Jai Mahakali Shikshan Sanstha's

AGNIHOTRI COLLEGE OF ENGINEERING (NAGTHANA)

Nagthana Road, Near Bypass Highway, Sindi (Meghe), Wardha (Maharashtra) 442001
Web: www.acenagthana.ac.in

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AGNIHOTRI COLLEGE OF ENGINEERING
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DETAILED SOLUTION OF MOCK-CET TEST PAPER - 03

(As Per MHT-CET Exam)

(Dated on 26/05/2020)

MHT-CET

SUBJECT : Physics Paper set 3 (solution)

Q. 1]The depth 'd' at which the value of acceleration due to gravity becomes $\frac{1}{n}$ times the value at the earth's surface is (R = radius of earth)

(A) $d = R\left(\frac{n}{n-1}\right)$

(B) $d = R\left(\frac{n-1}{2n}\right)$

(C) $d = R\left(\frac{n-1}{n}\right)$

(D) $d = R^2\left(\frac{n-1}{n}\right)$

Sol^n:(C)

A a depth d we have

$$g' = g\left(1 - \frac{d}{R}\right)$$

$$g' = \frac{g}{n}$$

$$\frac{g}{n} = g\left(1 - \frac{d}{R}\right)$$

$$\therefore \frac{1}{n} = 1 - \frac{d}{R}$$

$$\therefore \frac{d}{R} = 1 - \frac{1}{n} = \frac{n-1}{n}$$

$$d = R\left(\frac{n-1}{n}\right)$$

Q. 2]A particle is performing S.H.M. starting from extreme position. Graphical representation shows that, between displacement and acceleration, there is a phase difference of

(A) $0\ rad$

(B) $\frac{\pi}{4}\ rad$

(C) $\frac{\pi}{2}\ rad$

(D) $\pi\, rad$

Sol^n: (D)

Q. 3]The fundamental frequency of an air column in a pipe closed at one end is 100 Hz. If the same pipe is open at both the ends, the frequencies produced in Hz are

(A) 100,200,300,400,….

(B) 100,300,500,700,….

(C) 200,300,400,500,….

(D) **200,400,600,800,….**

Sol^n: (D)

For a closed pipe fundamental frequency $n_1 = \frac{V}{4L} = 100$ Hz

For an open pipe fundamental frequency $n_1' = \frac{V}{2L} = 2n_1 = 200\text{Hz}$

In an open pipe all multiples of the fundamental are produced.

Q. 4]For a particle moving in vertical circle, the total energy at different positions along the path

(A) is conserved

(B) increases

(C) decreases

(D) may increase or decrease

Sol^n: (A)

Q. 5]A simple pendulum of length 'L' has mass 'M' and it oscillates freely with amplitude 'A'. At extreme position, its potential energy is (g = acceleration due to gravity)

(A) $\frac{MgA^2}{2L}$

(B) $\frac{MgA}{2L}$

(C) $\frac{MgA^2}{L}$

(D) $\frac{2MgA^2}{L}$

Sol^n: (A)

$$\text{Potential energy} = \frac{1}{2}M\omega^2A^2$$

$$= \frac{1}{2}M \cdot \frac{g}{L} \cdot A^2 \qquad \left(\because \omega = \sqrt{\frac{g}{\ell}}\right)$$

Q. 6]On a photosensitive material, when frequency of incident radiation is increased by 30%, kinetic energy of emitted photoelectrons increases from 0.4eV to 0.9eV. The work function of the surface is

(A) 1 eV

(B) 1.267 eV

(C) 1.4 eV

(D) 1.8 eV

Sol^n: (B)

$h\nu = 0.4 + W_0 \quad \ldots$ (i)

$1.3\ h\nu = 0.9 + W_0 \quad \ldots$ (ii)

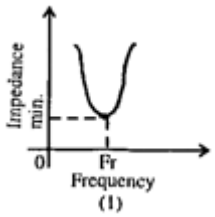
(ii) – 1.3 (i) gives

$0.3\ W_0 = 0.9 - 1.3\ (0.4)$

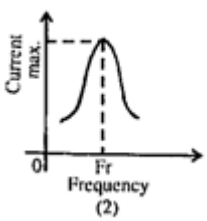
$\therefore \quad W_0 = \frac{0.38}{0.3} = 1.267$ eV

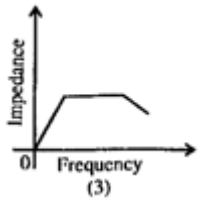
Q. 7]Out of the following graphs, which graph shows the correct relation (graphical representation) for LC parallel resonant circuit?

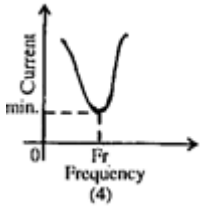
(A)



(B)



(C) 

(D) 

Sol^{n}: (D)

At parallel resonance, current is minimum

Q. 8] According to de-Broglie hypothesis, the wavelength associated with moving electron of mass 'm' is 'λe'. Using mass energy relation and Planck's quantum theory, the wavelength associated with photon is 'λp'. If the energy (E) of electron and photon is same then relation between 'λe' and 'λp' is

(A) $\lambda p \; \alpha \; \lambda e$

(B) $\lambda p \; \alpha \; \lambda e^2$

(C) $\lambda p \; \alpha \; \sqrt{\lambda e}$

(C) $\lambda p \; \alpha \; \dfrac{1}{\lambda e}$

Sol^{n}: (A)

For Photon : $E = \dfrac{hc}{\lambda_p}$

$\therefore \qquad \lambda_p = \dfrac{hc}{E} \qquad \ldots.(1)$

For electron : $E = mc^2 = pc$

$\therefore \qquad p = \dfrac{E}{C}$

$\lambda_e = \dfrac{h}{p} = \dfrac{hc}{E} \qquad \ldots.(2)$

By Eq.(1) and (2),

$\lambda_p \propto \lambda_e$

Q. 9]A parallel plate air capacitor has capacity ‘C’ farad, potential ‘V’ volt and energy ‘E’ joule. When the gap between the plates is completely filled with dielectric

(A) both V and E increase

(B) both V and E decrease

(C) V decreases, E increases

(D) V increases, E decreases

Sol^{n}: (B)

Q. 10]The resistivity of potentiometer wire is 40×10^{-8} ohm – metre andits area of corss-section is $8 \times 10^{-6} m^2$. If 0.2 ampere current is flowing through the wire, the potential gradient of the wire is

(A) $10^{-1}\ V/m$

(B) $10^{-2}\ V/m$

(C) $10^{-3}\ V/m$

(D) $10^{-4}\ V/m$

Sol^{n}: (B)

$$R = \frac{\rho \ell}{A} \qquad \therefore \quad \frac{R}{\ell} = \frac{\rho}{A} = \frac{40 \times 10^{-8}}{8 \times 10^{-6}} = 5 \times 10^{-2}$$

$$\frac{V}{\ell} = \frac{IR}{\ell} = 0.2 \times 5 \times 10^{-2} = 10^{-2}\ \text{V/m}$$

Subject :Chemistry

Q.1 Which of the following is Baeyer's reagent?

(A) alkaline KMnO4 (B) acidic K2Cr2O7

(C) alkaline Na2Cr2O7 (D) MnO2

Sol. (A)

Factual

Q.2 What is the chief constituent of Pyrex glass?

(A) B2O3 (B) SiO2 (C) Al2O3 (D) Na2O

Sol. (B)

Pyrex glass is obtained by fusing together 60 to 80% SiO2, 10 to 25% B2O3 and remaining amount of Al_2O_3

Q.3 Which of the following compounds has lowest boiling point?

(A) n–butyl alcohol (B) isobutyl alcohol

(C) tert–butyl alcohol (D) sec–butyl alcohol

Sol. (C)

For isomeric alcohols, as branching increases boiling point decreases.

Q.4 The rate constant for a first order reaction is 7.0 × 10–4 S–1. If initial concentration of reactant is 0.080M, what is the half life of reaction?

(A) 990 S (B) 79.2 S (C) 12375 S (D) 10.10 × 10–4 S

Sol. (A)

$$K = \frac{0.693}{t_{1/2}}$$

$$\therefore \quad t_{1/2} = \frac{0.693}{7.0 \times 10^{-4}}$$

$$= 990 \text{ sec}$$

Q.5 The polymer used in making handles of cookers and frying pans is

(A) bakelite (B) nylon–2–nylon–6

(C) orlon (D) polyvinyl chloride

Sol. (A)

Factual

Q.6 Which halogen has the highest value of negative electron gain enthalpy?

(A) Fluorine (B) Chlorine (C) Bromine (D) Iodine

Sol. (B)

Factual

Q.7 What is the actual volume occupied by water molecules present in 20 cm3 of water?

(A) 20 cm3 (B) 10 cm3 (C) 40 cm3 (D) 24.89 dm3

Sol. (B)

Half of the volume occupied in water is empty or unoccupied.

Q.8 For which among the following equimolar aqueous solutions Van't Hoff factor has the lowest value?

(A) Aluminium Chloride (B) Potassium Sulphate

(C) Ammonium Chloride (D) Urea

Sol. (D)

Urea is molecular solid hence does not undergo association or dissociation.

Q.9 The amino acid which is basic in nature is

(A) Histidine (B) Tyrosine (C) Proline (D) Valine

Sol.. (A)

Factual

Q.10 Which element among the following does **NOT** form diatomic molecules?

(A) Argon (B) Oxygen (C) Nitrogen (D) Bromine

Sol. (A)

Factual

MHT-CET Solution (Set - III)
Subject- Mathematics

1. A r. v. X ~ B (n, p). If values of mean and variance of X are 18 and 12 respectively then total number of possible values of X are

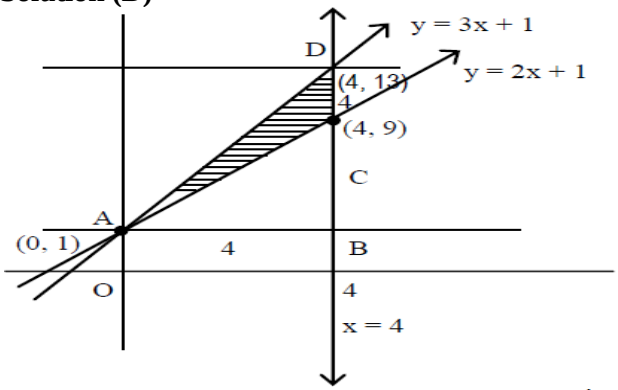
Solution (B)

$$\text{Mean} = np = 18$$
$$\text{Variance} = npq = 12$$
$$\frac{npq}{np} = \frac{12}{18}$$
$$q = \frac{2}{3}$$
$$p = 1 - q = 1 - \frac{2}{3}$$
$$p = \frac{1}{3}$$
$$np = 18$$
$$n\left(\frac{1}{3}\right) = 18$$
$$\boxed{n = 54}$$

$\therefore$ values of X are
0, 1, 2, ... 54
$\therefore$ 55 values.

2. The area of the region bounded by the lines y = 2x + 1, y = 3x + 1 and x = 4 is

Solution (D)



$$A\ (\text{Shaded region}) = A(\Delta ABD) - A(\Delta ABC) = \frac{1}{2}[4 \times 12 - 4 \times 8] = \frac{1}{2}(48 - 32) = 8 \text{ sq. units.}$$

OR

$$A\ (\Delta ACD) = \frac{1}{2}\begin{vmatrix} 0 & 1 & 1 \\ 4 & 9 & 1 \\ 4 & 13 & 1 \end{vmatrix}$$
$$= \frac{1}{2} \times 16 = 8$$

3. A box contains 6 pens, 2 of which are defective. Two pens are taken randomly from the box.
If r.v. X : Number of defective pens obtained, then standard deviation of X =

Solution (D)

x : no. of defective pens
Two pens are taken from box
$\therefore$ x can take values 0, 1, 2

$$p(x=0) = \frac{{}^4C_2}{{}^6C_2} = \frac{4\times 3}{6\times 5} = \frac{2}{5} = \frac{6}{15}$$

$$p(x=1) = \frac{{}^2C_1 \times {}^4C_1}{{}^6C_2} = \frac{2\times 4\times 2\times 1}{6\times 5} = \frac{8}{15}$$

$$p(x=2) = \frac{{}^2C_2}{{}^6C_2} = \frac{1\times 2\times 1}{6\times 5} = \frac{1}{15}$$

x	p	x_ip_i	$x_i^2p_i$
0	$\frac{6}{15}$	0	0
1	$\frac{8}{15}$	$\frac{8}{15}$	$\frac{8}{15}$
2	$\frac{1}{15}$	$\frac{2}{15}$	$\frac{4}{15}$

$$E(x) = \frac{10}{15}$$
$$= \frac{2}{3}$$

$$E(x^2) = \frac{12}{15}$$
$$= \frac{4}{5}$$

$$\text{Standard deviation} = \sqrt{E\left(x^2\right) - [E(x)]^2}$$

$$\text{Standard devivation} = \sqrt{\left(\frac{4}{5}\right) - \left(\frac{2}{3}\right)^2}$$
$$= \sqrt{\frac{4}{5} - \frac{4}{9}}$$
$$= \sqrt{\frac{4\times 4}{45}}$$
$$= \frac{4}{3\sqrt{5}}$$

4. If the volume of spherical ball is increasing at the rate of 4π cc/sec then the rate of change of its surface area when the volume is $288\ \pi$ cc is

Solution (A)

$$V = \frac{4}{3}\pi r^3 \Rightarrow \frac{dv}{dt} = 4\pi r^2 \frac{dr}{dt}$$

When $V = 288\ \pi$

$$288\ \pi = \frac{4}{3}\pi r^3 \Rightarrow \quad r = 6$$

$$\frac{dv}{dt} = 4\pi$$

$$\therefore\ 4\pi r^2 \frac{dr}{dt} = 4\pi = \frac{dr}{dt} = \frac{1}{r^2}$$

$$A = \text{Surface area} = 4\pi r^2$$

$$\therefore\ \frac{dA}{dt} = 8\pi r \frac{dr}{dt} = 8\pi r \times \frac{1}{r^2} = \frac{8\pi}{r} = \frac{8\pi}{6} = \frac{4\pi}{3}$$

5. If $f(x) = \log (\sec^2 x)^{\cot 2x}$ for $x \neq 0$

$= K$ for $x = 0$

Solution (B)

$$f(0) = \lim_{x\to 0} \log(\sec^2 x)^{\cot 2x}$$

$$k = \lim_{x\to 0} \cot^2 x \cdot \log(1 + \tan^2 x)$$

$$= \lim_{x\to 0} \frac{\log(1 + \tan^2 x)}{\tan^2 x}$$

$$k = 1$$

6. If c denotes the contradiction then dual of the compound statement $\sim p \wedge (q \vee c)$ is

Solution (A)

$$\text{Dual of} \sim P \wedge (q \vee c) = \sim P \vee (q \wedge t)$$

7. The differential equation of all parabolas whose axis is y-axis is

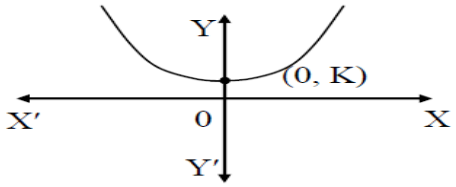
Solution (A)

axis = y axis
vertex is (0, k)
Equation of parabola is
$(x-0)^2 = 4a(y-k)$
$x^2 = 4ay - 4ak$
Differentiate w.r.t x

$$2x = 4a\frac{dy}{dx}$$

$$x = 2a\frac{dy}{dx}$$

$$\therefore \quad \frac{1}{2a} = \frac{1}{x}\frac{dy}{dx}$$



Differentiate w.r.t x,

$$\frac{d}{dx}\left(\frac{1}{x}\cdot\frac{dy}{dx}\right) = \frac{d}{dx}\left(\frac{1}{2a}\right)$$

$$\frac{1}{x}\cdot\frac{d^2y}{dx^2} + \frac{dy}{dx}\left(-\frac{1}{x^2}\right) = 0$$

$$\therefore \quad x\frac{d^2y}{dx^2} - \frac{dy}{dx} = 0$$

8. $\int_0^3 [x]\,dx =$ _____, where [x] is greatest integer function.

Solution (A)

$$\int_0^3 [x]\,dx = \int_0^1 0\,dx + \int_1^2 1\,dx + \int_2^3 2\,dx$$

$$= [x]_1^2 + 2[x]_2^3$$

$$= (2-1) + 2(3-2)$$

$$= 1 + 2$$

$$= 3$$

9. The objective function of LPP defined over the convex set attains its optimum value at

Solution (C)

At least one of the corner points

10. If the inverse of the matrix $\begin{bmatrix} \propto & 14 & -1 \\ 2 & 3 & 1 \\ 6 & 2 & 3 \end{bmatrix}$ does not exist then the value of α is

Solution (D)

$$A = \begin{bmatrix} \alpha & 14 & -1 \\ 2 & 3 & 1 \\ 6 & 2 & 3 \end{bmatrix}$$

$|A| = 7\alpha + 14$

A^{-1} does not exists if $|A| = 0$

$\Rightarrow 7\alpha + 14 = 0 \Rightarrow \alpha = -2$

Subject: Biology

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1. The Decomposers in an Ecosystem Are _____
A) Autotrophs

B) Microconsumers

C) Macroconsumers

D) Abiotic Components

Sol. (B)

2. In Members of Family Crassulaceae _____Is Regenerated From Starch During Night.
(A) Phospho Enol Pyruvic Acid

(B) Pyruvic Acid

(C) Malic Acid

(D) Oxalo Acetic Acid

Sol. (A)

3. Which One Of The Following Plants Reproduces Vegetatively By Epiphyllous Buds?

(A) Sweet Potato

(B) Potato

(C) Onion

(D) Kalanchoe

Sol. (D)

4. In Aulosira, Tolypothrix And Nostoc, _____ Are The Sites For Nitrogen Fixation.

(A) Vesicles

(B) Arbuscles

(C) Akinetes

(D) Heterocysts

Sol. (D)

5. The Number of Phenotype Recombinant Offsprings Formed During F2 Generation of A Dihybrid Cross Are

_____

(A) 9/16

(B) 7/16

(C) 6/16

(D) 4/16

Sol. (C)

6. Stamens With Long Bifurcated Connective Are Found In _____ Flower.

(A) Bignonia

(B) Bombax

(C) Salvia

(D) Cestrum

Sol. (C)

7. The Spatial Pattern Of Density And Distribution Of Species Along A Horizontal Gradient Is Called As _____

(A) Stratification

(B) Zonation

(C) Trophic Niche

(D) Volume Niche

Sol. (B)

8. The Co2 Content In Biogas Ranges From _____

(A) 10 - 14%

(B) 15 - 45%

(C) 50 - 60%

(D) 70 - 80%

Sol. (B)

9. Which One Of The Following Material Is Not Safe To Prepare Carry Bags?

(A) Cloth

(B) Paper

(C) Jute

(D) Polythene

Sol. (D)

10. If The Cells Of The Nucellus In The Angiosperm Ovule Contains 24 Chromosomes, What Will Be The Number Of Chromosomes In The Endosperm Of A Self Pollinated Flower?

(A) 12

(B) 24

(C) 36

(D) 48

Sol. (C)