VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main Home Practice Test - 10 | JEE - 2024

Date: 18/01/2024 **Maximum Marks: 300**

Timing: 10:00 AM to 1:00 PM **Duration : 3.0 Hours**

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Parts** (Part I: **Physics**, Part II: **Chemistry**, Part III: **Mathematics**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.
4. **Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. You will NOT be allowed to attempt the sixth question. If you wish to attempt any other question apart from the five already attempted, then you will have to delete any one response from the five previously answered and then proceed to answer the new one.**

   The answer to each question should be **rounded off to the nearest integer**.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. 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**.

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

Syllabus

Physics: Full Syllabus

Chemistry: Full Syllabus

Mathematics: Full Syllabus

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

PART - I : PHYSICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. A neutron beam, in which each neutron has same kinetic energy, is passed through a sample of hydrogen like gas (but not hydrogen) in ground state and at rest. Due to collision of neutrons with the ions of the gas, ions are excited and then they emits photons. Six spectral lines are obtained in which one of the lines is of wavelength $(6200/51)$ nm,. Which gas is this?

(A) H **(B)** He^{+} **(C)** Li^{+2} **(D)** Bi^{+3}

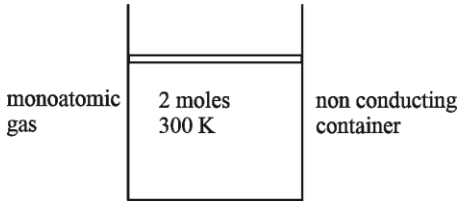
2. What is the angle of incidence of a light ray on an equilateral prism of refractive index $\mu = \sqrt{2}$ for which light will suffer minimum deviation.

(A) 60° **(B)** 30° **(C)** 45° **(D)** 90°

3. *n* drops of water, each of radius 2 mm, fall through air at a terminal velocity of 8 cm/s. If they coalesce to form a single drop, then the terminal velocity of the combined drop is 32 cm/s. The value of *n* is:

(A) 5 **(B)** 6 **(C)** **7** **(D)** 8

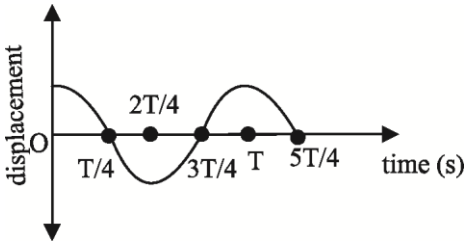
4. Two moles of a monoatomic gas at 300 K are kept in a non conducting container enclosed by a piston. Gas is now compressed to increased the temperature from 300 K to 400 K. Work done by the gas is $\left(R = \frac{25}{3} J/mol - K\right)$.



(A) 3000 J **(B)** –3000 J **(C)** 2500 J **(D)** –2500 J

SPACE FOR ROUGH WORK

5. The displacement time graph of a particle executing SHM is given in figure:
(sketch is schematic and not to scale)



Which of the following statements is/are true for this motion?

I. The force is zero at $t = \frac{3T}{4}$

II. The acceleration is maximum at $t = T$

III. The speed is maximum at $t = \frac{T}{4}$

IV. The P.E. is equal to K.E. of the oscillation at $t = \frac{T}{2}$

(A) (II), (III), and (IV) **(B)** (I) and (IV)
(C) (I), (II) and (IV) **(D)** (I), (II) and (III)

6. MATCH LIST I WITH LIST II

	List I		**List II**
a.	Potential (V)	(i)	$\left[M^{-1}L^{-2}T^{4}A^{2}\right]$
b.	Capacitance (C)	(ii)	$\left[M^{1}L^{1}T^{-2}A^{-2}\right]$
c.	Permeability of free space (μ_0)	(iii)	$\left[ML^{2}T^{-3}A^{-1}\right]$
d.	Electric field (E)	(iv)	$\left[M^{1}L^{1}T^{-3}A^{-1}\right]$

Choose the correct answer from the options given below

(A) $(a)\rightarrow(ii),\ (b)\rightarrow(iii),(c)\rightarrow(i),(d)\rightarrow(iv)$

(B) $(a)\rightarrow(iii),\ (b)\rightarrow(i),(c)\rightarrow(ii),(d)\rightarrow(iv)$

(C) $(a)\rightarrow(i),\ (b)\rightarrow(iv),(c)\rightarrow(iii),(d)\rightarrow(ii)$

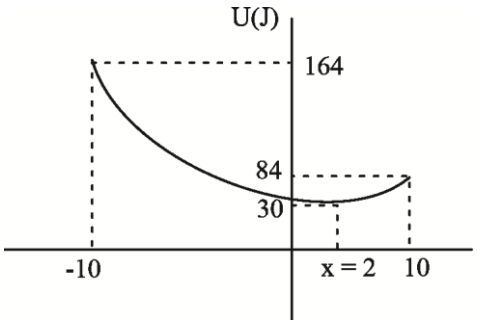
(D) $(a)\rightarrow(iv),\ (b)\rightarrow(iii),(c)\rightarrow(ii),(d)\rightarrow(i)$

SPACE FOR ROUGH WORK

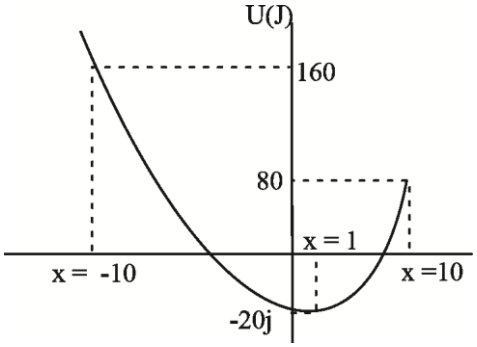
7. A single conservative force $F(x)$ acts on a 1.0 kg particle that moves along *x*-axis the potential energy $U(x)$ is given by $U(x)=20+(x-2)^2$

Where *x* is in meter. At $x=5.0\,m$ the particle has kinetic energy of 20 J. Which of the following represent the best plot of $U(x)$ as a function of *x* for $-10m \le x \le 10\,m$.

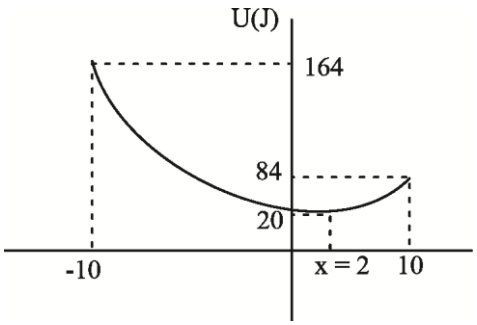
(A)



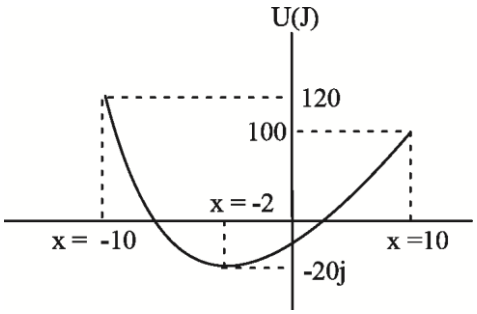
(B)



(C)



(D)



8. An series *LCR* circuit is resonating with a source whose emf varies with time as described in diagram-1. If we replace source by another source whose emf varies with time according to diagram-2, then:

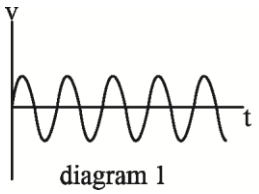


diagram 1

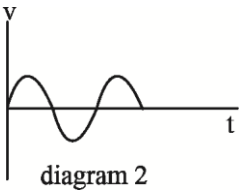


diagram 2

(A) For getting resonance again, decrease *R*

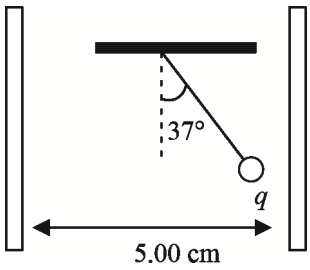
(B) Current will remain in phase with source voltage

(C) For getting resonance again, decrease *C*

(D) Current will lead source voltage after replacing the source

SPACE FOR ROUGH WORK

9. A small sphere with mass 1.2 gm hangs by a thread between two parallel vertical plates 5.00 cm apart. The plates are insulating and have uniform surface charge densities $+\sigma$ and $-\sigma$. The charge on the sphere is $q = 9\times10^{-6}C$. What potential difference between the plates will cause the thread to assume an angle of 37° with the vertical as shown in figure.



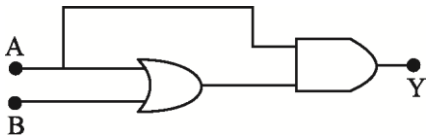
(A) 30 V **(B)** 12 V

(C) 50 V **(D)** 25 V

10. A cylindrical tank is filled with water to level of 3m. A hole is opened at height of 52.5 cm from bottom the ratio of the area of the cylinder is to area of hole is 10. The square of the speed with which water is coming out from the orifice is (take $g = 10\,ms^{-2}$)

(A) $50m^2s^{-2}$ **(B)** $49m^2s^{-2}$ **(C)** $51.5m^2s^{-2}$ **(D)** $50.5m^2s^{-2}$

11. Find the truth table for the function *Y* of *A* and *B* represented in the following figure.



(A)

A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

(B)

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	1

(C)

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

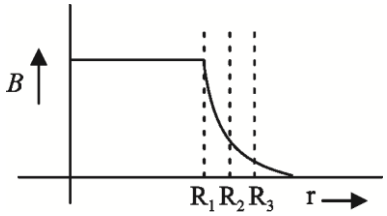
(D)

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

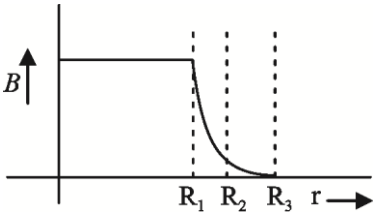
SPACE FOR ROUGH WORK

12. A coaxial cable is made up of two conductors. The inner conductor is solid and is of radius R_1 and the outer conductor is hollow of inner radius R_2 and outer radius R_3. The space between the conductors is filled with air. The inner and outer conductors are carrying currents of equal magnitudes and in opposite directions. Then, the variation of magnetic field with distance from the axis is best plotted as:

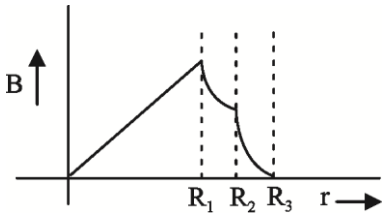
(A)



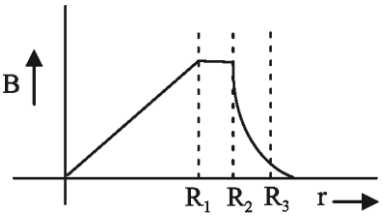
(B)



(C)



(D)



13. Four particles, each of mass *M*, move along a circle of radius *R* under the action of their mutual gravitational attraction. The speed of each particle is:

(A) $\frac{GM}{R}$

(B) $\sqrt{2\sqrt{2}\frac{GM}{2}}$

(C) $\sqrt{\frac{GM}{R}\left(2\sqrt{2}+1\right)}$

(D) $\sqrt{\frac{GM}{R}\left(\frac{2\sqrt{2}+1}{4}\right)}$

SPACE FOR ROUGH WORK

14. During a rainy day, rain is falling vertically with a velocity 2m/s. A boy at rest starts his motion with a constant acceleration of $2m/s^2$ along a straight road. If the angle of the axis of umbrella with vertical is changed at such a rate that relative to the boy rain always falls parallel to the axis of the umbrella. Find the rate at $t = \frac{1}{2}s$.

(A) $\left(\frac{3}{5}\right)rad/s$ **(B)** $\left(\frac{4}{5}\right)rad/s$ **(C)** $\left(\frac{6}{5}\right)rad/s$ **(D)** $\left(\frac{8}{5}\right)rad/s$

15. Five point charges $(+q\,each)$ are placed at the five vertices of a regular hexagon of side 2*a*. What is the magnitude of net electric field at the centre of hexagon?

(A) $\frac{q}{4\pi \in_0 a^2}$ **(B)** $\frac{q}{16\pi \in_0 a^2}$ **(C)** $\frac{\sqrt{2}q}{4\pi \in_0 a^2}$ **(D)** $\frac{5q}{16\pi \in_0 a^2}$

16. An experiment measures quantities *x*, *y*, *z* and then *t* is calculated from the data as $t = \frac{xy^2}{z^3}$. If percentage errors in *x*, *y* and *z* are respectively $1\%, 3\%, 2\%,$ then percentage error in *t* is:

(A) 10% **(B)** 4% **(C)** 7% **(D)** 13%

SPACE FOR ROUGH WORK

17. A block of mass m is pulled by a constant power P placed on a rough horizontal plane. The friction coefficient between the block and surface is μ. The maximum velocity of the block is:

(A) $\frac{\mu P}{mg}$ **(B)** $\frac{P}{\mu mg}$ **(C)** $\frac{P}{2\mu mg}$ **(D)** $\frac{P}{4\mu mg}$

18. Two satellites of the same mass are launched in the same orbit around the earth so as to rotate opposite to each other. If they collide inelastically and stick together as wreckage, the total energy of the system just after collision is:

(A) $-\frac{2GMm}{r}$ **(B)** $-\frac{GMm}{r}$ **(C)** $\frac{GMm}{2r}$ **(D)** $\frac{GMm}{4r}$

19. A particle of mass m initially at rest is acted upon by a unidirectional force $F = F_0 \cos\left(\frac{\pi}{2}t\right)$. The distance travelled by the particle when it stops first in the subsequent motion is:

(A) $\frac{2F_0}{m\pi}$ **(B)** $\frac{4F_0}{m\pi^2}$ **(C)** $\frac{8F_0}{m\pi^2}$ **(D)** $\frac{2F_0}{m\pi^2}$

20. A copper coil has a resistance of 20.0Ω at 0°C and a resistance of 26.4Ω at 80°C. The temperature coefficient of resistance of copper is:

(A) $3\times10^{-3}{}^{\circ}C^{-1}$ **(B)** $4\times10^{-3}\,^{\circ}C^{-1}$ **(C)** $5\times10^{-3}\,^{\circ}C^{-1}$ **(D)** $1.5\times10^{-4}\,^{\circ}C^{-1}$

SPACE FOR ROUGH WORK

SECTION-2

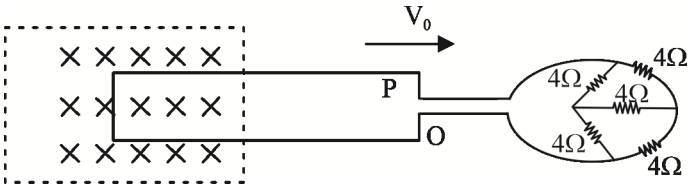
Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

1. A body of mass '*m*' and radius *R* is rolling without sliding on an inclined plane. If the velocity of the body at bottom of inclined is 10 m/s and the kinetic energy of body at the top of the inclined is half of the kinetic energy at bottom of inclined, then the moment of inertia of the body is $\frac{xmR^2}{2}$, then the value of *x* is_____.

2. The difference in the number of waves when yellow light propagates through air and vaccum columns of the same thicknenss is two. The thickness of the air column is _____*mm* (refractive index of air $\mu_a = 1.0003$) (wavelength of yellow light in vaccum $= 6000\text{Å}$).

3. Air is filled at 60°C in a vessel of open mouth. The vessel is heated to a temperature T so that 1/4th part of air escapes. Assuming the volume of vessel remaining constant, the values of T is.

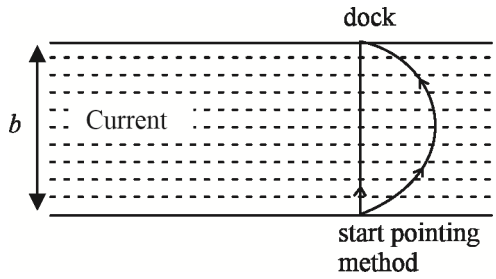
4. A square metal wire loop of side 10 cm and resistances 1Ω is moved with constant velocity v_0 in a uniform magnetic field of induction $B = 2Wbm^{-2}$, as shown in figure. The magnetic field lines are perpendicular to the plane of loop and directed into the paper. The loop is connected to the network of resistance, each of value 4Ω. The resistance of the lead wires is negligible. The speed of the loop so as to have a steady current of 1 mA in the loop is *x* mm/s then the value of *x* is _____.



5. A particle executes SHM with an amplitude 8 cm and a frequency $10\,s^{-1}$. Assuming the particle to be at a displacement 4 cm initially, in the positive direction. Then its maximum velocity is $+x\pi\, m/s$ where the value of *x* is _____.

SPACE FOR ROUGH WORK

6. Suppose you are anchored near the shore of a channel in which there is steady current, and you are going to run your (motor) boat with a constant $v_{br} = 'v'$ (speed of boat with respect to water) to a dock directly across the channel on the opposite shore. The way in which one might steer the boat to the dock is POINTING method. In pointing method keep the nose of the boat pointed directly at the dock. Velocity of boat with respect to water is '*v*' and velocity of water is '*u*'. Width of water channel is '*b*'. the time taken by boat to reach the dock is $\frac{xbv}{\left(v^2-u^2\right)}$, then the value of *x* is _____.



7. For the circuit shown, the value of current at time $t = 4s$ will be _____A.

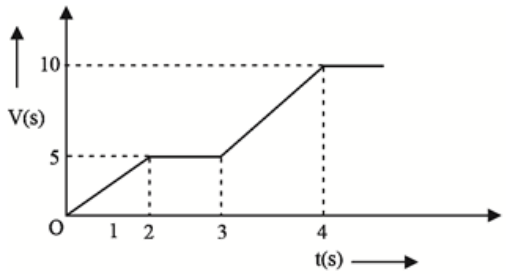


Figure 1

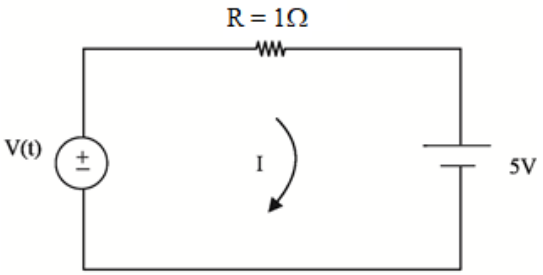
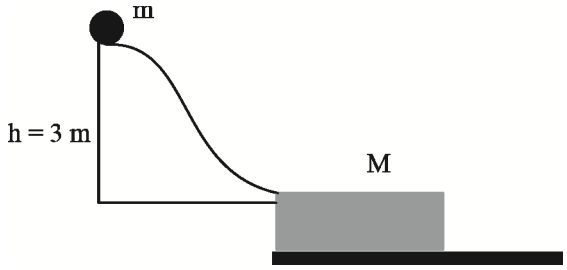


Figure 2

[Voltage distribution V(t) is shown by figure (1) and the circuit is shown in figure. (2).

SPACE FOR ROUGH WORK

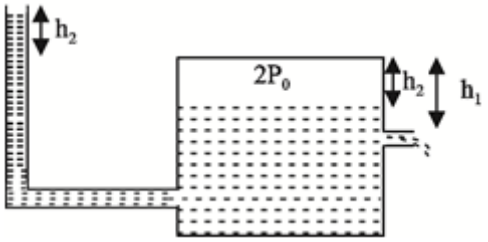
8. A small disc of mass 5 kg slides down a smooth hill of height 3 m without initial velocity and gets onto a plank of mass 10 kg lying on a smooth horizontal plane at the base of hill figure. Due to friction between the disc and the plank, disc slows down and finally moves as one piece with plank.



Total work performed by friction in this process is $-10xJ$, then the value of x is _____.

9. Two cylinders A and B fitted with pistons contains equal amounts of an ideal diatomic gas at 300 K. The piston of A is free to move while that of B is held fixed. The same amount of heat is given to the gas in each cylinder. If the rise in temperature of the gas in A is 30 K, then the rise in temperature of the gas in B is.

10. Figure shows a large closed cylindrical tank containing water. Initially, the air trapped above the water surface has a height h_2 and pressure $2P_0$ where P_0 is the atmospheric pressure. There is a hole in the wall of the tank at a depth h_1 below the top from which water comes out. A long vertical tube is connected as shown. The distance of water surface in the long tube from the top of the tank is xh_1 when the water stops coming out of the hole. The value of x is _____ .



SPACE FOR ROUGH WORK

PART - II : CHEMISTRY 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. How many moles of AgCl would be obtained, when 100 mL of 0.1 M $Co(NH_3)_5Cl_3$ is treated with excess of $AgNO_3$? [Van't Hoff factor (i) for complex is 3]

(A) 0.01 **(B)** 0.02 **(C)** 0.03 **(D)** 0.04

2. On heating $ZnCl_2.2H_2O$, the compound obtained is:

(A) $ZnCl_2$ **(B)** $Zn(OH)Cl$ **(C)** $Zn(OH)_2$ **(D)** Zn

3. The order of electron gain enthalpy (magnitude) of O, S and Se is:

(A) $O > S > Se$ **(B)** $S > Se > O$ **(C)** $Se > S > O$ **(D)** $S > O > Se$

4. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$, the compounds with the greatest and the least ionic character, respectively are:

(A) LiCl and RbCl **(B)** RbCl and $BeCl_2$

(C) RbCl and $MgCl_2$ **(D)** $MgCl_2$ and $BeCl_2$

5. H-bonding is maximum in:

(A) C_6H_5OH **(B)** C_6H_5COOH

(C) CH_3CH_2OH **(D)** CH_3COCH_3

SPACE FOR ROUGH WORK

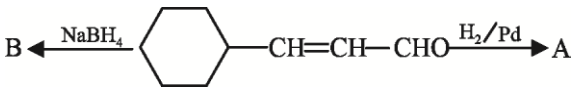
6. In which of the following arrangements the order is not according to the property indicated against it?

(A) Li < Na < K < Rb : increasing metallic radius

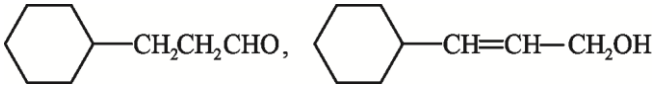
(B) I < Br < F < Cl : increasing electron gain enthalpy (with negative sign)

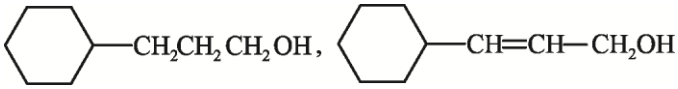
(C) B < C < N < O : increasing first ionization enthalpy

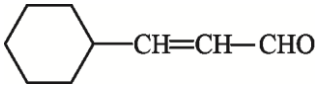
(D) $Al^{3+} < Mg^{2+} < Na^{+} < F^{-}$: increasing ionic size

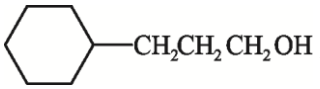
7. 

A and B are respectively:

(A) 

(B) 

(C) 

(D) 

8. The half-life of the reaction, $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$ is 2.1 h at 30°C. Starting with 10 g of N_2O_5, how many grams of N_2O_5 will remain after a period of 7 h? (Take ln 2 = 0.7)

(A) 5 g **(B)** 1 g **(C)** 8 g **(D)** 9 g

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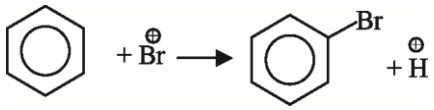
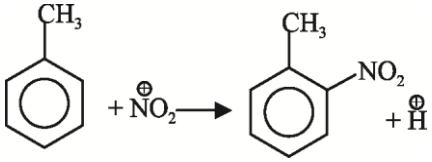
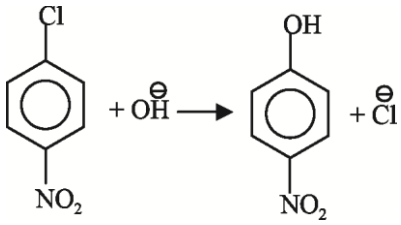
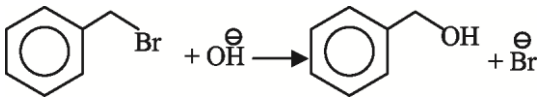
9. Which of the following reaction is S_N2Ar reaction?

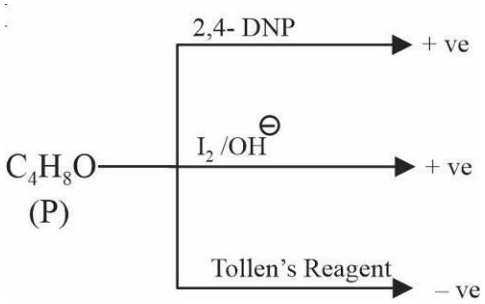
(A) 

(B) 

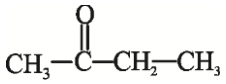
(C) 

(D) 

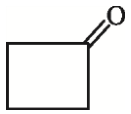
10.



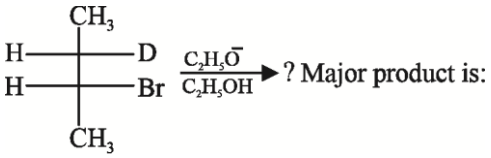
Identify 'P'.

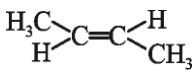
(A) 

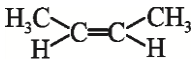
(B) $CH_3-CH_2-CH_2-CHO$

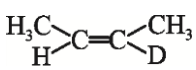
(C) 

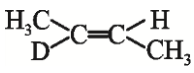
(D) 

11. 

(A) 

(B) 

(C) 

(D) 

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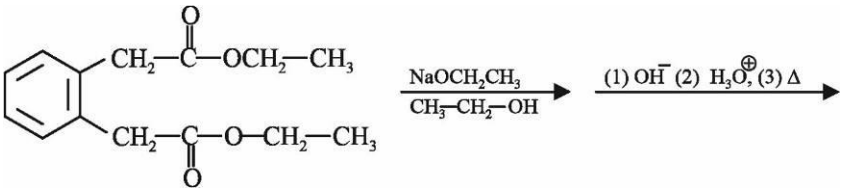
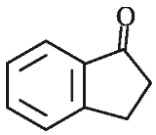
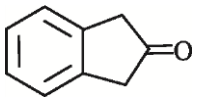
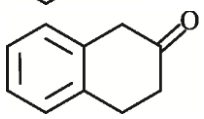
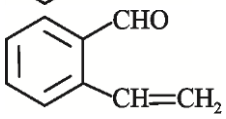
12. What is the final product of this sequence of reactions?



(A) 

(B) 

(C) 

(D) 

13. Which one of the following reactions does not occur?

(A) $F_2 + 2Cl^- \longrightarrow 2F^- + Cl_2$ **(B)** $Cl_2 + 2F^- \longrightarrow 2Cl^- + F_2$

(C) $Br_2 + 2I^- \longrightarrow 2Br^- + I_2$ **(D)** $Cl_2 + 2Br^- \longrightarrow 2Cl^- + Br_2$

14. If $\lambda^{\infty}_{eq}(NaCl)$, $\Lambda^{\infty}_{eq}(KCl)$ and $\lambda^{\infty}_{eq}K_2SO_4$ are 123.7, 147.0 and 152.1 $\Omega^{-1}cm^2eq^{-1}$ then $\lambda^{\infty}_{eq}(Na_2SO_4)$ would be

(A) $128.8\,\Omega^{-1}cm^2eq^{-1}$ **(B)** $257.6\,\Omega^{-1}cm^2eq^{-1}$

(C) $105.5\,\Omega^{-1}cm^2eq^{-1}$ **(D)** $118\,\Omega^{-1}cm^2eq^{-1}$

15. Concentrated nitric acid oxidizes phosphorous (P_4) into:

(A) PH_3 **(B)** P_2O_5 **(C)** H_3PO_3 **(D)** H_3PO_4

SPACE FOR ROUGH WORK

16. Cellulose on hydrolysis yields.

(A) $\beta - D - Fructose$ **(B)** $\alpha - D - Glucose$

(C) $\beta - D - Glucose$ **(D)** $\alpha - D - Fructose$

17. The yellow colour of chromate changes to orange on acidification due to formation of:

(A) Cr^{3+} **(B)** Cr_2O_3 **(C)** $Cr_2O_7^{2-}$ **(D)** CrO_4^-

18. Which of the following methods is not used for the conversion of carboxylic acids into acid halides?

(A) $RCOOH + SOCl_2 \longrightarrow$ **(B)** $RCOOH + PCl_5 \longrightarrow$

(C) $RCOOH + Cl_2 \longrightarrow$ **(D)** $RCOOH + PCl_3 \longrightarrow$

19. **Statement - I :** CH_3MgBr is prepared in cold aqueous solution.

Statement - II : Water molecule reacts with Grignard Reatent.

(A) Statement-I is True, Statement-II is True ; Statement-II is a correct explanation for Statement-I

(B) Statement-I is True, Statement-II is True; Statement-II is NOT a correct explanation for Statement-I

(C) Statement -I is False, Statement -II is True

(D) Statement -I and Statement -II both are False

20. Across the lanthanide series, the basicity of the lanthanide hydroxides:

(A) Increases **(B)** Decreases

(C) First increases and then decreases **(D)** Does not change

SPACE FOR ROUGH WORK

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

1. Electromagnetic radiation of wavelength 242 nm is just sufficient to ionize Sodium atom. Then the ionization energy of Sodium in kJ mol^{-1} is_____. (Round off to nearest integer)

2. 1 M NH_4OH and 1M HCl are mixed to make total volume of 300 mL. If pH of the mixture is 9.26, $pK_a\,[NH_4^+] = 9.26$ and volume ratio of NH_4OH and HCl is x : y. Find x + y?

3. The number of species having non-linear shape among the following is:
$I_3^-, I_3^+, PbCl_2, XeF_2$

4. In a first order reaction the reacting substance has half-life period of ten minutes. If fraction of the substance left is $\frac{1}{x}$ of initial concentration after 50 minute the reaction has occurred. Then write the value of 'x'. (Integer answer)

5. The volume of 1.5 M H_3PO_4 solution required to neutralize exactly 90 mL of a 0.5 M $Ba(OH)_2$ solution is (in ml).

SPACE FOR ROUGH WORK

6. The conductivity of a saturated solution of $BaSO_4$ is $3.06\times10^{-6}\ ohm^{-1}cm^{-1}$ and its equivalent conductance is $1.53 ohm^{-1}cm^2\ equiv^{-1}$. If the K_{sp} for $BaSO_4$ will be 10^{-a} then write the value of 'a'.

7. The equilibrium constant, K_p for the reaction : $2SO_2(g)+O_2(g)\rightleftharpoons 2SO_3(g)$ is $4.0\,atm^{-1}$ at 1000 K. The partial pressure of O_2 is $\frac{1}{b}$. If at equilibrium the amount of SO_2 and SO_3 is the same. Write the value of b.

8. The number of geometrical isomer of $\left[Co(NH_3)_3(NO_3)_3\right]$ are:

9. A solution of x moles of sucrose in 100 grams of water freezes at $-0.22°C$. As ice separates the freezing point goes down to –0.25°C. How many grams of ice would have separated?

10. A reaction has $\Delta H=-33\,kJ$ and $\Delta S=-58\,J/K$. This reaction would be spontaneous below T temperature. Write the value of T (in Kelvin) {Nearest integer}

SPACE FOR ROUGH WORK

PART - III : MATHEMATICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. Let $f : R \to R$ be differentiable function such that

$$f(x+y)=\frac{f(x)+f(y)}{1-f(x)\,f(y)}$$

$f\left(\frac{\pi}{4}\right)=0$. Then, the value of $\sum_{k=1}^{10}\frac{1}{\cos(k+1)\cos\left(k+f\left(k\pi\right)\right)}$.

(A) $\sin(10)\sec(1)\sec^2 1$ **(B)** $\sin(11)\cos(10)\sin^2 1$

(C) $\sin(10)\sec(11)\sec(1)\cos ec(1)$ **(D)** $\sin(11)\cos(10)\cos ec^2(1)$

2. Let the mean and standard deviation of frequency distribution.

x:	$x_1=3$	$x_2=4$	$x_3=5$	$x_4=7$
f:	p	2	3	q

be 5 and $\sqrt{2.2}$ respectively. If x_4 is changed from 7 to 8, then the mean for the new data will be:

(A) 5.2 **(B)** 4.3 **(C)** 5.3 **(D)** 2.4

3. Area bounded by curve $y^2=x$ and the line $x=y+2$ is :

(A) $\frac{5}{2}$ **(B)** $\frac{7}{2}$ **(C)** $\frac{9}{2}$ **(D)** $\frac{11}{2}$

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4. A circle has *x*-intercept and *y*-intercept equal to $2\sqrt{2}$ and $2\sqrt{5}$ respectively, also its centre lies on the line $x+y=3$ then the radius of circle is:

(A) $\sqrt{3}$ **(B)** $\sqrt{7}$ **(C)** $\sqrt{6}$ **(D)** $\sqrt{8}$

5. Consider the vectors $\vec{a}=2\hat{i}+\hat{j}-2\hat{k}$ and $\vec{b}=3\hat{i}-\hat{j}+\hat{k}.$ A parallelogram is constructed such that its diagonal are along $2\vec{a}-\vec{b}$ and $\vec{a}-2\vec{b}.$ The area of the parallelogram is :

(A) $9\sqrt{5}\,sq.units$ **(B)** $\frac{9\sqrt{10}}{2}\,sq.units$

(C) $9\sqrt{10}\,sq.units$ **(D)** $18\sqrt{5}\,sq.units$

6. If $\tan\frac{\pi}{9}, A, 2\cot\frac{2\pi}{9}$ are in A.P. then value of $\frac{4A+\tan\frac{\pi}{18}}{\tan\frac{4\pi}{9}}$ is equal to:

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

7. $\lim\limits_{x\to 0}\frac{x^2\left(\sqrt[4]{1+\sin^6 x}-\sqrt[4]{1-\sin^6 x}\right)}{\sqrt{1+\sin^8 x}-\sqrt{1-\sin^8 x}}$ is equal to:

(A) $\frac{5}{2}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{3}{2}$ **(D)** None of these

8. In a parallelogram *ABCD*, vertices *A* and *C* are $(-2,3)$ and $(4,-1)$ also vertex *B* is the point of intersection of line $x+y-5=0$ and $2x+3y-12=0$ then diagonal *BD* passes through the point.

(A) $(3,2)$ **(B)** $(2,3)$ **(C)** $(2,1)$ **(D)** $(1,2)$

9. Two diagonals of a parallelogram are along the lines $3x+4y-7=0$ and $2x-3y+1=0$. If the equation of one of the sides of the parallelogram is $x+7y-25=0$, then equation of side opposite to this is :

(A) $x+7y-9=0$ **(B)** $x+7y+9=0$

(C) $x+7y+3=0$ **(D)** $x+7y-6=0$

SPACE FOR ROUGH WORK

10. Let $f:[0,\infty)\to[-1,1]$ be a function defined by $f(x)=\begin{cases}\min\{\cos t: 0\le t\le x\}, & 0\le x\le 2\pi\\ \cos x, & x>2\pi\end{cases}$

Then which of the following is true?

(A) f is continuous everywhere but non differentiate at two points in $(1,\infty)$

(B) f is discontinuous and non differentiable exactly at one points in $(0,\infty)$

(C) f is discontinuous at one point and NOT differentiable exactly at two points in $(0,\infty)$

(D) f is discontinuous and non-differentiable exactly at two points in $(0,\infty)$

11. The equation of a circle whose diameter is the common chord of the circle $x^2+y^2-4x-8y-5=0$ and $x^2+y^2-12x+2y+29=0$ is :

(A) $41x^2+41y^2-396x-38y+781=0$

(B) $2x^2+2y^2-16x-6y+25=0$

(C) $41x^2+41y^2+396x-38y-781=0$

(D) $17x^2+17y^2-300x+154y+901=0$

12. Let $y=y(x)$ be the solution of the differential equation $\frac{dy}{dx}=\frac{y\left(1+x^2\right)}{x\left(1-x^2\right)}$, $x>\frac{3}{2}$.If $y(2)=2$, then $y(3)$ is equal to :

(A) $\frac{8}{9}$ **(B)** $\frac{9}{8}$ **(C)** 3 **(D)** None of these

SPACE FOR ROUGH WORK

13. The point $P(a,b)$ undergoes the following three transformations successively:

(I) Reflection about the line $y=-x$

(II) Translation through 3 units along the positive direction of x-axis

(III) Rotation through angle $\frac{\pi}{2}$ about the origin in the anti-clockwise direction. If the coordinates of the final position of the point P are $(1,1)$ then the value of $a+2b$ is :

(A) 7 **(B)** 5 **(C)** 9 **(D)** 13

14. A possible value of 'r', for which the fifth term in the expansion of $\left\{a^{\log_a \sqrt[8]{9^{r-1}+2}}+b^{\frac{1}{4}\log_b\left(3^r+2\right)}\right\}^{12}$ in increasing power of $b^{\frac{1}{4}\log_b\left(3^r+2\right)}$ is 3135 (given $a,b>1$):

(A) -1 **(B)** 1 **(C)** 0 **(D)** 2

15. Let Z be the set of integers and a relation R on Z be defined by $R=\left\{(x,y)\in Z\times Z:\left[(3x+y)^2-(x+3y)^2=0\right]\right\}$ Then the relation R is :

(A) Reflexive and symmetric, but not transitive

(B) Reflexive but neither symmetric nor transitive

(C) Symmetric but neither reflexive nor transitive

(D) An equivalence relation

16. Let $f(x)=27^{12\sin x-9\cos x}.81^{9\cos^3 x-12\sin^3 x}$ and Range of $f(x)$ is $[A,B]$. If $\sqrt[15]{A}$ and $\sqrt[15]{B}$ are the roots of quadratic equation $ax^2+bx+c=0$ then the value of $3b+10a$ is equal to :

(A) 13 **(B)** 9 **(C)** 7 **(D)** None of these

SPACE FOR ROUGH WORK

17. In a series of 8 matches between two teams, an unbiased coin is tossed in every match, then smallest value of '*n*' such that probability of winning a toss by a particular team atmost '*n*' times is greater than $\frac{1}{2}$ is:

(A) 1 **(B)** 4 **(C)** 5 **(D)** 3

18. For real numbers a and $b \neq 0$, if straight lines $\frac{x-2}{1}=\frac{y-a}{3}=\frac{z-2}{2}, \frac{x+1}{2}=\frac{y-b}{3}=\frac{z-2}{1}$ and $\frac{x-1}{2}=\frac{y-1}{4}=\frac{z}{4}$ are concurrent at a point then value of $2a-b$ is:

(A) 3 **(B)** 7 **(C)** 5 **(D)** 9

19. Let C be he set of all complex numbers.

Let $S_1=\{z \in C;|z-1|=2\}, S_2=\{z \in C;|z-3|=2\}, S_3=\{z \in C; z(1+i)+\bar{z}(1-i) \geq 14\}$

Then the minimum value of $|z_1-z_2|^2$ for $z_1 \in S_1 \cap S_2$ and $z_2 \in S_3$ is equal to :

(A) $\frac{5+\sqrt{3}}{\sqrt{2}}$ **(B)** $\frac{5-\sqrt{3}}{\sqrt{2}}$ **(C)** $\frac{2\sqrt{3}-5}{\sqrt{2}}$ **(D)** $\frac{2\sqrt{3}+5}{\sqrt{2}}$

20. Let $g:(m,n) \to R$ be thrice differentiable function such that $g(x)=\int_a^x f(t)dt$ for a differentiable function $f(x)$. If $g(x)=0$ has exactly 6 distinct roots in (m,n), then $f(x).f'(x)f''(x)=0$ has at least:

(A) Seven roots in (m,n) **(B)** Twelve roots in (m,n)

(C) Three roots in (m,n) **(D)** Five roots in (m,n)

SPACE FOR ROUGH WORK

SECTION-2

Section 2 contains 10 Numerical Value Type Questions Out of which ONLY 5 (any) questions have to be attempted. The answer to each question should be **rounded off to the nearest integer**.

1. The number of real roots of the equation $x^4 - x^3 - 4x^2 - x + 1 = 0,$ where $(x > 0)$ is equal to _____.

2. If $\lim\limits_{n\to\infty} \sum\limits_{k=1}^{n+1} \tan^{-1}\left(\frac{1}{2k^2}\right) = \lambda,$ then $[\lambda]$ is equal to (where $[\cdot]$ denotes greatest integer function)

3. Suppose that *a, b, c, d* are positive real numbers satisfying $(a+c)(b+d) = ac + bd,$ then the smallest possible value of $\frac{a}{b} + \frac{b}{c} + \frac{c}{d} + \frac{d}{a}$ is:

4. Z is a complex number $z = \frac{(4\sin\theta - i)}{(3 - i\sin\theta)}, \theta \in \left(0, \frac{\pi}{2}\right), z = \overline{z}$ then the value of $4\left(\sin^2\theta + \cos^2 3\theta\right)$ is:

5. Let *n* be a non-negative integer. Then the number of divisors of the form "$4n+2$" of the number of $(14)^4 (20)^3 (11)^1$ is :

SPACE FOR ROUGH WORK

6. Let $(1+x)^n = 3+\frac{8}{3}+\frac{80}{3^3}+\frac{240}{3^4}+.....,\ x,\ n \in R$. Then the sum of the series $3+\frac{8}{3}+\frac{80}{3^3}+\frac{240}{3^4}+.....$ is.

7. Let $X = \left\{n \in N / n^2 - 160n + 1500 \le 0\right\}$, $Y = \left\{4k+1 / k \in N\right\}$ and $Z = \left\{5k / k \in N\right\}$, then sum of all the elements of the set $\left(Y - Z\right) \cap X$ is equal to _____.

8. Let $y = f\left(x\right)$ be the solution of the differential equation $e^x\left(dy - dx\right) + e^{-x}\left(dy + dx\right) = 0$, if $y\left(0\right) = \log_e 2$ then the value of $2 \times e^{f\left(\log_e 2\right)}$ is equal to_____.

9. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ and $B = A + A^2 + A^3 + ... + A^{10}$ then the sum of $B_{21} + B_{31} + B_{32}$ is equal to (B_{ij} represents element of i^{th} row and j^{th} column in B)_____.

10. If $\int_0^{\pi/2} \left(\cos^3 x\right) e^{-\sin x} dx = m - n\int_0^1 te^{-t} dt$ then value of $m+n$ is equal to _____.

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••• End of JEE Main Home Practice Test - 10 [JEE - 2024] •••