma_1 - \sigma_2)$

8. A uniform conducting rod of length ℓ is rotated in xy plane about its one end with angular velocity ω in uniform magnetic field \vec{B} directed along z-axis then electric field in the rod at its mid point will be

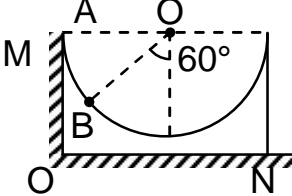
(A) $\frac{B\omega\ell}{2}$

(B) $B\omega\ell$

(C) $\frac{B\omega\ell}{3}$

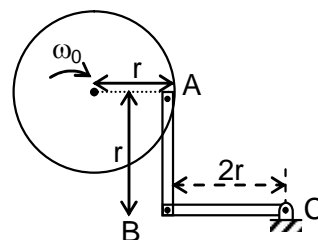
(D) $\frac{B\omega\ell}{4}$

Space for Rough work

9. A charged particle is projected in a magnetic field $(2\hat{i} + 2\hat{j} + \hat{k})$. The acceleration of the particle at an instant is equal to $(x\hat{i} + 2\hat{j} - 6\hat{k})$ m/s². Value of x is
 (A) 1 (B) 2
 (C) 3 (D) 4
10. A ball of mass 1 kg is released from portion A inside a wedge with a hemispherical cut of radius 0.5 m as shown. The force exerted on ball by wedge when ball is in position B (no friction anywhere)
 (A) 10 N (B) $5\sqrt{3}$ N
 (C) $\frac{15\sqrt{3}}{2}$ N (D) 15 N
- 
11. Three simple harmonic motions in the same direction having same amplitude a and angular frequency ω are superposed. If each differences in phase from the next by 45° then,
 (A) The resultant amplitude is $(\sqrt{2} - 1)a$.
 (B) The phase of resultant motion relative to first is 90° .
 (C) The energy associated with the resulting motion is $(3 + 2\sqrt{2})$ times the energy associated with any side motion.
 (D) The resulting motion is not simple harmonic
12. A large tank filled with water to a height of h is said to be emptied through a small hole at the bottom. The ratio of time taken for the level of water to fall down from h to $h/2$ and from $h/2$ to zero is:
 (A) $\sqrt{2}$ (B) $\frac{1}{\sqrt{2}}$
 (C) $\sqrt{2} - 1$ (D) $\frac{1}{\sqrt{2} - 1}$

Space for Rough work

13. A train has just completed a U-curve in a track which is a semicircle. The engine is at the front end of the semicircular part of the track while the last carriage is at the rear end of the semicircular track. The driver blows a whistle of frequency 200 Hz. Velocity of sound is 340 m/s. Then, the apparent frequency as observed by a passenger in the middle of the train, when the speed of the train is 30 m/s, is
 (A) 219 Hz (B) 188 Hz
 (C) 200 Hz (D) 181 Hz
14. A cart is moving on horizontal road with acceleration g and a bob of mass m is hanging inside cart with a string of length ℓ on ceiling of cart. Find net force acting on bob
 (A) mg (B) $\frac{mg}{\sqrt{2}}$
 (C) $\sqrt{2}mg$ (D) $2mg$
15. At $t = 0$ disk rotates with a constant angular velocity ω_0 clockwise as shown in figure. Then angular velocity of rod BC
 (A) ω_0 (B) $2\omega_0$
 (C) $\frac{\omega_0}{2}$ (D) $\frac{\omega_0}{4}$



16. In an ideal Young's double slit experiment when a glass plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass plate is :
 (A) 2λ (B) $2\lambda/3$
 (C) $\lambda/3$ (D) λ

Space for Rough work

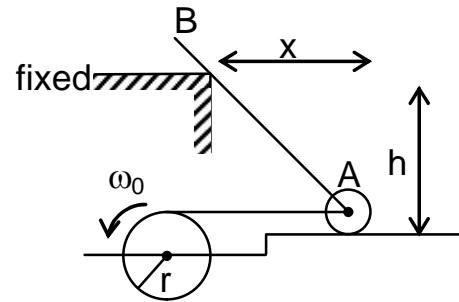
17. The angular velocity ω of the cylindrical bar AB as a function of distance x and constant angular velocity ω_0 of drum is

(A) $\omega = \frac{hr\omega_0}{x^2 - h^2}$

(B) $\omega = \frac{hr\omega_0}{x^2 + h^2}$

(C) $\omega = \frac{rh^2\omega_0}{x^3 - h^3}$

(D) $\omega = \frac{r^2h\omega_0}{x^3 - h^3}$



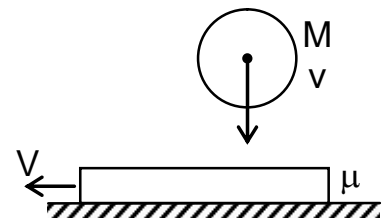
18. A plank is moving with velocity v on a smooth horizontal plane. The upper surface of plane is rough on which a ball falls with velocity v and rebounds with vertical component of velocity $\frac{v}{2}$. If the plank comes to rest after collision then coefficient of friction between plank and ball is

(A) $\frac{1}{3}$

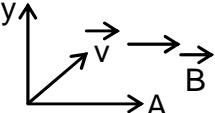
(B) $\frac{2}{3}$

(C) $\frac{4}{3}$

(D) none of these

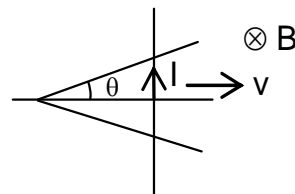


Space for Rough work

19. A capacitor of capacity C is charged to a potential difference V , another capacitor of capacity $2C$ is charged to a potential difference $4V$. Two capacitor are isolated and connected to each other with reverse polarities (positive to positive). Heat produced during redistribution of charge between capacitors will be
- (A) $2CV^2$ (B) $3CV^2$
 (C) $\frac{25}{3}CV^2$ (D) $\frac{25}{2}CV^2$
20. A charged particle specific charge α is released from origin at $t = 0$ with velocity $\vec{v} = v_0(\hat{i} + \hat{j})$ in a uniform magnetic field $\vec{B} = B_0\hat{i}$, coordinate of particle at time $t = \frac{\pi}{B_0\alpha}$ are
- 
- (A) $\left[\frac{v_0}{2\beta\alpha}, \frac{\sqrt{2}v_0}{B\alpha}, \frac{-v_0}{B_0\alpha} \right]$ (B) $\left[\frac{-v_0}{2\beta\alpha}, 0, 0 \right]$
 (C) $\left[0, \frac{2v_0}{B_0\alpha}, \frac{v_0\pi}{2B_0\alpha} \right]$ (D) $\left[\frac{v_0\pi}{\beta\alpha}, 0, \frac{-2v_0}{B_0\alpha} \right]$
21. An electron in a hydrogen atom makes a transition from first excited state to ground state. The equivalent current due to circulating electron
- (A) increases 2 times (B) increases 4 times
 (C) increases 8 times (D) remains the same
22. In a moving coil galvanometer the coil is suspended in a radial magnetic field of a uniform magnetic field. This is done so as to
- (A) increase sensitivity of the instrument
 (B) increase accuracy of the instrument
 (C) make instrument portable
 (D) make its deflection proportional to the current

Space for Rough work

23. On a V shaped conducting wire of zero resistance, a rod having resistance k per unit length being moved with constant speed v . The current I flowing will be equal to

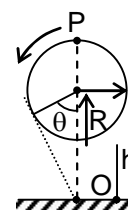


- (A) $\frac{B \sin \theta}{k} v$ (B) $\frac{B \sin \left(\frac{\theta}{2}\right)}{k} v$
 (C) $\frac{Bv}{k}$ (D) none of these

24. Three identical sources of sound are placed at $(0, 3)$, $(0, 0)$ and $(0, -3)$ a detector is at $(4, 0)$ observe sound intensity which is same as intensity of any source then frequency of each source will be (speed of sound is 300 m/s)

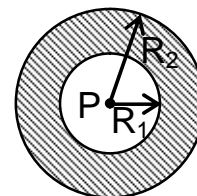
- (A) 150 Hz (B) 175 Hz
 (C) 200 Hz (D) 250 Hz

25. A plane is moving with constant speed in a vertical circle of radius R . The centre of circle is at a height h directly overhead of an observer standing on the ground. The observer receives the maximum frequency of the sound is double of actual frequency. If v_s is speed of sound then speed of plane is



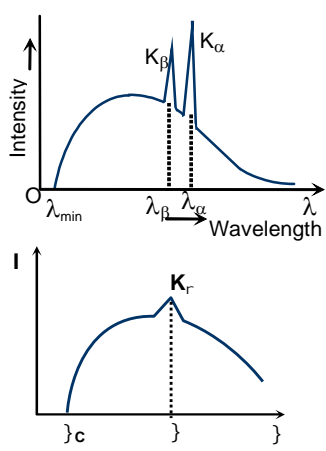
- (A) $\frac{v_s}{2}$ (B) $2v_s$
 (C) $\frac{2v_s}{3}$ (D) $3v_s$

26. A point source of power P is placed at centre of spherical shell having geometric mean of radius R . If k is thermal conductivity what thickness is required to maintain a temperature difference T between inner and outer surface of shell in steady state



- (A) $\frac{4\pi R^2 k T}{P}$ (B) $\frac{4\pi R^2 P}{k T}$
 (C) $\frac{k T P}{4\pi R^2}$ (D) none of these

Space for Rough work

27. A point source of light is placed above an opaque sphere at height R from surface where R is radius of sphere. Find area of shadow of sphere at horizontal ground on which sphere is placed
- (A) $12\pi R^2$ (B) $3\pi R^2$
 (C) $\frac{7\pi R^2}{2}$ (D) $\frac{9\pi R^2}{2}$
28. A gun of mass m_1 (without bullet) fires a bullet of mass m_2 with a horizontal speed v_0 with respect to ground. The gun is fitted a concave mirror of focal length f facing towards a receding bullet. The speed of separation of bullet and the image just after firing is
- (A) $\frac{2m_2}{m_1}v_0$ (B) $2\left(\frac{m_2}{m_1} + 1\right)v_0$
 (C) $2\left(\frac{m_2}{m_1} - 1\right)v_0$ (D) $\frac{2m_2}{m_1}v_0 + v_0$
29. The figure represents intensity of x-rays produced by two tubes A and B as a function of wavelength λ for tube A, potential difference maintained across tube is V_A while atomic number of target is Z_A while V_B and Z_B are corresponding quantities for tube B. Then,
- (A) $Z_A > Z_B, V_A > V_B$
 (B) $Z_A = Z_B, V_A = V_B$
 (C) $Z_A < Z_B, V_A < V_B$
 (D) $Z_A < Z_B, V_A > V_B$
- 
30. If average life time of an excited state of H_2 is 10^{-8} sec. How many revolution an electron can make when it is in the state $n = 2$ before it makes a transition to $n = 1$ state
- (A) 8.2×10^6 (B) 4.1×10^6
 (C) 2×10^6 (D) none of these

Space for Rough work

Chemistry

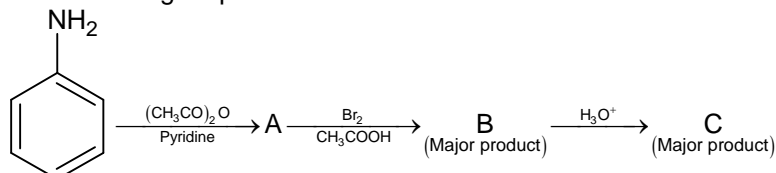
PART – II

SECTION – A

(Only One Option Correct Type)

This section contains **30 multiple choice** questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. In the following sequence of reaction



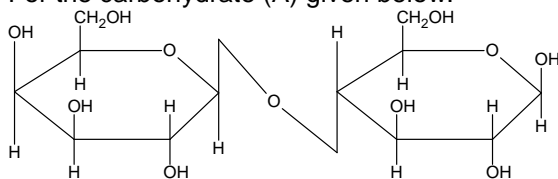
the major product (C) is:

- | | |
|-------------------------|-------------------------|
| <p>(A) </p> <p>(C) </p> | <p>(B) </p> <p>(D) </p> |
|-------------------------|-------------------------|

2. The pH of the resulting solution formed by mixing 10 ml of $\frac{M}{10}$ NH_4OH solution with 4 ml of $\frac{M}{10}$ H_2SO_4 solution. ($\log 2 = 0.3010$, $\text{p}K_b$ of $\text{NH}_4\text{OH} = 4.76$)
- | | |
|----------|----------|
| (A) 8.63 | (B) 5.36 |
| (C) 5.06 | (D) 8.94 |
3. Which of the following compound on thermal decomposition produces $\text{N}_2\text{O}(\text{g})$?
- | | |
|--------------------------------|--------------------------------|
| (A) LiNO_3 | (B) NH_4NO_3 |
| (C) $\text{Pb}(\text{NO}_3)_2$ | (D) $\text{Mg}(\text{NO}_3)_2$ |

Space for Rough work

4. For the carbohydrate (A) given below:



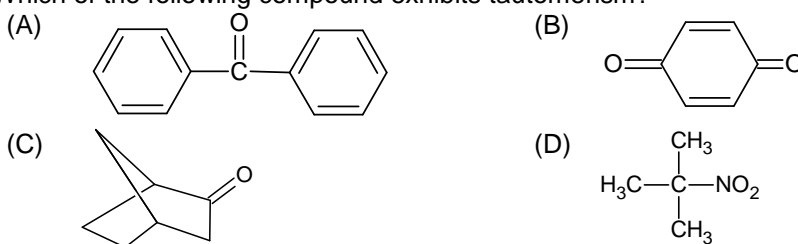
the **incorrect** statement is:

- (A) the carbohydrate (A) is a reducing sugar
 (B) the carbohydrate (A) on hydrolysis produces D-glucose and D-galactose
 (C) the carbohydrate (A) shows mutarotation
 (D) the carbohydrate (A) is maltose

5. Which of the following silicate is a pyrosilicate?

- (A) Zn_2SiO_4 (B) $Sc_2(Si_2O_7)$
 (C) $Be_3Al_2Si_6O_{18}$ (D) $Ca_3Si_3O_9$

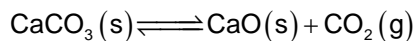
6. Which of the following compound exhibits tautomerism?



7. Which of the following compound is used as antidepressant drug?

- (A) Equanil (B) Chloroamphenicol
 (C) Prontosil (D) Cimetidine

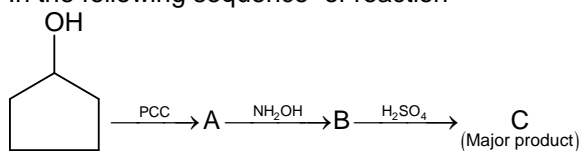
8. 22 g of $CaCO_3$ were put into a closed container of volume 10 L and heated to $1000^\circ C$, 40% of $CaCO_3$ decomposed at equilibrium. K_p for the following equilibrium is:



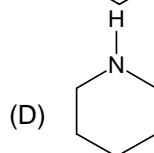
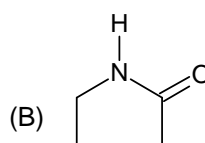
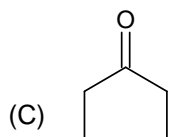
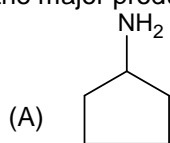
- (A) 2.463 atm (B) 1.64 atm
 (C) 4.634 atm (D) 1.642 atm

Space for Rough work

9. Which of the following carbide on hydrolysis produces propyne?
(A) Magnesium carbide (B) Calcium carbide
(C) Aluminium carbide (D) Beryllium carbide
10. The **incorrect** statement among the following is
(A) $N(\text{SiH}_3)_3$ is more basic than $N(\text{CH}_3)_3$.
(B) Dipole moment of NH_3 is greater than that of NF_3 .
(C) The O – O bond length in H_2O_2 is greater than the O – O bond length in O_3 .
(D) O_2^+ is more stable than O_2 .
11. In the following sequence of reaction



the major product (C) is:

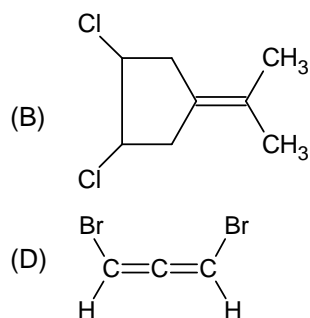
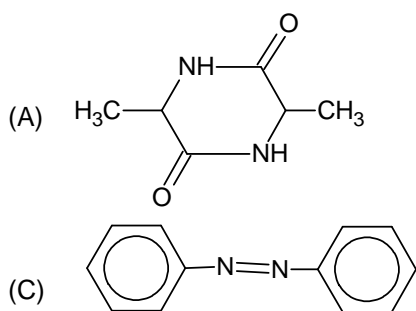


Space for Rough work

12. In the following reaction
- $$\text{CH}_3 - \text{C} \equiv \text{CH} \xrightarrow[\text{(ii) H}_2\text{O}_2/\text{OH}^-]{\text{(i) BH}_3\text{-THF}} \text{A}$$
- (Major product)
- the major product (A) is:
- (A) $\text{CH}_3 - \overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_3$ (B) $\text{CH}_3 - \text{CH}_2 - \text{CHO}$
- (C) $\text{CH}_3 - \overset{\text{OH}}{\text{C}} = \text{CH}_2$ (D) $\text{CH}_3\text{CH}_2\text{COOH}$
13. Which of the following electrolyte is most effective for the coagulation of $\text{Al}(\text{OH})_3$ sol?
- (A) Na_2SO_4 (B) $\text{K}_4[\text{Fe}(\text{CN})_6]$
- (C) KCl (D) Na_2CO_3
14. The vapour pressure of an ideal solution of two liquid A and B at 298 K is 200 mm. Mole fraction of liquid A in the vapour phase is 0.2 and in the liquid phase is 0.8. The vapour pressure of pure liquid B at 298 K is
- (A) 800 mm (B) 600 mm
- (C) 360 mm (D) 50 mm
15. Which of the following reaction does not take place in the Bessemer converter in the extraction of copper?
- (A) $2\text{FeS} + 3\text{O}_2 \longrightarrow 2\text{FeO} + 2\text{SO}_2$ (B) $\text{FeO} + \text{SiO}_2 \longrightarrow \text{FeSiO}_3$
- (C) $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \longrightarrow 6\text{Cu} + \text{SO}_2$ (D) $\text{FeS} + \text{Cu}_2\text{O} \longrightarrow \text{FeO} + \text{Cu}_2\text{S}$
16. Which of the compound on hydrolysis produces orthophosphoric acid?
- (A) POCl_3 (B) Ca_3P_2
- (C) P_4O_6 (D) PCl_3

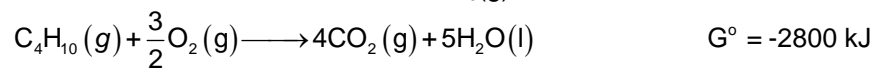
Space for Rough work

17. Which of the following compound is formed when chlorine is treated with hot and concentrated NaOH solution?
(A) NaClO_3 (B) NaOCl
(C) NaClO_4 (D) NaClO_2
18. The enthalpy of vapourisation of a liquid is 30 KJ mol^{-1} and entropy of vapourisation is $75 \text{ JK}^{-1} \text{ mol}^{-1}$. The boiling point of the liquid at 1 atm is
(A) 250 K (B) 400 K
(C) 450 K (D) 600 K
19. If the ionization energy of He^+ is $19.6 \times 10^{-18} \text{ J atm}^{-1}$, then the energy of first stationary state of Li^{2+} is
(A) $19.6 \times 10^{-18} \text{ J atm}^{-1}$ (B) $4.41 \times 10^{-18} \text{ J atm}^{-1}$
(C) $19.6 \times 10^{-19} \text{ J atm}^{-1}$ (D) $4.41 \times 10^{-17} \text{ J atm}^{-1}$
20. Which of the following compound cannot exhibit geometrical isomerism?



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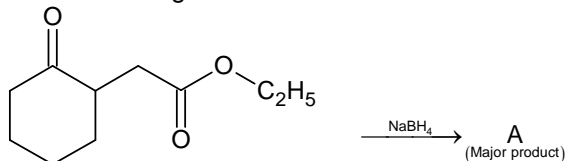
21. A fuel cell involves combustion of $C_4H_{10}(g)$ at 1 atm and 298 K



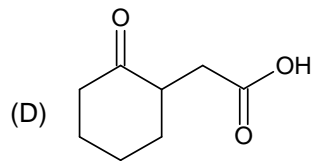
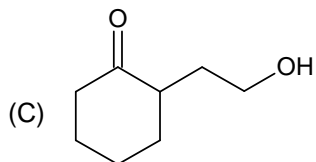
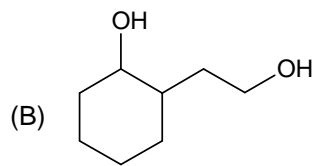
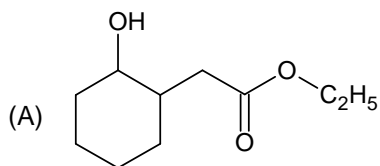
The E°_{cell} is

- (A) 1.11 V (B) 0.965 V
(C) 1.52 V (D) 0.65 V

22. In the following reaction



the major product (A) is

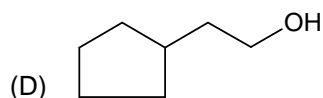
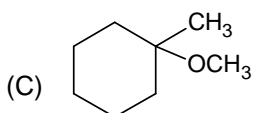
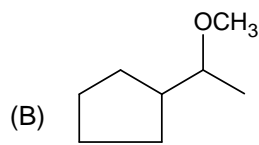
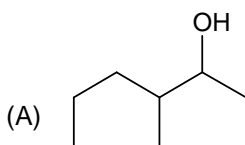
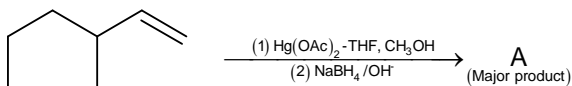


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23. In the following reaction
- $$\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CN} \xrightarrow[2. \text{H}_2\text{O}]{1. \text{AlH}(\text{i-Bu})_2} (\text{A})$$
- (Major product)
- the major product (A) is:
- (A) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{COOH}$
(B) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CHO}$
(C) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CHO}$
(D) $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_2 - \text{COOH}$
24. Which of the following reaction is correct?
- (A) $\text{PH}_4\text{I} + \text{KOH} \longrightarrow \text{KI} + \text{H}_2\text{O} + \text{PH}_3$
(B) $3\text{HgCl}_2 + \text{PH}_3 \longrightarrow 3\text{Hg} + \text{PCl}_3 + 3\text{HCl}$
(C) $\text{P}_4 + 8\text{SOCl}_2 \longrightarrow 4\text{PCl}_3 + \text{SCL}_4 + 4\text{SO}_2 + \text{S}$
(D) $3\text{CuSO}_4 + \text{PH}_3 \longrightarrow \text{H}_3\text{PO}_3 + 3\text{CuO} + 3\text{SO}_2$
25. The **incorrect** statement among the following is:
- (A) Nylon 6, 6 is a condensation polymer.
(B) Neoprene is a polymer of isoprene.
(C) Buna - N is a copolymer of 1,3-butadiene and acrylonitrile.
(D) Bakelite is a thermosetting polymer.
26. For a 1st order reaction $\text{A}(\text{g}) \longrightarrow 2\text{B}(\text{g}) + \text{C}(\text{s})$ the half-life is 45 min. The reaction is carried out taking certain mass of A(g) at constant temperature in a closed vessel in which it exerts a pressure of 200 mm. The total pressure of gaseous mixture after 90 min. will be
- (A) 50 mm (B) 250 mm
(C) 350 mm (D) 600 mm

Space for Rough work

27. In the following reaction



28. A metallic element crystallises in a simple cubic lattice. The edge length of the lattice is 3 \AA . The density of the metal is 8 g/cc . Number of unit cell in 216 g of the metal is

(A) 5×10^{23}

(B) 10^{23}

(C) 10^{24}

(D) 2×10^{21}

29. Standard enthalpy of neutralization of a strong acid and strong base is -13.7 kcal . The heat liberated when 50 ml of 0.01 M Ba(OH)_2 reacts with 20 ml of 0.01 M HCl is

(A) 2.74 cal

(B) 6.85 cal

(C) 5.48 cal

(D) 5.24 cal

30. The **incorrect** statement among the following is:

(A) $[\text{Ni}(\text{CN})_4]^{2-}$ is a square planar complex.

(B) $\text{Ni}(\text{CO})_4$ is diamagnetic in nature.

(C) $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an outer orbital complex.

(D) $[\text{CoF}_6]^{3-}$ is a high spin complex.

Space for Rough work

Mathematics**PART – III****SECTION – A****(Only One Option Correct Type)**

This section contains **30 multiple choice** questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. Equation of plane which is equally inclined to the planes $x + 2y + 2z - 10 = 0$ and $2x - y - 2z - 9 = 0$ and belongs to their family of planes is
(A) $3x + y + z - 20 = 0$ (B) $x - 3y - 4z + 1 = 0$
(C) $x + 3y - z - 8 = 0$ (D) none of these
2. Number of distinct straight lines which passes through origin and cuts the circle $x^2 + y^2 - 2x - 4y + 4 = 0$ at A and B such that $OA + OB = 3\sqrt{2}$, (where O is origin) is/are
(A) 0 (B) 1
(C) 2 (D) 3
3. 7th term of the sequence 1, 3, 9, 23, 53, 115 is
(A) 240 (B) 241
(C) 242 (D) 243
4. If the position vectors of points A and B with respect to origin O are $\vec{a} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - \hat{j} + \hat{k}$ respectively, then the projection of the vector $2\vec{a} + 3\vec{b} + 4(\vec{a} \times \vec{b})$ on a line perpendicular to the plane OAB is
(A) $2\sqrt{2}$ (B) $4\sqrt{2}$
(C) $8\sqrt{2}$ (D) $16\sqrt{2}$
5. If the variance of a set of observations is 16 and each observation is divided by 4, then variance of new set of observations is
(A) 16 (B) 8
(C) 4 (D) none of these

Space for Rough work

6. The only statement among the following that is a tautology is
 (A) $P \vee (P \wedge Q)$ (B) $P \wedge (P \vee Q)$
 (C) $(P \wedge (P \rightarrow Q)) \rightarrow Q$ (D) $Q \rightarrow (P \wedge (P \rightarrow Q))$
7. On a triangular base ABC, right angled at B, a pole is fixed at B. If the pole makes an angle 30° at A and 60° at C & $AC = \sqrt{30}$, then height of pole is
 (A) 2 (B) 3
 (C) 4 (D) 5
8. If $f(x) = \sec^{-1}(\sin(2 \tan^{-1}(x))) + \operatorname{cosec}^{-1}(\cos(2 \tan^{-1}(x)))$ has m values in its domain and n values in the range, then $(m + n)$ is
 (A) 4 (B) 5
 (C) 6 (D) none of these
9. Number of common normals to the circle $x^2 + y^2 - 4x + 4y = 0$ and a parabola with focus $(1, -1)$ and directrix $y = x + 2$ is/are
 (A) 0 (B) 1
 (C) 2 (D) 3
10. Two diagonals of a regular hexagon are selected at random. The probability that these diagonals intersect inside the hexagon is
 (A) $\frac{2}{3}$ (B) $\frac{5}{9}$
 (C) $\frac{4}{9}$ (D) none of these
11. Number of points in $[0, \pi]$, where $f(x) = \left[\frac{x \tan x}{\sin x + \cos x} \right]$ is non-differentiable is/are (where $[.]$ denotes the greatest integer function)
 (A) 0 (B) 4
 (C) 9 (D) none of these

Space for Rough work

12. An ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ is reflected about a line $\sqrt{5}x - y - 7 = 0$. The equation of the line which is parallel to $\sqrt{5}x - y - 7 = 0$ and tangent to the reflected curve is
- (A) $\sqrt{5}x - y + 7 = 0$ (B) $\sqrt{5}x - y + 14 = 0$
(C) $\sqrt{5}x - y - 14 = 0$ (D) none of these
13. The solution of the differential equation $\frac{dy}{dx} = e^{y+x} + e^{y-x}$ is
- (A) $e^{-y} = e^{-x} - e^x + c$ (B) $e^{-y} = e^x - e^{-x} + c$
(C) $e^{-y} = e^{-x} + e^x + c$ (D) none of these
14. Area bounded by $y = e^{x-2}$ and $y^2 - 4x - 2y + 9 = 0$ is
- (A) greater than $\frac{8}{3}$ square units (B) less than $\frac{8}{3}$ square units
(C) greater than $\frac{10}{3}$ square units (D) less than $\frac{1}{3}$ square units
15. In a ΔABC , r_1, r_2, r_3 are ex-radii and r is in-radius. If $r = 1$ and $r_1^2 + r_2^2 + r_3^2 + 27 = 6(r_1 + r_2 + r_3)$, then area of ΔABC is
- (A) 3 (B) $3\sqrt{3}$
(C) 9 (D) $9\sqrt{3}$
16. Letters of the word 'PENDENT' are arranged and words are formed. Number of words in which no E's as well as no N's are together are
- (A) 660 (B) 620
(C) 600 (D) 580

Space for Rough work

17. The value of $\sum_{m=1}^{\infty} \tan^{-1} \left(\frac{m^4 + m^2 + 2}{2m} \right)$ is
- (A) 0 (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{2}$ (D) none of these
18. If $\sum_{r=1}^n (r-1)(r+1) = \frac{(n+a)(n+b)(n+c)}{3}$, $a < b < c$, then $2a + 3b + 4c$ is
- (A) 6 (B) 7
(C) 8 (D) 9
19. If one root is three times the another root of the equation $x^2 + ax + f(a) = 0 \forall a \in \mathbb{R}$, then $f(4)$ is
- (A) 3 (B) 4
(C) 6 (D) 9
20. If $1, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the roots of $z^5 = 1$, then the value of $\left(\frac{i-\alpha_1}{i+\alpha_1} \right) \left(\frac{i-\alpha_2}{i+\alpha_2} \right) \left(\frac{i-\alpha_3}{i+\alpha_3} \right) \left(\frac{i-\alpha_4}{i+\alpha_4} \right)$ is
(where $i^2 = -1$)
- (A) 0 (B) 1
(C) 2 (D) none of these
21. The shortest distance of the point $(1, 0, 1)$ from a line which passes through $(1, 1, 1)$ and parallel to the plane $2x + 2y + z - 1 = 0$ is
- (A) $\frac{1}{3}$ (B) $\frac{2}{3}$
(C) 1 (D) $\frac{4}{3}$

Space for Rough work

22. Eccentricity of the hyperbola $3x^2 - 3y^2 + 8xy - 16x + 12y + 4 = 0$ is
(A) $\sqrt{2}$ (B) $\sqrt{3}$
(C) 2 (D) $\sqrt{5}$
23. Number of rational terms in the expansion of $(\sqrt{5} + \sqrt{3})^{1001}$ are
(A) 500 (B) 501
(C) 502 (D) none of these
24. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $B = \begin{bmatrix} p \\ q \end{bmatrix} \neq 0$ and $AB = B$ with $a + d = 500$, then $|A|$ is
(A) 501 (B) 500
(C) 499 (D) none of these
25. The value of $\int_{-1}^1 x \ln(1^x + 2^x + 3^x + 6^x) dx$ is
(A) $\ln 2 + \ln 3$ (B) $\frac{\ln 2 + \ln 3}{3}$
(C) $\ln 4 + \ln 9$ (D) $\frac{\ln 4 + \ln 9}{3}$

Space for Rough work

26. Let f be a polynomial function such that for all real x , $f(x^3 + 1) = x^6 + x^3 + 2$, then $\int_{-2}^2 f(x) dx$ is
- (A) $\frac{10}{3}$ (B) $\frac{20}{3}$
(C) $\frac{40}{3}$ (D) $\frac{50}{3}$
27. If $y = \sec^{-1}\left(\frac{\sqrt{x}+1}{\sqrt{x}-1}\right) + \sin^{-1}\left(\frac{\sqrt{x}-1}{\sqrt{x}+1}\right)$, then $\frac{dy}{dx}$ is equal to
- (A) 1 (B) 2
(C) 3 (D) 0
28. Angle between the tangents drawn from the origin to the circle $2x^2 + 2y^2 - 12x - 16y + 25 = 0$ is
- (A) $\frac{\pi}{3}$ (B) $\frac{\pi}{4}$
(C) $\frac{\pi}{6}$ (D) none of these
29. If $f(x) = x^3 - 3x^2 + 2x + 4$, then number of distinct real roots of $f(f(x)) = 4$ are
- (A) 1 (B) 2
(C) 3 (D) none of these
30. If $f(x) = x^3 + 2x^2 + 3 - 4 \sin x$ and $g(x)$ is the inverse of $f(x)$, then $g'(3)$ is equal to
- (A) $\frac{1}{2}$ (B) $-\frac{1}{2}$
(C) $\frac{1}{4}$ (D) $-\frac{1}{4}$

Space for rough work