Jai Mahakali Shikshan Sanstha's

AGNIHOTRI COLLEGE OF ENGINEERING (NAGTHANA)

Nagthana Road, Near Bypass Highway, Sindi (Meghe), Wardha (Maharashtra) 442001
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DETAILED SOLUTION OF MOCK-CET TEST PAPER - 02

(As Per MHT-CET Exam)

(Dated on 23/05/2020)

MHT-CET

SUBJECT : Physics Paper Set 2 (Solutions)

Q. 1]A wheel of moment of inertia 2 Kg m2 is rotating about an axis passing through centre and perpendicular to its plane at a speed 60 rad/s. Due to friction, it comes to rest in 5 minutes. The angular momentum of the wheel three minutes before it stops rotating is

(A) 24 Kg m^2/s
(B) 48 Kg m^2/s
(C) 72 Kg m^2/s
(D) 96 Kg m^2/s

Sol^n:(C)

$I = 2$ kg m^2, $\omega_0 = 60$ rad/s

$t = 5$ min $= 5 \times 60 = 300$ s

$$\alpha = \frac{0-60}{300} = \frac{-60}{300} = \frac{-1}{5} \text{ rad/s}^2$$

for 2 min (from starting) (2 min = 120 sec)

$$\omega = \omega_0 + \alpha t$$

$$= 60 - \frac{1}{5} \times 120 = 60 - 24$$

$\omega = 36$ rad/s & $L = I\omega = 2 \times 36 = 72$ kg m^2/s

Q. 2]The equation of the progressive wave is $Y = 3\sin\left[\pi\left(\frac{t}{3} - \frac{x}{5}\right) + \frac{\pi}{4}\right]$ where x and Y are in metre and time in second. Which of the following is correct?

(A) velocity V = 1.5 m/s
(B) amplitude A = 3 cm
(C) frequency F = 0.2 Hz
(D) wavelengthλ = 10 m

Sol^n:(D)

$$y = 3\sin\left[2\pi\left(\frac{t}{6} - \frac{x}{10}\right) + \frac{\pi}{4}\right]$$

Compare $y = A\sin\left[2\pi\left(\frac{t}{T} - \frac{x}{\lambda}\right) + \frac{\pi}{4}\right]$

x and y are metre

$\therefore \lambda = 10$ m

Q. 3]Two spherical black bodies have radii 'r1' and 'r2'. Their surface temperatures are 'T1' and 'T2'. If they radiate same power then $\frac{r_2}{r_1}$ is

(A) $\frac{T_1}{T_2}$

(B) $\frac{T_2}{T_1}$

(C) $\left(\frac{T_1}{T_2}\right)^2$

(D) $\left(\frac{T_2}{T_1}\right)^{\mathbf{2}}$

Sol^n:(C)

$$\frac{Q}{t} = \sigma A T^4$$

i.e. power = $\sigma A T^4$

$\therefore$ for same power

$\therefore$ $A \propto \frac{1}{T^4}$

$\therefore$ $\frac{A_2}{A_1} = \frac{T_1^4}{T_2^4}$

$\therefore$ $\frac{4\pi r_2^2}{4\pi r_1^2} = \frac{T_1^4}{T_2^4}$

$\therefore$ $\frac{r_2}{r_1} = \left(\frac{T_1}{T_2}\right)^2$

Q. 4]The closed and open organ pipes have same length. When they are vibrating simultaneously in first overtone, produce three beats. The length of open pipe is made $\frac{1}{3}^{rd}$ and closed pipe is made three timesthe original, the number of beats produced will be

(A) 8

(B) 14

(C) 17

(D) 20

Sol^n: (C)

For open pipe first overtone $\nu_1 = \frac{v}{L}$

For closed pipe first overtone $\nu_1' = \frac{3v}{4L}$

$\therefore \quad \nu_1 - \nu_1' = \frac{v}{L} - \frac{3v}{4L} = 3$

$\therefore \quad \frac{v}{4L} = 3$

$\therefore \quad \frac{v}{L} = 12$

When length of open pipe is made $\frac{L}{3}$ the fundamental frequency

$$\nu = \frac{v}{2\left(\frac{L}{3}\right)} = \frac{3v}{2L}$$

When length of closed pipe is made 3 times, the fundamental frequency

$$\nu' = \frac{v}{4(3L)} = \frac{v}{12L}$$

Beats produced $= \nu - \nu'$

$= \frac{3v}{2L} - \frac{v}{12L}$

$= \frac{17}{12} \cdot \frac{v}{L} \quad = \frac{17}{12} \times 12$

$= 17$

Q. 5]A lift mass 'm' is connected to a rope which is moving upward with maximum acceleration 'a'. For maximum safe stress, the elastic limit of the rope is 'T'. The minimum diameter of the rope is (g = gravitational acceleration).

(A) $\left[\frac{2m(g+a)}{\pi T}\right]^{\frac{1}{2}}$

(B) $\left[\frac{4m(g+a)}{\pi T}\right]^{\frac{1}{2}}$

(C) $\left[\frac{m(g+a)}{\pi T}\right]^{\frac{1}{2}}$

(D) $\left[\frac{m(g+a)}{2\pi T}\right]^{\frac{1}{2}}$

Sol^n:(B)

The maximum tension in the rope = m (g + a)

Stress in the rope = $\dfrac{m(g+a)}{\pi r^2}$

$\therefore \quad T = \dfrac{m(g+a)}{\pi r^2} = \dfrac{m(g+a)}{\pi\left(\dfrac{d}{2}\right)^2}$

$\therefore \quad T = \dfrac{4m(g+a)}{\pi d^2}$

$\therefore \quad d^2 = \dfrac{4m(g+a)}{\pi T}$

$\therefore \quad d = \left[\dfrac{4m(g+a)}{\pi T}\right]^{\frac{1}{2}}$

Q. 6]A solid sphere of mass 2 kg is rolling on a frictionless horizontal surface with velocity 6 m/s. It collides on the free end of an ideal spring whose other end is fixed. The maximum compression produced in the spring will be (Force constant of the spring = 36 N/m).

(A) $\sqrt{14}\ m$

(B) $\sqrt{2.8}\ m$

(C) $\sqrt{1.4}\ m$

(D) $\sqrt{0.7}\ m$

Sol^n: (B)

Kinetic energy of rolling solid sphere

$= \frac{1}{2}mV^2 + \frac{1}{2}I\omega^2$

$= \frac{1}{2}mV^2 + \frac{1}{2}\times\frac{2}{5}mr^2\omega^2$

$= \frac{1}{2}mV^2 + \frac{1}{5}mV^2$

$= \frac{7}{10}mV^2$

The potential energy of the spring on maximum compression x

$= \frac{1}{2}kx^2$

$\therefore \quad \frac{1}{2}kx^2 = \frac{7}{10}mV^2$

$x^2 = \frac{14}{10}\frac{mV^2}{k}$

$= \frac{14}{10}\times\frac{2\times(6)^2}{36}$

$= 2.8$

$\therefore \quad x = \sqrt{2.8}\ \text{m}$

Q. 7] A flywheel at rest is to reach an angular velocity of 24 rad/s in 8 second with constant angular acceleration. The total angle turned through during this interval is

(A) 24 rad
(B) 48 rad
(C) 72 rad
(D) 96 rad

Sol^n:(D)

$$\omega_0 = 0,\ \ \omega = 24 \text{ rad/s},\ t = 8\text{s}$$

$$\therefore \quad \alpha = \frac{\omega - \omega_0}{t} = \frac{24}{8} = 3\text{rad/s}^2$$

$$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

$$= 0 + \frac{1}{2} \times 3 \times (8)^2$$

$$= \frac{3 \times 64}{2} = 96 \text{ rad.}$$

Q. 8] Two uniform wires of the same material are vibrating under the same tension. If the first overtone of the first wire is equal to the second overtone of the second wire and radius of the first wire is twice the radius of the second wire then the ratio of the lengths of the first wire to second wire is

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

(B) $\frac{1}{4}$

(C) $\frac{1}{5}$

(D) $\frac{1}{6}$

Sol^n:(A)

Fundamental frequency of the first wire

$$f = \frac{1}{2L_1}\sqrt{\frac{T}{m}} = \frac{1}{2L_1}\sqrt{\frac{T}{\pi r_1^2 \rho}} = \frac{1}{2L_1 r_1}\sqrt{\frac{T}{\pi\rho}}$$

The first overtone $f_1 = 2f = \frac{2}{2L_1 r_1}\sqrt{\frac{T}{\pi\rho}} = \frac{1}{L_1 r_1}\sqrt{\frac{T}{\pi\rho}}$

The second overtone of the second wire

$$f_2 = \frac{3}{2L_2 r_2}\sqrt{\frac{T}{\pi\rho}}$$

$$f_1 = f_2$$

$$\frac{1}{L_1 r_1}\sqrt{\frac{T}{\pi\rho}} = \frac{3}{2L_2 r_2}\sqrt{\frac{T}{\pi\rho}}$$

$\therefore \quad 3L_1 r_1 = 2L_2 r_2$

$$\frac{L_1}{L_2} = \frac{2}{3}\cdot\frac{r_2}{r_1}$$

$$= \frac{2}{3}\cdot\frac{r_2}{2r_2} \qquad [\because r_1 = 2r_2]$$

$$= \frac{1}{3}$$

Q. 9]When one end of the capillary is dipped in water, the height of water column is 'h'. The upward force of 105 dyne due to surface tension is balanced by the force due to the weight of water column. The innercircumference of the capillary is

(Surface tension of water = 7×10^{-2} N/m)

(A) 1.5 cm

(B) 2 cm

(C) 2.5 cm

(D) 3 cm

Sol^n: (A)

$F = 105$ dyne $= 105 \times 10^{-5}$ N, $T = 7 \times 10^{-2}$ N/m

$2\pi r T = F$

$$2\pi r = \frac{F}{T} = \frac{105\times10^{-5}}{7\times10^{-2}}$$

$= 15 \times 10^{-3}$ m

$= 1.5 \times 10^{-2}$ m

$= 1.5$ cm

Q. 10] For a rigid diatomic molecule, universal gas constant R = nCp where 'Cp' is the molar specific heat at constant pressure and 'n' is a number. Hence n is equal to

(A) 0.2257

(B) 0.4

(C) 0.2857

(D) 0.3557

Sol^n:(C)

For rigid diatomic molecule

$$\frac{C_P}{C_V} = \frac{7}{5}$$

$$\therefore \quad C_V = \frac{5}{7} C_P$$

Also $C_P - C_V = R$

$$C_P - \frac{5}{7} C_P = R$$

$$\frac{2}{7} C_P = R$$

$$\therefore n = \frac{2}{7} = 0.2857$$

MHT-CET

Subject : Chemistry Paper Set 2 (Solution)

Q.1 tert-butyl methyl ether on treatment with hydrogen iodide in cold gives

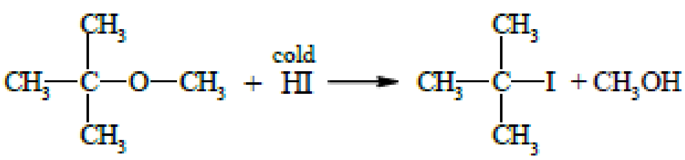
(A) tert-butyl iodide and methyl iodide

(B) tert-butyl alcohol and methyl alcohol

(C) tert-butyl alcohol and methyl iodide

(D) tert-butyl iodide and methyl alcohol

Sol. (D)



Q.2 Name the process that is employed to refine aluminium.

(A) Hall's process (B) Mond process

(C) Hoope's process (D) Serperck's process

Sol. (C)

Factual

Q.3 The colour and magnetic nature of manganate ion $(MnO_4)^{2-}$ is

(A) green, paramagnetic (B) purple, diamagnetic

(C) green, diamagnetic (D) purple, paramagnetic

Sol. (A)

$(MnO_4)^{2-}$ – manganate ion is green and paramagnetic.

Q.4 The osmotic pressure of solution containing 34.2 g of cane sugar (molar mass = 342 g mol–1) in 1L of solution at 20° C is

(Given, R = 0.082 L atm K–1 mol–1)

(A) 2.40 atm (B) 3.6 atm (C) 24 atm (D) 0.0024 atm

Sol. (A)

$$\pi = CRT$$

$$\pi = \frac{34.2}{342 \times 1L} \times 0.082 \times 293 = 2.40 \text{ atm}$$

Q.5 In assigning R-S configuration which among the following groups has highest priority?

(A) $-SO_3H$ (B) $-COOH$ (C) $-CHO$ (D) $-C_6H_5$

Sol. (A)

$-SO_3H$ (sulphur atomic number 16)

Q.6 Which of the following is used as antiseptic?

(A) Chloramphenicol (B) Bithional

(C) Cimetidine (D) Chlordiazepoxide

Sol. (B)

Factual

Q.7 In preparation of sulphuric acid from sulphur dioxide in lead chamber process. What substance is used as a catalyst?

(A) Manganese dioxide (B) Vanadium pentoxide

(C) Nitric oxide (D) Raney Nickel

Sol. (C)

Catalyst used in lead chamber process is nitric oxide.

Q.8 The correct charge on and co-ordination number of 'Fe' in $K_3[Fe(CN)_6]$ is

(A) +2, 4 (B) +3, 6 (C) +2, 6 (D) +3, 3

Sol. (B)

$$K_3[Fe(CN)_6] \Rightarrow [Fe(CN)_6]^{3-}$$
$$x + 6(-1) = -3$$
$$\therefore x = +3$$

Coordination number of Fe is 6 as 6 CN^- are attached.

Q.9. Which among the following reactions is an example of pseudo first order reaction?

(A) Inversion of cane sugar

(B) Decomposition of H_2O_2

(C) Conversion of cyclopropane to propene

(D) Decomposition of N_2O_5

Sol. (A)

Factual

Q.10 The amine which reacts with p-toluenesulphonyl chloride to give a clear solution which on acidification gives insoluble compound is

(A) $C_2H_5NH_2$ (B) $(C_2H_5)_2NH$

(C) $(C_2H_5)_3N$ (D) $CH_3NHC_2H_5$

Sol. (A)

1° amine gives clear solution which on acidification gives insoluble compound.

MHT-CET Solution (Set - II)

Subject- Mathematics

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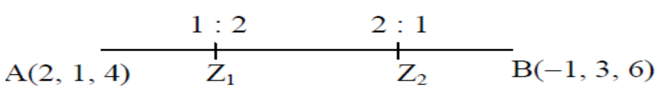
1. The objective function $z = 4x_1 + 5x_2$, subject to $2x_1 + x_2 \geq 7$, $2x_1 + 3x_2 \leq 15$, $x_2 \leq 3$, $x_1, x_2 \geq 0$ has minimum value at the point

Ans – A

Corner point
Value of $z = 4x_1 + 5x_2$
Since two points are on x-axis minimum value occurs on x-axis.
Minimum value = 14.

2. If z_1 and z_2 are z co–ordinates of the points of trisection of the segment joining the points A (2, 1, 4), B (–1, 3, 6) then $z_1 + z_2 =$

Ans – D



For $Z_1 \rightarrow 1:2$
For $Z_2 \rightarrow 2:1$
(Internal division formula)

$$\begin{aligned} Z &= Z_1 + Z_2 \\ &= \frac{(1)(6)+2(4)}{1+2} + \frac{2(6)+(1)(4)}{2+1} \\ &= \frac{6+8}{3} + \frac{12+4}{3} \\ &= \frac{14+16}{3} \\ &= \frac{30}{3} \\ &= 10 \end{aligned}$$

3. If g(x) is the inverse function of f(x) and $f'(x) = \frac{1}{1+x^4}$, then g′(x) is

Ans – A

$g = f^{-1}$
$f(g(x)) = x$
Differentiate w.r.t. x
$f'(g(x)) \cdot g'(x) = 1$

$$\therefore \frac{1}{1+(g(x))^4} \cdot g'(x) = 1$$
$$g'(x) = 1 + [g(x)]^4$$

4. If $\int \frac{1}{\sqrt{9-16x^2}} dx = \alpha \sin^{-1}(\beta x) + c$, then $\alpha + \frac{1}{\beta} =$

Ans – A

$$\int \frac{1}{\sqrt{9-16x^2}}\,dx = \alpha \sin^{-1}(\beta x) + c$$

$$\int \frac{1}{\sqrt{3^2-(4x)^2}}\,dx = \frac{1}{4}\sin^{-1}\left(\frac{4x}{3}\right) + c$$

$$\alpha = \frac{1}{4} \qquad \beta = \frac{4}{3}$$

$$\alpha + \frac{1}{\beta} = \frac{1}{4} + \frac{3}{4} = 1$$

5. (0, 0), A (1, 2), B (3, 4) are the vertices of ΔOAB. The joint equation of the altitude and median drawn from O is

Ans – D

$$\Rightarrow\ m = \frac{3}{2}$$

$$\therefore\ y = \frac{3}{2}x \Rightarrow 3x - 2y = 0$$

Slope of AB = $\frac{2}{2} = 1 \Rightarrow$ Slope of OP = –1

Equation of OP $\Rightarrow y = -x \Rightarrow x + y = 0$

Joint equation of OP and OD $\Rightarrow (x + y)(3x - 2y) = 0$

$\Rightarrow\ 3x^2 + xy - 2y^2 = 0$

6. If the function $f(x) = \left[\tan\left(\frac{\pi}{4} + x\right)\right]^{\frac{1}{x}}$ for $x \neq 0$
$= K$ for $x = 0$
is continuous at x = 0, then K = ?

Ans – C

$$f(0) = \lim_{x\to 0} f(x)$$

$$= \lim_{x\to 0}\left[\tan\left(\frac{\pi}{4} + \pi\right)\right]^{\frac{1}{x}}$$

$$= \lim_{x\to 0}\left(\frac{1+\tan x}{1-\tan x}\right)^{\frac{1}{x}}$$

$$= \lim_{x\to 0} \frac{\left[(1+\tan x)^{\frac{1}{\tan x}}\right]^{\frac{\tan x}{x}}}{\left[(1-\tan x)^{-\frac{1}{\tan x}}\right]^{-\frac{\tan x}{x}}}$$

taking limits

$$= \frac{e^1}{e^{-1}} = e^1 \cdot e^1 = e^2$$

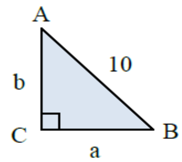
7. In Δ ABC if $\sin^2 A + \sin^2 B = \sin^2 C$ and $l(AB) = 10$, then the maximum value of the area of Δ ABC is

Ans – C

$\sin^2 A + \sin^2 B = \sin^2 C$

$\Rightarrow a^2 + b^2 = c^2$ (Sine Rule)

$A(\Delta ABC) = \frac{1}{2}ab \qquad \ldots (1)$



From sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$\Rightarrow \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{10}{1}$

$\Rightarrow a = 10 \sin A,\ b = 10 \sin B$

Using equation (1) $A(\Delta ABC) = \frac{1}{2}(10 \sin A)(10 \sin B)$

$= 50 \sin A \sin B$

But maximum value of $\sin A \sin B = \frac{1}{2}$

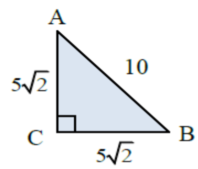
$\therefore$ Maximum value of $A(\Delta ABC) = 50 \times \frac{1}{2} = 25$

OR

$\angle C = 90° \Rightarrow$ ABC is right angled triangle

$\therefore$ Area of Δ is maximum when it is 45°–45°–90° Δ.

$\therefore A(\Delta ABC) = \frac{1}{2} \times 5\sqrt{2} \times 5\sqrt{2} = 25$



8. If x = f(t) and y = g(t) are differentiable functions of t then $\frac{d^2y}{dx^2}$ is

Ans – A

$$x = f(t)$$
$$y = g(t)$$
$$\frac{dx}{dt} = f'(t)$$
$$\frac{dy}{dt} = g'(t)$$
$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{g'(t)}{f'(t)}$$
$$\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{g'(t)}{f'(t)}\right)$$
$$= \frac{f'(t) \cdot g''(t) - g'(t) \cdot f''(t)}{(f'(t))^2} \cdot \frac{dt}{dx}$$
$$= \frac{f'(t) \cdot g''(t) - g'(t) \cdot f''(t)}{(f'(t))^2} \cdot \frac{1}{f'(t)}$$
$$= \frac{f'(t) \cdot g''(t) - g'(t)\, f''(t)}{(f'(t))^3}$$

9. Which of the following statement pattern is a tautology?

Ans-C

It can be done using truth table or using rules of logic.

(A) $p \vee (q \rightarrow p) \equiv p \vee (\sim q \vee p) \equiv p \vee p \vee \sim q$

$\equiv p \vee \sim q$

(B) $\sim q \rightarrow \sim p \equiv q \vee \sim p$

(D) $p \wedge \sim p \equiv F$

So left is (C)

(C)

p	q	$q \rightarrow p$	$\sim p$	$\sim p \leftrightarrow q$	$(q \rightarrow p) \vee (\sim p \leftrightarrow q)$
T	T	T	F	F	T
T	F	T	F	T	T
F	T	F	T	T	T
F	F	T	T	F	T

10. If the angle between the planes $\bar{r}.(m\hat{i} - \hat{j} + 2\hat{k}) + 3 = 0$ and $\bar{r}.(2\hat{i} - m\hat{j} - \hat{k}) - 5 = 0$ is $\frac{\pi}{3}$

Ans – C

Direction ratios $\bar{n}_1$ are m, −1, 2

Direction ratios $\bar{n}_2$ are 2, −m, −1

$$\theta = \frac{\pi}{3}$$

$$\cos\theta = \left|\frac{\bar{n}_1 \cdot \bar{n}_2}{|\bar{n}_1||\bar{n}_2|}\right| \Rightarrow \frac{1}{2} = \left|\frac{2m + m - 2}{\sqrt{m^2+5}\sqrt{m^2+5}}\right|$$

$$\frac{1}{2} = \left|\frac{3m-2}{m^2+5}\right| \Rightarrow m^2 + 5 = \pm(6m - 4)$$

$$\Rightarrow m^2 + 5 = 6m - 4,\ m^2 + 5 = -6m + 4$$

$$m^2 - 6m + 9 = 0,\ m^2 + 6m + 1 = 0$$

$$(m-3)^2 = 0$$

$$m = 3$$

Subject : Biology

Q.1 During fertilization if the pollen tube enters the ovule through integuments, then it is Called as ----

(A) Misogamy (B) Porogamy (C) Chalazogamy (D) Siphonogamy

Sol. (A)

Q.2 To determine whether F1 hybrid is homozygous or heterozygous for a particular trait ------ crossed is performed.

(A) Monohybrid (B) Test (C) Back (D) Reciprocal

Sol. (B)

Q.3 Number of oxygen molecules utilized in glycolysis is ________

(A) 0 (B) 2 (C) 4 (D) 6

Sol. (A)

Q.4 A cell organelle which lacks membrane, consists of 65% rRNA, 35% proteins and helps In protein synthesis is _______

(A) Nucleus (B) Nucleoid (C) Ribosome (D) Nucleolus

Sol. (C)

Q.5 Cyclic photophosphorylation will NOT take place in the absence of ______

(A) Carotenoids (B) Chlorophyll-a (C) Xanthophylls (D) Phycoerythrin

Sol. (B)

Q.6 How many different types of gametes will be formed by a pea plant with genotype TtYy?

(A) 16 (B) 08 (C) 06 (D) 04

Sol. (D)

Q.7 The megasporangium proper of an angiosperm ovule is represented by

(A) Integument (B) Funicle (C) Nucellus (D) Micropyle

Sol. (C)

Q.8 Which one of the following is an essential factor for photophosphorylation?

(A)Sunlight (B) Carbohydrate (C) Oxygen (D) Water

Sol. (A)

Q.9 Generally the pollen grains of monocots are ______ and dicots are _____ respectively.

(A) Uniporate and Biporate (B) Biporate and Triporate

(C) Uniporate and Triporate (D) Triporate and Tetraporate

Sol. (C)

Q.10 A nucleic acid whose molecular weight ranges between 40,000 to 1,00,000 in a cell is -

(A) DNA (B) mRNA (C) tRNA (D) rRNA

Sol. (D)