# FIITJEE FARIDABAD

## RANK IMPROVEMENT TEST SERIES

# JEE -Main- 2020

## RITS – 22 CODE: 128150

*Time: 3 hours* *Maximum marks: 300*

## INSTRUCTIONS

**Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.**

### A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.

2. The Test Booklet consists of **75** questions. The maximum marks are **300.**

3. There are ***three*** parts in the question paper. **Part-I** consisting of **Chemistry, Part-II** consisting of **Physics &Part-III** consisting of **Mathematics.** Each question is allotted **4 (four)** marks for correct response.

4. Marking Scheme for All Two Parts:

**(i) Part-A (01-20) –** Contains Twenty (20) multiple choice objective questions which have four (4) options each and only one correct option. Each question carries **+4 marks** which will be awarded for every correct answer and **-1 mark** will be deducted for every incorrect answer.

**(i) Part-C (01-05)** contains Five (05) Numerical based questions with single digit integer as answer, ranging from 0 to 9 (both inclusive). Each question carries **+4 marks** which will be awarded for every correct answer and there will be no negative marking.

**Name of the Candidate:**______________________________________________

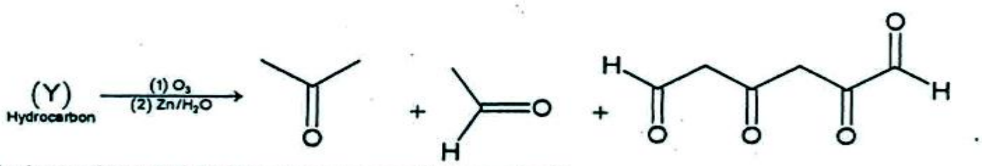
**Batch :**____________________ **Date of Examination** ____________________

**Enrolment Number :**______________________________________________

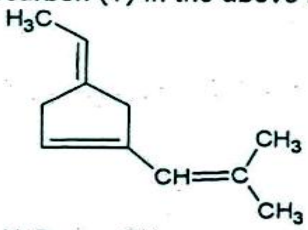
1. $ClCH_2CHCl_2 \xrightarrow[KOH/\Delta]{alcoholic} X$ (major product)

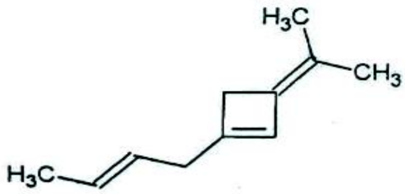
What will be the major product X of the above reaction?

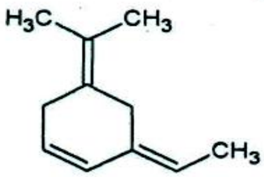
(A) CHCl = CHCl
(B) $CH_2 = CCl_2$
(C) $HC \equiv CH$
(D) $ClCH_2CHO$

2. 

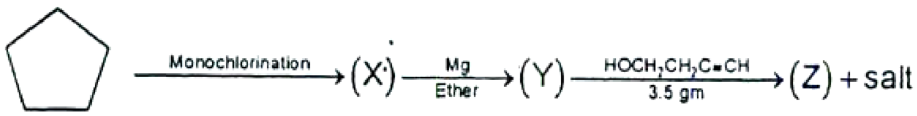
Hydrocarbon (Y) in the above reaction can be?

(A) 

(B) 

(C) 

(D) All of these

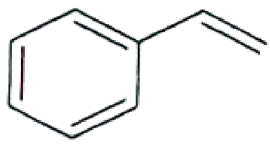
3. 

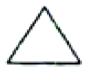
70 gm

The number of moles of (Z) produced would be (assuming the yield to be 100%)?

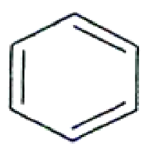
(A) 1
(B) 0.01
(C) 0.1
(D) 10 mol

4. Which of the following does not decolourise $Br_2$ water?

(A) 

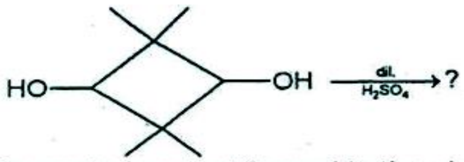
(B) 

(C) $HC \equiv CH$

(D) 

5. Monomer used to prepare orlon is:

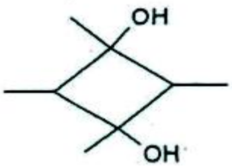
(A) $H_2C{=}CH{-}Cl$
(B) $F_2C{=}CF_2$
(C) $H_2C{=}CHCN$
(D) $H_2C{=}C(Cl){-}CH{=}CH_2$

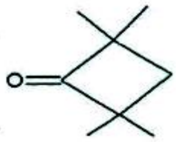
6. 

The major product formed in the above reaction is:

(A) 

(B) 

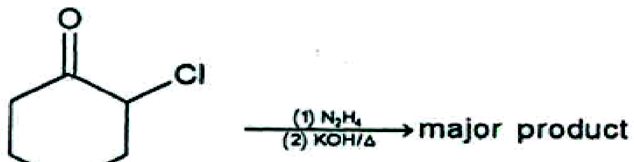
(C) 

(D) 

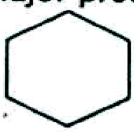
7. $CH_2 = C = CH_2 \xrightarrow{H_3O^+} ?$

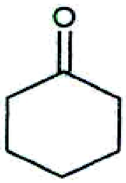
Select the correct statement(s) regarding the (major) product formed in the above reaction.

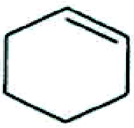
(A) It reduces Fehling's solution
(B) It is oxidised by Tollen's reagent
(C) It decolourises $Br_2 - CCl_4$
(D) It gives iodoform test

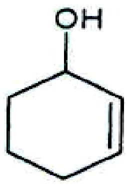
8. 

The major product formed in the given reaction is:

(A) 

(B) 

(C) 

(D) 

9. Which of the following method(s) does work for the preparation of secondary amine?

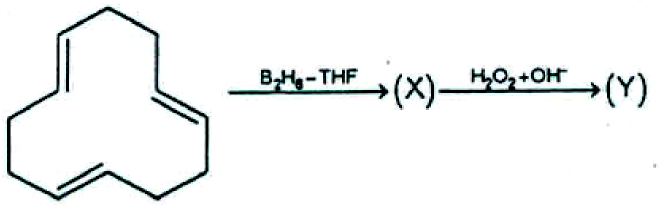
(A) $R_3N \xrightarrow[\text{(ii) } H_3O^+ \text{ (iii) } \Delta]{\text{(i) Br-CN}} ?$

(B) $R - \overset{\overset{O}{||}}{C} - NH - R' \xrightarrow{LiAlH_4} ?$

(C) $RNC \xrightarrow[\Delta]{Ni/H_2} ?$

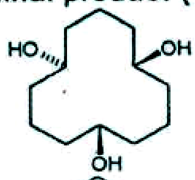
(D) All of these

10.

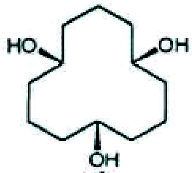


The final product (Y) is

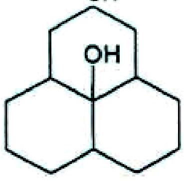
(A)



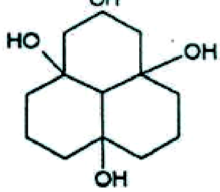
(B)



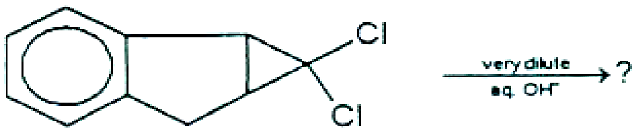
(C)



(D)

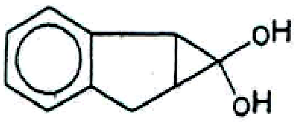


11.

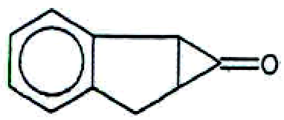


The major product is

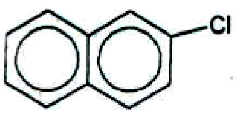
(A)



(B)

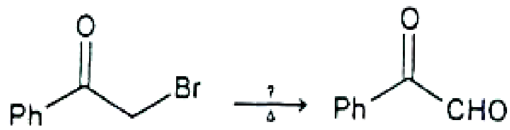


(C)



(D) None of these

12.



The reagent used in the above transformation is:

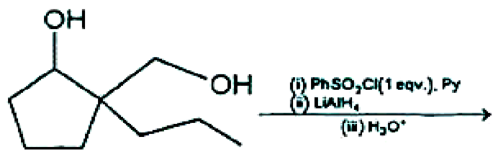
(A) $(CH_3)_2SO$

(B) $H-\overset{O}{\overset{\|}{C}}-N(CH_3)_2$

(C) Acetone

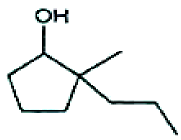
(D) $P_4O_{10}$

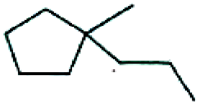
Space for rough work

13. 


The major product formed is:

(A) 


(B) 

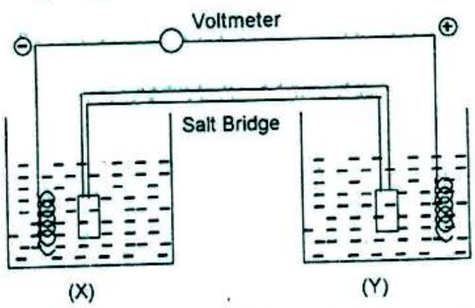

(C) 

(D) None of these

Given-

The cell potential for the unbalanced chemical reaction:

$Hg_2^{2+} + NO_3^- + H_3O^+ \longrightarrow Hg^{2+} + HNO_2 + H_2O + e^-$




Is measured under standard conditions in the electrochemical sell shown in the diagram were 0.02 V.

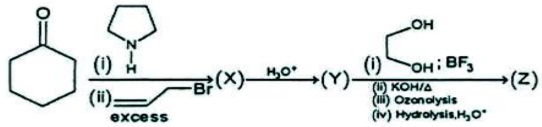
14. Choose the correct statement for the given cell diagram
(A) Compartment (X) has less pH than compartment (Y)
(B) (Y) compartment has acidic solution
(C) Current will flow from X → Y through internal supply
(D) $\Delta G°$ for the above cell reaction is more than 1 at the equilibrium

15. Equilibrium constant for cell reaction is:

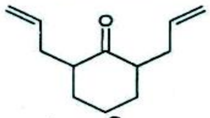
(A) $10^{3/2}$
(B) $e^{-\frac{3}{2}}$
(C) $e^{-\frac{2}{3}}$
(D) $10^{\frac{2}{3}}$

16. If same amount of charge (which is required for formation of 0.1 mol of $HNO_2$ in the above given cell) used for electrolysis 0.1 M, 1 L aqueous solution of $CuSO_4$. Then the volume of gases liberated at STP will be:
(A) 2.24 litre
(B) 5.6 litre
(C) 22.4 litre
(D) 11.2 litre

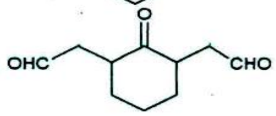
*Space for rough work*

17. 

Select the correct statements:

(A) (Y) is 

(B) (Z) has three carbonyl groups

(C) (Z) is 

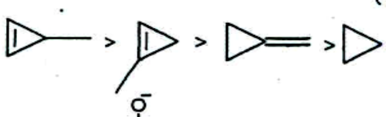
(D) Formation of (X) involves equilibrium mixture of the iminium salt and the acylated enamine

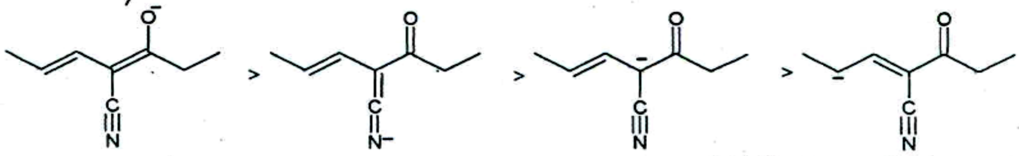
*Space for rough work*

18. Select the correct order with respect to the mentioned properties:

(A) $CH_3CH_2OH > (CH_3)_2CHOH > (CH_3)_2CDOH > (CH_3)_3C.OH$

(Ease of oxidation)

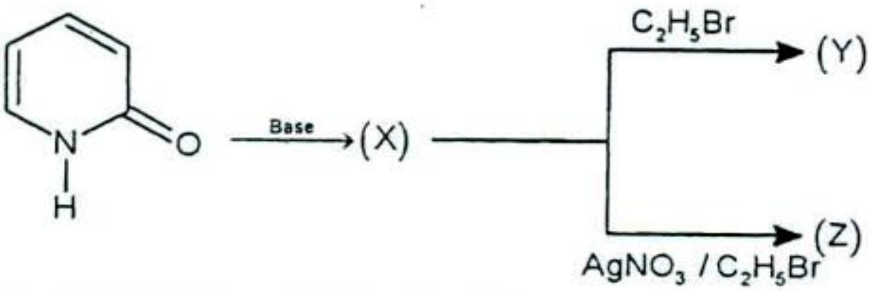
(B)  (Heat of hydrogenation)

(C) 

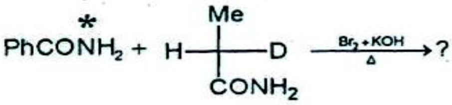
(stability of resonating structures)

(D) $PhSO_3H > PhCOOH > PhOH > PhCH_2\overset{+}{N}H_3$

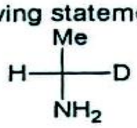
(acidic strength)

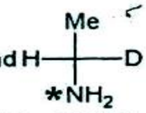
19. 

Select the correct statement(s) regarding X, Y and Z:

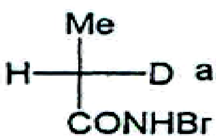
20. 

Which of the following statement(s) is/are correct regarding the given reaction:

(A) $Ph\overset{*}{N}H_2$ and  are produced

(B) Cross – over products $PhNH_2$ and  are also produced

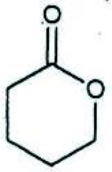
(C) Migration of –R (alkyl group) of R – $CONH_2$ takes place with retention of configuration.

(D) $PhCO\overset{*}{N}HBr$ and  are the intermediates formed

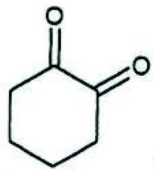
# Integer

1. Select the total number of methods to convert cyclohexanone into 1,2-cyclohexanedione.
(I) nitrous acid and (aqueous medium)
(II) $Br_2 + H_3O^+$; aqueous KOH; oxidation by $CrO_3$ in acetic acid
(III) aqueous NaOH + $\Delta$; ozonolysis
(IV) $SeO_2$
(V) NaCN + dilute $H_2SO_4$; $H_3O^+$; $\Delta$
(VI) $Br_2$ + KOH (aqueous); $\Delta$
(VII) $Br_2 + H_3O^+$; $N_2H_4$; KOH + $\Delta$; cold alkaline $KMnO_4$; $HIO_4$.

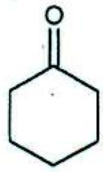
2. How many of the following compounds would undergo aldol condensation when treated with dilute aqueous caustic soda under suitable condition?

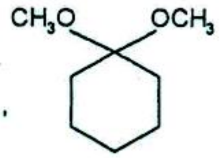


, 

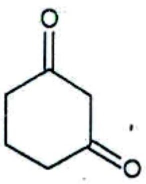
, 

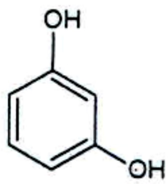
, $CH_3CHO$ , $PhCOCH_3$, $CH_3COCH_3$



, 

3. Find the total number of compounds which give yellow precipitate of iodoform when heated with $I_2$ and alkali?

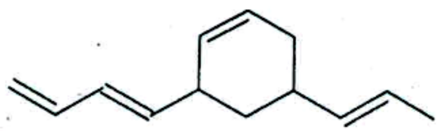
$PhCOCH_3$, $CH_2=CH-CHO$, 

, 

$CH_3CH(OH)CH_2CH(OH)CH_3$, $ICH_2COCH_3$, $CH_3CONH_2$, $CH_3COCH_2COCH_3$

4. What is the maximum number of moles of $CH_3MgCl$ that can be consumed by one mole of phosgene?

5. How many geometrical isomers (excluding enantiomers) are possible for the compound given below?



1. Two boats A and B move away from buoy anchored at the middle of a river along mutually perpendicular straight lines. The boat A moves along the river and the boat B across the river. Having moved off an equal distance from the buoy, the boats returned. Find the ratio $t_A/t_B$, where $t_A$ and $t_B$ are the time of motion of the boats A and B respectively, if the velocity of each boat with respect to water is 2 times greater than the stream velocity.
(A) $2/\sqrt{3}$ (B) $\sqrt{3}/2$ (C) 1 (D) $1/\sqrt{3}$

2. A massive platform of mass M is moving horizontally with speed v = 6 m/s. at t = 0, a body of mass m (m << M) is gently placed on the platform.
If coefficient of friction between the body and platform is μ = 0.3 and g = 10 m/s$^2$, then
(A) The body covers a distance of 3 m on the platform in the direction opposite to the motion of platform.
(B) The body covers a distance of 3 m on the platform in the direction of motion of the platform before coming to rest.
(C) The body covers a distance of 6 m on the platform in the direction opposite to themotion of platform.
(D) The body covers a distance of 6 m on the platform in the direction of motion of the platform before coming to rest.

3. A block is suspended vertically by an ideal spring of force constant K. If the block is pulled down by applying a constant force F and if maximum displacement of the block from its initial position of rest is δ, then
(A) $\frac{F}{K} < \delta < \frac{2F}{K}$ (B) $\delta = \frac{2F}{K}$
(C) $\delta = \frac{F}{K}$ (D) increase in potential energy of the spring is $\frac{1}{2}K\delta^2$

4. A ball strikes a wall with a velocity $\vec{u}$ at an angle θ with the normal to the wall surface and rebounds from it at an angle β with the surface. Then:
(A) $(\theta + \beta) > 90°$, if the wall is smooth(B) if the wall is smooth, coefficient of restitution = $\frac{\tan\beta}{\cot\theta}$
(C) if wall is smooth, coefficient of restitution $< \frac{\tan\beta}{\cot\theta}$(D) none of the above

5. A uniform rod AB of mass m and length ℓ is at rest on a smooth horizontal surface. A horizontal impulse P is applied to the end B perpendicular to the rod. The time taken by the rod to turn through a right angle is
(A) $\frac{12\pi m\ell}{P}$ (B) $\frac{\pi m\ell}{6P}$ (C) $\frac{5\pi m\ell}{12P}$ (D) $\frac{\pi m\ell}{12P}$

6. A cubical box of side L is filled with two liquids of densities ρ and 2ρ. Each liquid fills half the volume of the vessel. Then the net force on any one vertical side wall of the vessel due to liquid is. [Neglect atm pressure]
(A) $\frac{5}{8}\rho g L^3$ (B) $\rho g L^3$ (C) $\frac{1}{2}\rho g L^3$ (D) $\frac{1}{8}\rho g L^3$

7. A cylindrical vessel is filled with water upto height h. The vessel empties in time t sec. if the water is now filled upto height ηh, the vessel will be emptied in time
(A) ηt sec (B) $\eta^2$t sec (C) $\sqrt{\eta}$ t sec (D) t/η sec

***Space for rough work***

8. Two rods of identical dimensions, with Young's Moduli $Y_1$ and $Y_2$ are used to form a composite rod. The equivalent Young's Modulus for the composite rod is (if the composite rod is also having the same dimension as one of the original rod)

(A) $\frac{Y_1Y_2}{Y_1+Y_2}$ (B) $\frac{1}{2}\frac{Y_1Y_2}{Y_1+Y_2}$ (C) $\frac{1}{2}(Y_1+Y_2)$ (D) $Y_1+Y_2$

9. Two tuning forks A and B sounded together give 8 beats per second. With an air resonance tube closed at one end, the two forks give resonance when the two air columns are 32 cm and 33 cm respectively. What will be the frequencies of the two forks?

(A) 264 Hz, 256 Hz (B) 340 Hz, 358 Hz (C) 222 Hz, 300 Hz (D) 176 Hz, 184 Hz

10. Two vessels A and B of rigid walls contain ideal gas. The pressure, temperature and the volume in the vessels are $P_A, T_A, V$ and $P_B, T_B, V$ respectively. The vessels are now connected through a small tube. If P and T are the pressure and temperature when equilibrium is reached, then which of the following relation is correct?

(A) $\frac{P}{T}=\left[\frac{P_A}{T_A}+\frac{P_B}{T_B}\right]$ (B) $\frac{P}{T}=\frac{1}{2}\left[\frac{P_A}{T_A}+\frac{P_B}{T_B}\right]$ (C) $\frac{P}{T}=2\left[\frac{P_A}{T_A}+\frac{P_B}{T_B}\right]$ (D) $\frac{P}{T}=\frac{3}{2}\left[\frac{P_A}{T_A}+\frac{P_B}{T_B}\right]$

11. A fully charged capacitor has a capacitance C. it is distributed through a small coil of resistance wire embedded in a thermally insulated block of specific heat capacity s and mass m. if the temperature of the block is raised by $\Delta T$, the potential difference V across the capacitance is

(A) $\frac{ms\,\Delta T}{C}$ (B) $\sqrt{2\frac{ms\,\Delta T}{C}}$ (C) $\sqrt{2\frac{mC\,\Delta T}{s}}$ (D) $\frac{mC\,\Delta T}{s}$

12. A particle of mass $1\times10^{-26}$ kg and charge $+1.6\times10^{-19}$ C travelling with a velocity $1.28\times10^{6}$ m/s in the
x – direction enters a region in which a uniform electric field E and a uniform magnetic field of induction B are present such that $E_x = E_y = 0, E_z = -102.4$ kVm$^{-1}$ and $B_x = B_z = 0, B_y = 8\times10^{-2}$ Wb m$^{-2}$.
The particle enters this region at the origin at time t = 0. Co – ordinates of the particle (in meters) at time$t = 5\times10^{-6}$ sec is

(A) $(0, 0, 6.4)$ (B) $(0, 6.4, 0)$ (C) $(0, 0, 3.2)$ (D) $(6.4, 0, 0)$

13. Two infinitely long straight wires lie in the x – y plane along x and y axis, respectively. Each wire carries a current$I$, respectively, in positive direction of x and y axes. The locus of the points, where the magnetic field is zero, is

(A) $y^2 = x$ (B) $x = y^2$ (C) $x - y = 0$ (D) $x + y = 0$

14. An ac source of angular frequency ω is fed across a resistor R and a capacitor C in series. The current registered is $I$. If now the frequency of source is changed to ω/3 (but maintaining the same voltage), the current in the circuit is found to be halved. The ratio of reactance to resistance at the original frequency ω will be

(A) $\sqrt{\frac{3}{5}}$ (B) $\sqrt{\frac{5}{3}}$ (C) $\frac{3}{5}$ (D) $\frac{5}{3}$

15. A person uses $+1.5$ D glasses to have normal vision from 25 cm onwards. He uses a 20 D lens as a simple microscope to see an object. What will be the maximum magnifying power, is he uses the microscope together with his glasses

(A) 6 (B) 3 (C) 10 (D) 9

***Space for rough work***

16. A monochromatic radiation of wavelength $\lambda_1$ is incident on a stationary atom as a result of which the wavelength of the photon after the collision becomes $\lambda_2$. The atom has De Broglie's wavelength $\lambda_3$ and velocity in the direction of incident photon after collision. Then

(A) $\lambda_3 = \sqrt{\lambda_1\lambda_2}$ (B) $\lambda_1 = \frac{\lambda_2\lambda_3}{\lambda_2+\lambda_3}$ (C) $\lambda_1 = \sqrt{{\lambda_1}^2 + {\lambda_3}^2}$ (D) $\lambda_3 = \sqrt{{\lambda_1}^2 + {\lambda_2}^2}$

17. If a stationary electron gets annihilated due to the association with a stationary positron (hypothetically), the wavelength of the resulting radiation will be ($m_0$= rest mass of electron( or positron) , c=speed of light )

(A) $\frac{h}{m_0 c}$ (B) $\frac{2h}{m_0 c}$ (C) $\frac{h}{2m_0 c}$ (D) none of these

18. A radioactive sample has decay constant λ. The rate of production of nuclei in the given sample is $\frac{9\lambda N_0^2}{N}$, where $N_0$ is the number of radioactive nuclei in the sample at t = 0 and N is the number of radioactive nuclei in the sample at time t = t sec. Then the number of nuclei present in the radioactive sample at $t \to \infty$,

(given $N_0=10^6$ nuclei)

(A) $4 \times 10^6$ (B) $5 \times 10^6$ (C) $1 \times 10^6$ (D) $3 \times 10^6$

19. Consider the following data:

10 main scale division = 1 cm, 10 vernier division = 9 main scale division

Zero of the vernier scale is right of the zero marking of the main scale with 6 vernier divisions coinciding with the main scale divisions and the actual reading for length measurement is 4.3 cm with 2 vernier divisions coinciding with main scale graduations. Then the actual length is

(A) 4.26 cm (B) 4.32 cm (C) 4.38 cm (D) 4.60 cm

20. Which of the following statement regarding semiconductors is correct?

(A) An n – type semiconductor is a negatively charged semiconductor

(B) Photodiodes are preferably used in reverse bias mode, as small changes in electron and hole concentration are better detected in reverse bias mode

(C) The voltage – current variation graph for a diode has same units along positive and negative direction of the axis depicting current

(D) Threshold voltage for a germanium based diode is more than that of silicon based diode

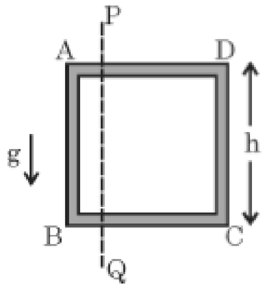
***Space for rough work***

## PART-C
## Integer Answer Type

*This section contains 5 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9.*

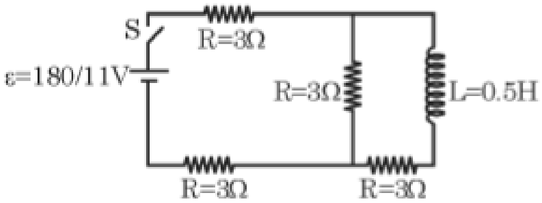
**1.** Suppose a hypothetical magnetic field exists in space $\hat{B} = B_0\hat{u}_r$ above the earth surface where $\hat{u}_r$ is a unit vector directed radially outward from origin. Origin is on surface of earth. A light charged particle has to perform uniform circular motion in the combined uniform (vertical) gravitational field of earth and magnetic field with speed v and radius r. Height of the plane of motion from earth surface will be $h = \frac{nv^2}{g}$. Find n.

**2.** ABCD is a square frame of conductor of electrical resistivity $\rho$.
The frame lies in a vertical plane. PQ is an imaginary boundary separating space into two parts. Left of PQ, a uniform gravitational field $\vec{g}$ exists (figure) whereas no gravitational field is present right of PQ. The electrical potential difference between A and B will be $\frac{k}{4}\frac{mgh}{e}$. e is charge on an electron and m is mass of electron. Find k.
(Given the square frame is fixed).

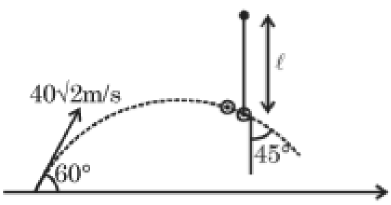



**3.** A shell of radius 1m is coated with a thin layer of $\beta^-$ active material. It's initial charge is zero and initial number of active atoms is $\frac{4}{3} \times 10^{12}$. If half life of decay is 1 hr and all the electron are emitted with an energy of 1.44 keV, find the time (in hr.) after which charge on the sphere becomes constant. Neglect the time taken by electron to return back.

**4.** In the circuit shown, find the current in Amp through the battery at t = 0.1 ln 2 sec, if switch is closed at t = 0.




**5.** A ball is projected with initial velocity $40\sqrt{2}$ m/s at an angle of 60° with horizontal as shown in figure. When its velocity is making an angle of 45° with downward vertical, it collides a vertically hanging ball of same mass and sticks to it as shown in figure. Find the maximum value of length $\ell$ (in m) of the string, so that the combined mass completes the vertical circle in subsequent motion.



1. The circles $z\bar{z}+z\bar{a}_1+\bar{z}a_1+b_1=0,\ b_1\in R$ and $z\bar{z}+z\bar{a}_2+\bar{z}a_2+b_2=0, b_2\in R$ will intersect orthogonally, if
(A) $\mathrm{Re}(a_1\bar{a}_2)=b_1+b_2$ (B) $\mathrm{Im}(a_1\bar{a}_2)=b_1+b_2$ (C) $2\,\mathrm{Re}(a_1\bar{a}_2)=b_1+b_2$ (D) $2\,\mathrm{Im}(a_1\bar{a}_2)=b_1+b_2$

2. Total number of positive integral solution of $x_1+x_2+x_3=24$ and $x_1^2+x_2^2=x_3^2$ is equal to
(A)1 (B)2 (C)4 (D) None of these

3. Let a, b, c, $c_1$, $a_1$, $e\in R$, all are distinct and satisfy the relations $a(b+c)^2+a_1bc+e=0$ and $a(b+c_1)^2+a_1bc_1+e=0$, then
(A) $a(c+c_1)=2(a+a_1)b$ (B) $acc_1=e-ab^2$ (C) $a(c+c_1)=(a+a_1)b$ (D) $acc_1=e+ab^2$

4. $\sum_{r=1}^{n} r({}^nC_r-{}^nC_{r-1})$ is equal to
(A)$2^n+n+1$ (B)$2^n-n+1$ (C)$n-2^n+1$ (D) $n-2^n-1$

5. Let $\vec{a}=\hat{i}+\hat{j},\vec{b}=2\hat{i}-\hat{k}$. Then the position vector of the point of intersection of the lines $\vec{r}\times\vec{a}=\vec{b}\times\vec{a}$ and $\vec{r}\times\vec{b}=\vec{a}\times\vec{b}$ is
(A) $3\hat{i}+\hat{j}-\hat{k}$ (B) $3\hat{i}-\hat{j}+\hat{k}$ (C) $3\hat{i}-\hat{j}-\hat{k}$ (D) None of these

6. $\vec{a},\vec{b}$ are two mutually perpendicular unit vectors and $\vec{c}$ be a unit vector that is inclined at an angle $\theta$ to both $\vec{a}$ and $\vec{b}$. If $\vec{c}=x_1\vec{a}+x_2\vec{b}+x_3(\vec{a}\times\vec{b})$, then
(A) $x_1=x_2+1$ (B) $x_2^2=-\cos\theta$ (C) $x_3^2=1-2x_1^2$ (D) $x_2^2=1-2x_3^2$

7. Range of f(x)=[$\cos^{-1}$\{x\}], where [.] and \{.\} denotes the greatest integer function and fractional part respectively, is
(A)\{0,1\} (B)\{0, 1, 2\} (C)\{0, 1, 2, 3\} (D) None of these

8. If $f(x+f(y))=f(x)+y,\ \forall x,y\in R$ and $f(0)=1$ then value of $f(7)$ is
(A)1 (B)7 (c)6 (D) 8

9. $a_n=\sum_{r=0}^{n-1}\left[x+\frac{r}{n}\right]$, where [.] denote the greatest integer function, then the value of $\lim_{n\to\infty}\frac{a_1+a_2+a_3+.....+a_n}{n^2}=$
(A)x (B)$\frac{x}{2}$ (C)$\frac{x}{3}$ (D) None of these

10. f(x)=$[x^2]-\{x\}^2$, where [.] and {.} denote the greatest integer function and fractional part respectively. Is
(A)Continuous at x = 1, -1 (B)Continuous at x = -1 but not at x = 1
(C)Continuous at x = 1 but not at x = -1 (D) Discontinuous at x = 1 and x = -1

11. $y=\frac{ax+b}{cx+d}$, then $2.\frac{dy}{dx}.\frac{d^3y}{dx^3}$ is equal to
(A)$\left(\frac{d^2y}{dx^2}\right)^2$ (B) $3.\frac{d^2y}{dx^2}$ (C) $3\left(\frac{d^2y}{dx^2}\right)^2$ (D) none of these.

***Space for rough work***

12. If the tangent to the curve xy+ax+by=0 at (1, 1) makes an angle $\tan^{-1}(2)$ with x-axis, Then $\frac{a+b}{ab}$ is equal to

(A) 1/2 (B) – 1/2 (C) 1 (D) -1

13. If a > b > 0, then maximum value of $\frac{ab(a^2-b^2)\sin x.\cos x}{a^2\sin^2 x+b^2\cos^2 x}$ in $x\in\left(0,\frac{\pi}{2}\right)$ is

(A) $\frac{a^2-b^2}{2}$ (B) $2(a^2-b^2)$ (C) $\frac{a^2+b^2}{2}$ (D) $2(a^2+b^2)$

14. $\int_{-\ell n3}^{\ell n3}\left|\frac{e^x-1}{e^x+1}\right|dx$ is equal to

(A) $\ell n\frac{4}{3}$ (B) $\ell n\frac{2}{3}$ (C) $2.\ell n\frac{4}{3}$ (D) $2.\ell n\frac{2}{3}$

15. If $\cos A=\frac{3}{4}$ , then the value of expression $32.\sin\frac{A}{2}.\sin\frac{5A}{2}$ is equal to

(A)11 (B)-11 (C) $\sqrt{11}$ (D) $-\sqrt{11}$

16. The exhaustive set of values of 'a' such that $x^2+ax+\sin^{-1}(x^2-4x+5)+\cos^{-1}(x^2-4x+5)=0$ has atleast one solution is

(A) $\left\{-2-\frac{\pi}{4}\right\}$ (B) $\left\{-\infty,-2-\frac{\pi}{4}\right\}$ (C) $\left(-\infty,-2-\frac{\pi}{4}\right]$ (D) $\left[-2-\frac{\pi}{4},-\infty\right)$

17. In acute angled triangle ABC, $r=r_2+r_3-r_1$ and $\angle B>\frac{\pi}{3}$ , then exhaustive range of $\frac{a-c}{b}$ is

( $r_1,r_2,r_3,r$ and s have usual meanings)

(A) $\left(\frac{1}{2},1\right)$ (B) $\left(\frac{1}{4},\frac{1}{2}\right)$ (C) $\left(\frac{1}{4},1\right)$ (D) $\left(\frac{1}{3},1\right)$

18. The combined equation of straight lines that can be obtained by reflecting the lines $y=|x-2|$ in the y-axis, is

(a) $y^2+x^2+4x+4=0$ (B) $y^2+x^2-4x+4=0$ (C) $y^2-x^2+4x-4=0$ (D) $y^2-x^2-4x-4=0$

19. Tangent drawn to $x^2+y^2=25$ at the point P(3,4) meets the circle $x^2+y^2=81$ at the points A and B, If the tangents drawn to $x^2+y^2=81$ at the points A and B intersect at C, then co-ordinates of 'C' is.

(A) $\left(\frac{243}{25},\frac{81}{25}\right)$ (b) $\left(\frac{243}{25},\frac{324}{25}\right)$ (C) $\left(\frac{243}{5},\frac{81}{25}\right)$ (D) None of these

20. If the circle $x^2+y^2+2ax+2by+c=0$ passes through exactly three quadrants and does not pass through origin, then

(A) $c>0,a^2>b^2$ (B) $c<0,a^2+b^2>2c$ (C) $c(a^2-c)(b^2-c)<0$ (D) $c>0,a^2>c,b^2>c$

***Space for rough work***

## PART-C

### Integer Answer Type

*This section contains 5 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9.*

**1.** Let $f(x) = \tan^{-1}x - \frac{2}{\pi}\left(\tan^{-1}x\right)^2 + \frac{4}{\pi^2}\left(\tan^{-1}x\right)^3 - \ldots\ldots\ldots$ upto infinite terms. If the equation $f^2(x) + (\sin^{-1}x)^2 = k$ posses a solution, then the number of integral values of k is

**2.** If $f : R \to R$ satisfies the functional equation $f(x) + f\left(1 - \frac{1}{x}\right) = \tan^{-1}x$, $\forall x \in R - \{0\}$ and let $N = \int_0^1 f(x)\,dx$, then least integer greater than or equal to N is

**3.** Let $y = f(x)$ be a thrice differentiable function defined on R such that $f(x) = 0$ has at least 5 distinct zeros, then minimum number of zeros of the equation $f(x) + 6f'(x) + 12f''(x) + 8f'''(x) = 0$ is

**4.** Let $N = 2^{2015} \times \dfrac{\int_0^1 x^{1007}(1-x)^{1007}\,dx}{\int_0^1 x^{1007}\left(1-x^{2016}\right)^{1007}\,dx}$, then the number of divisors of N of the form $4n + 2$, $(n \in N)$ is

**5.** A certain kind of bacteria either die, split into two or split into three bacteria. All splits are exact copies. The chances of dying is $\frac{1}{4}$, the chances of splitting into two is $\frac{1}{2}$ and splitting into three is $\frac{1}{4}$. If the probability that it survives for infinite length of time is $\frac{m-\sqrt{13}}{n}$ $(m, n \in N)$, then the value of $(m+n)$ is

***Space for rough work***

# RITS-22

# JEE MAINS-2020

# ANSWER KEY

# Code:128150

| CHEMISTRY | | PHYSICS | | MATHEMATICS | |
|---|---|---|---|---|---|
| 1 | B | 1 | **A** | 1 | **C** |
| 2 | D | 2 | **D** | 2 | **B** |
| 3 | C | 3 | **B** | 3 | **D** |
| 4 | D | 4 | **B** | 4 | **C** |
| 5 | C | 5 | **D** | 5 | **A** |
| 6 | A | 6 | **A** | 6 | **C** |
| 7 | D | 7 | **C** | 7 | **A** |
| 8 | C | 8 | **A** | 8 | **A** |
| 9 | D | 9 | **A** | 9 | **B** |
| 10 | B | 10 | **B** | 10 | **D** |
| 11 | C | 11 | **B** | 11 | **C** |
| 12 | A | 12 | **D** | 12 | **A** |
| 13 | B | 13 | **C** | 13 | **A** |
| 14 | B | 14 | **A** | 14 | **C** |
| 15 | D | 15 | **D** | 15 | **A** |
| 16 | A | 16 | **B** | 16 | **A** |
| 17 | C | 17 | **A** | 17 | **D** |
| 18 | C | 18 | **D** | 18 | **D** |
| 19 | B | 19 | **A** | 19 | **B** |
| 20 | A | 20 | **B** | 20 | **D** |
| 1 | 3 | 1 | **1** | 1 | **5** |
| 2 | 5 | 2 | **3** | 2 | **2** |
| 3 | 7 | 3 | **2** | 3 | **2** |
| 4 | 3 | 4 | **2** | 4 | **5** |
| 5 | 8 | 5 | **4** | 5 | **7** |