

# Studentpad

JEE-MAIN 2021-22

Time : 90 Min

Pre : Full Portion Paper

Marks : 120

01) The line L given by  $\frac{x}{5} + \frac{y}{b} = 1$  passes through the point (13, 32). The line K is parallel to L and has the equation  $\frac{x}{c} + \frac{y}{3} = 1$ . Then, the distance between L and K is

- 1)  $\frac{17}{\sqrt{15}}$
- 2)  $\sqrt{17}$
- 3)  $\frac{23}{\sqrt{15}}$
- 4)  $\frac{23}{\sqrt{17}}$

02) The transverse displacement Y (x, t) of a wave on a string is given by  $y(x, t) = e^{-(ax^2 + bt^2 + 2\sqrt{ab}xt)}$ . This represents a

- 1) Wave moving in -x direction with speed  $\sqrt{\frac{b}{a}}$
- 2) Wave moving in + x direction with speed  $\sqrt{\frac{a}{b}}$
- 3) Standing wave of frequency  $\frac{1}{\sqrt{b}}$
- 4) Standing wave of frequency  $\sqrt{b}$

03) According to molecular orbital theory, which of the following will not be a viable molecule ?

- 1)  $\text{He}_2^+$
- 2)  $\text{He}_2^{2+}$
- 3)  $\text{H}_2^-$
- 4)  $\text{H}_2^{2-}$

04) A stream of electrons from a heated filament was passed between two charged plates kept at a potential difference V esu. If e and m are charge and mass of an electron, respectively, then value of  $h/\lambda$  (where,  $\lambda$  is wavelength associated with electron wave) is given by

- 1) 2 meV
- 2) mev
- 3)  $\sqrt{2 \text{ meV}}$
- 4)  $\sqrt{\text{meV}}$

05)  $\int_{\pi/4}^{3\pi/4} \frac{dx}{1 + \cos x}$  is equal to

- 1) 4
- 2) 2
- 3) -2

4) -1

06) A galvanometer having a coil resistance of  $100 \Omega$  gives a full scale deflection when a current of 1 mA is passed through it. The value of the resistance which can convert this galvanometer into ammeter giving a full scale deflection for a current of 10 A, is

- 1)  $0.01 \Omega$
- 2)  $0.1 \Omega$
- 3)  $2 \Omega$
- 4)  $3 \Omega$

07) A signal of 5 kHz frequency is amplitude modulated on a carrier wave of frequency 2MHz. The frequencies of the resultant signal is/are

- 1) 2 MHz only
- 2) 2000 kHz and 1995 kHz
- 3) 2005 kHz 2000 kHz and 1995 kHz
- 4) 2005 KHz and 1995 kHz

08) Let  $\alpha, \beta$  be real and z be a complex number. If  $z^2 + \alpha z + \beta = 0$  has two distinct roots on the line  $\text{Re}(z) = 1$ , then it is necessary that

- 1)  $|\beta| = 1$
- 2)  $\beta \in (-1, 0)$
- 3)  $\beta \in (1, \infty)$
- 4)  $\beta \in (0, 1)$

09) In a large building, there are 15 bulbs of 40 W, 5 bulbs of 100 W, 5 fans of 80 W and 1 heater of 1 kW. The voltage of the electric mains is 220 V. The minimum capacity of the main fuse of the building will be

- 1) 14 A
- 2) 12 A
- 3) 10 A
- 4) 8 A

10) If the tangent at (1, 7) to the curve  $x^2 = y - 6$  touches the circle  $x^2 + y^2 + 16x + 12y + c = 0$ , then the value of c is

- 1) 185
- 2) 195
- 3) 85
- 4) 95

11) Given,  $E_{\text{Cl}_2/\text{Cl}^-}^0 = 1.36 \text{ V}$ ,  $E_{\text{Cr}^{3+}/\text{Cr}}^0 = -0.74 \text{ V}$

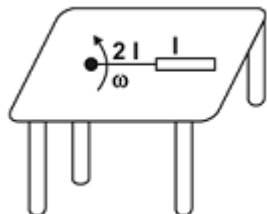
$E_{\text{Cr}_2\text{O}_7^{2-}/\text{Cr}^{3+}}^0 = 1.33 \text{ V}$ ,  $E_{\text{MnO}_4^-/\text{Mn}^{2+}}^0 = 1.51 \text{ V}$

Among the following, the strongest reducing agent

is

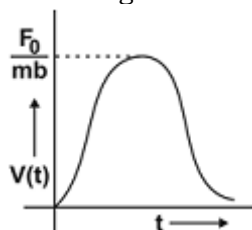
- 1) Cr
- 2)  $\text{Cr}^{3+}$
- 3)  $\text{Mn}^{2+}$
- 4)  $\text{Cl}^-$

12) A metallic rod of length  $l$  is tied to a string of length  $2l$  and made to rotate with angular speed  $\omega$  on a horizontal table with one end of the string fixed. If there is a vertical magnetic field  $B$  in the region, the emf induced across the ends the rod is

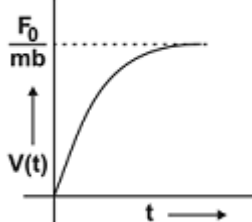


- 1)  $\frac{5B\omega l^2}{2}$
- 2)  $\frac{4B\omega l^2}{2}$
- 3)  $\frac{3B\omega l^3}{2}$
- 4)  $\frac{2B\omega l^3}{2}$

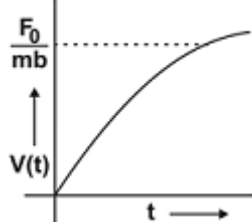
13) A particle of mass  $m$  is at rest at the origin at time  $t = 0$ . It is subjected to a force  $F(t) = F_0 e^{-bt}$  in the  $x$  direction. Its speed  $v(t)$  is depicted by which of the following curves?



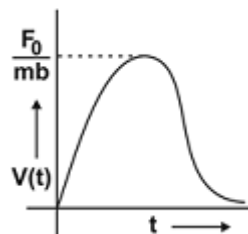
1)



2)



3)



4)

14) The half-life period of a first order chemical reaction is 6.93 min. The time required for the completion of 99% of the chemical reaction will be ( $\log 2 = 0.301$ )

- 1) 23.03 min
- 2) 230.3 min
- 3) 46.06 min
- 4) 460.6 min

15) Distance between two parallel planes  $2x + y + 2z = 8$  and  $4x + 2y + 4z + 5 = 0$  is

- 1)  $\frac{9}{2}$
- 2)  $\frac{7}{2}$
- 3)  $\frac{5}{2}$
- 4)  $\frac{3}{2}$

16) The hybridization of orbitals of N atom in  $\text{NO}_3^-$ ,  $\text{NO}_2^+$  and  $\text{NH}_4^+$  are respectively

- 1)  $sp^2$ ,  $sp^3$ ,  $sp$
- 2)  $sp^2$ ,  $sp$ ,  $sp^3$
- 3)  $sp$ ,  $sp^3$ ,  $sp^2$
- 4)  $sp$ ,  $sp^2$ ,  $sp^3$

17) A particle has an initial velocity  $3\hat{i} + 4\hat{j}$  and an acceleration of  $0.4\hat{i} + 0.3\hat{j}$ . Its speed after 10 s is

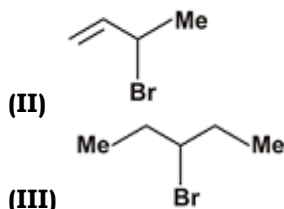
- 1) 7 units
- 2)  $7\sqrt{2}$  units
- 3) 10 units
- 4) 8.5 units

18) A man grows into a giant such that his linear dimensions increase by a factor of 9. Assuming that his density remains same, the stress in the leg will change by a factor of

- 1)  $\frac{1}{9}$
- 2)  $\frac{1}{81}$
- 3) 81
- 4) 9

19) Consider the following bromides





The correct order of  $S_N1$  reactivity is

- 1) (II) > (III) > (I)
- 2) (III) > (II) > (I)
- 3) (II) > (I) > (III)
- 4) (I) > (II) > (III)

20) Question contain Statement I and Statement II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement I: When ultraviolet light is incident on a photocell, its stopping potential is  $V_0$  and the maximum kinetic energy of the photoelectrons is  $K_{max}$ . When the ultraviolet light is replaced by X-rays, both  $V_0$  and  $K_{max}$  increase.

Statement II: Photoelectrons are emitted with speeds ranging from zero to a maximum value because of range of frequencies present in the incident light.

- 1) Statement I is true, Statement II is true; Statement II is not the correct explanation of Statement I.
- 2) Statement I is true, Statement II is true; Statement II is the correct explanation of Statement I.
- 3) Statement I is false, Statement II is true.
- 4) Statement I is true, Statement II is false.

21) The area of the region described by  $A = \{(x, y) : x^2 + y^2 \leq 1 \text{ and } y^2 \leq 1 - x\}$  is

- 1)  $\frac{\pi}{2} + \frac{4}{3}$
- 2)  $\frac{\pi}{2} + \frac{2}{3}$
- 3)  $\frac{\pi}{2} - \frac{2}{3}$
- 4)  $\frac{\pi}{2} - \frac{4}{3}$

22) For the non-stoichiometric reaction  $2A + B \rightarrow C + D$ , the following kinetic data were obtained in three separate experiments, all at 298 K.

	Initial concentration (A)	Initial concentration (B)	Initial rate of formation of C ( $\text{mol L}^{-1} \text{S}^{-1}$ )
(i)	0.1 M	0.1 M	$1.2 \times 10^{-3}$
(ii)	0.1 M	0.2 M	$1.2 \times 10^{-3}$
(iii)	0.2 M	0.1 M	$2.4 \times 10^{-3}$

The rate law for the formation of C is

- 1)  $\frac{dC}{dt} = K[A][B]^2$
- 2)  $\frac{dC}{dt} = K[A]^2[B]$

$$3) \frac{dC}{dt} = K[A][B]$$

$$4) \frac{dC}{dt} = K[A]$$

23) A compound with molecular mass 180 is acylated with  $\text{CH}_3\text{COCl}$  to get a compound with molecular mass 390. The number of amino groups present per molecule of the former compound is

- 1) 6
- 2) 5
- 3) 4
- 4) 2

24) In the context of the Hall-Heroult process for the extraction of Al, which of the following statements is false?

- 1)  $\text{Al}_2\text{O}_3$  is mixed with  $\text{CaF}_2$  which lowers the melting int of the mixture and brings conductivity
- 2) CO and  $\text{CO}_2$  are produced in this process
- 3)  $\text{Al}^{3+}$  is reduced at the cathode to form Al
- 4)  $\text{Na}_3\text{AlF}_6$  serves as the electrolyte

25) Let  $x_1, x_2, \dots, x_n$  be n observations and  $\bar{x}$  be their arithmetic mean and  $\sigma^2$  be the variance.

Statement I Variance of  $2x_1, 2x_2, \dots, 2x_n$  is  $4\sigma^2$ .

Statement II Arithmetic mean  $2x_1, 2x_2, \dots, 2x_n$  is  $4\bar{x}$

- 1) Statement I is true, Statement II is true; Statement II is not a correct explanation for Statement I
- 2) Statement I is true, Statement II is true; Statement II is a correct explanation for Statement I
- 3) Statement I is false, Statement II is true
- 4) Statement I is true, Statement II is false

26)  $\int_0^\pi [\text{Cot } x] dx$ , [ ] denotes the greatest integer function, is equal to

- 1)  $\frac{\pi}{2}$
- 2)  $-\frac{\pi}{2}$
- 3) -1
- 4) 1

27) The density of a material in the shape of a cube is determined by measuring three sides of the cube and its mass. If the relative errors in measuring the mass and length are respectively 1.5% and 1%, the maximum error in determining the density is

- 1) 6%
- 2) 4.5%
- 3) 3.5%
- 4) 2.5%

28) The pH of a 0.1 molar solution of the acid HQ

is 3. The value the ionisation constant,  $K_a$  of the acid is

- 1)  $1 \times 10^{-7}$
- 2)  $1 \times 10^{-3}$
- 3)  $1 \times 10^{-5}$
- 4)  $3 \times 10^{-1}$

29)  $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x)(3 + \cos x)}{x \tan 4x}$  is equal to

- 1)  $\frac{1}{2}$
- 2) 3
- 3) 2
- 4) 4

30) If  $A = \begin{bmatrix} 5a & -b \\ 3 & 2 \end{bmatrix}$  and  $A \text{ adj } A = AA^T$ , then

$5a + b$  is equal to

- 1) 13
- 2) 5
- 3) 4
- 4) -1

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