AVIRAL CLASSES
CREATING SCHOLARS

JEE (ADVANCED), PMT & FOUNDATIONS

# MOCK TEST JEE -2020
# TEST-03 ANSWER KEY

Test Date :05-01-2020

## [PHYSICS]

1.

**Ans. (3)**

$$B = \frac{E}{c}$$

2. **Ans. (2)**

Temperature quickly rises for monoatomic gas as $Q = {}^nC_v\, \Delta T$ so it exert more pressure as compare to diatomic gas.

3. **Ans. (3)**

There is no relative motion between source & observer.

4. **Ans. (4)**

$$f_1 = f_0\left[\frac{v}{v - v_S}\right] \; ; \; \frac{\Delta f_1}{f_0} = \frac{v_S}{v - v_S} = \frac{10}{100}$$

$$\because \; v = 11 v_S$$

$$f_2 = f_0\left[\frac{v}{v + v_S}\right] \; ; \; \frac{\Delta f_2}{f_0} = \frac{v_S}{v + v_S} = \frac{25}{3}\%$$

5. **Ans. (3)**

$$A_r = 0.02 \times 0.75 = 0.015$$

$$y_r = +0.015 \sin 8\pi\left[t + \frac{x}{20}\right]$$

6.

**Ans. (1)**

Area covered by TV signals $= \pi d^2$ , $d = \sqrt{2Rh}$ where, R is the radius of the earth and h is height of antenna $\boxed{A \propto h}$.

7. **Ans. (1)**

$$I_1\omega_1 = I_2\omega_2$$

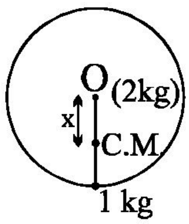
8. (2)

9.

**Ans. (1)**

$$x = (5 \times 1)/3 = 5/3$$

$$I_0 = \frac{2 \times 5^2}{2} + 1 \times 5^2 = 50$$




$$T = 2\pi\sqrt{\frac{I_0}{Mgx}} = 2\pi\sqrt{\frac{50}{\frac{3 \times 10 \times 5}{3}}} = 2\pi$$

10. (2)

11. **Ans. (1)**

$$E \times \frac{1}{k} \Rightarrow \Delta V \times \frac{1}{k}$$

$$\Rightarrow E_3 < E_2 < E_1 \text{ and } \Delta V_3 < \Delta V_2 < \Delta V_1$$

12. **Ans. (2)**

In first case

$i = k_1\theta_1,\ i = k_2\theta_2$

$\therefore\ k_1\theta_1 = k_2\theta_2$ ...(1)

In second case

$v_1 = v_2$

$\Rightarrow\ k_1\theta_1' r_1 = k_2\theta_2' r_2$ ...(2)

from (1) & (2), we get

$$r_2 = r_1 \frac{\theta_2\theta'_1}{\theta_1\theta'_2}$$

13. **Ans. (4)**

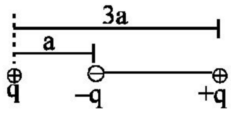
$$\int_{-CE}^{q}\frac{dq}{CE-q}=\int_{0}^{t}\frac{dt}{RC}$$

$$q=CE\left(1-2e^{-\frac{t}{RC}}\right)\Rightarrow I=\frac{dq}{dt}=\frac{2E}{R}e^{-\frac{t}{RC}}$$

$$H=\int_{0}^{\infty}I^2Rdt=2CE^2=4\times U_C$$

14. (1)

15. **Ans. (3)**

(3) 


$$U=\frac{-kq^2}{a}+\frac{+kq^2}{3a}=\frac{-2kq^2}{3a}$$

$$\Delta U+\Delta KE=0$$

$$\frac{1}{2}(2ma^2)\omega^2=\frac{2kq^2}{3a}$$

$$\omega=\sqrt{\frac{2kq^2}{3ma^3}}$$

$$\omega=\frac{q}{\sqrt{6\pi\varepsilon_0 ma^3}}$$

16. **Ans. (1)**

CCW path at r = 2R gives $2\pi(2R)E = -(d/dt)[(B_0-\beta t)(\pi R^2)] \Rightarrow E = R\beta/4$ ; CCW opposes the loss of B out of the paper just as would be the case if a real wire were there with E in the direction of I.

17. **Ans. (2)**

$$\frac{1}{f}=(\mu-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)=3$$

$$\therefore\ 3=(1.25-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right) \quad ...(1)$$

$$\&\ -2=\left(\frac{1.25}{\mu}-1\right)\left(\frac{1}{R_1}-\frac{1}{R_2}\right) \quad ...(2)$$

$$-\frac{3}{2}=\frac{0.25\mu}{1.25-\mu}\Rightarrow -0.5\mu=3.75-3\mu$$

$$\Rightarrow\ \mu=3.75/2.5=1.5$$

18.

**Ans. (1)**

$$\frac{1}{v}-\frac{1}{-15}=\frac{1}{5}$$

$$\frac{1}{v}=\frac{1}{5}-\frac{1}{15}$$

$$v=7.5$$

$$v'=-12.5$$

$$\frac{1}{v'}-\frac{1}{12.5}=\frac{1}{-15}$$

$$\frac{1}{v'}=\frac{2}{25}-\frac{1}{15}$$

$$\frac{1}{v'}=\frac{12-10}{150}$$

v' = 75 cm

v'' = –95 cm

$$\frac{1}{v''}+\frac{1}{95}=\frac{1}{5}$$

v'' = 5.3 cm

19.

**Ans. (3)**

$$\mu=\frac{\sin\left(\frac{A+D}{2}\right)}{\sin\frac{A}{2}}\ \text{gives}$$

$2\cos(A/2) = \mu$ or $\cos(A/2) = 1.732/2 = \sqrt{3}/2$

or $A = 60°$

20.

**Ans. (1)**

$$\mu = \int_{R/2}^{R} I\pi x^2 = \int_{R/2}^{R} (\sigma 2\pi x dx)\frac{\omega}{2\pi}\pi x^2$$

$$= 15\pi\sigma\omega R^4/64$$

21.

$$Z = \sqrt{(X_L - X_C)^2 + R^2} = \sqrt{25+25} = 5\sqrt{2}$$

$$I_{rms} = \frac{10/\sqrt{2}}{5\sqrt{2}} = 1$$

$$V = 1 \times (X_L - X_C) = 1 \times 5 = 5 \text{ Volt}$$

22. **4**

23. **5**

24.

Let initially No → atoms were present

$\therefore$ $n = N_0 - N_0 e^{-\lambda(2)} \longrightarrow$ (i)

and $1.25\,n = N_0 - N_0 e^{-\lambda(2+2)} \longrightarrow$ (ii)

[Total β particle emitted in 4 seconds]

Dividing (ii) by (i)

$$1.25 = \frac{1 - e^{-4\lambda}}{1 - e^{-2\lambda}}$$

On solving $e^{-2\lambda} = \frac{1}{4}$

$\therefore -2\lambda = -\ln 4$

$$\therefore \frac{-2\ln 2}{T_{1/2}} = -2\ln 2$$

$$\therefore T_{1/2} = 1 \text{ second}$$

25.

$$T = 2\pi\sqrt{\frac{I}{MB}}$$

$$\frac{T_1}{T_2} = \sqrt{\frac{M_2}{M_1}} = 2$$

$T_2 = 1$ sec.

# [CHEMISTRY]

26.

**Ans. (3)**

$$-16560 = \Delta_r G^\circ + RT\ln\left(\frac{1}{2}\right)$$

$$-16560 = -RT\ln Kp - RT\ln 2$$

$$\Rightarrow Kp = 4$$

27.

**Ans. (4)**

| | A | + 2B | ⟶ 2C + D |
|---|---|---|---|
| t = 0 | 0.6 | 0.8 | 0 |
| t = t | 0.6–0.2 | 0.8–0.4 | 0.4 |

$$(\text{Rate})_i = K(0.6)\,(0.8)^2$$

$$(\text{Rate})_f = K(0.4)\,(0.4)^2$$

$$\frac{(\text{Rate})_f}{(\text{Rate})_i} = \frac{K(0.4)^3}{K(0.6)(0.8)^2} = \frac{1}{6}$$

28. (2)

$M_1V_1 + M_2V_2 = M_TV_T$

MT = 0.33

29. (3)

$\Delta T_f = i \times K_f \times m$

(i = 3)

So, $[MA_6]A_2$

30. (1)

By $\lambda_c = \lambda_\infty - B\sqrt{c}$

(I) can be weak electrolyte

(II) can be KCl

(III) can be HCl

31.

**Ans.(2)**

[Sol. $\frac{r_{D_2}}{r_{O_2}} = \frac{n_{D_2}}{n_{O_2}}\sqrt{\frac{M_{O_2}}{M_{D_2}}}$ ; $n_{O_2} = 1$ ;

$$n_{D_2} = \frac{8}{4} \Rightarrow 2$$

$$\Rightarrow 2\sqrt{\frac{32}{4}} \Rightarrow 4\sqrt{2} \text{ Ans.]}$$

32.

**Ans.(1)**

**Sol.** $HA \underset{}{\overset{K_a}{\rightleftharpoons}} H^+ + A^-$

$c-x \quad 0.1 + x \quad x$

$HB \rightarrow H^+ + B^-$

$(0.1) \quad 0.1$

$$K_a = \frac{(0.1+x)(x)}{c-x} \quad \{\text{Let } x\ c << c \text{ (approx)}\}$$

$$\Rightarrow \text{sub. } 0.1 + x = 0.1 \ ; x = \frac{K_a.c}{0.1} = K_a \ \{\because c = 0.1\}$$

$$\alpha = \frac{x}{c} = 10^{-5}$$

33. (4) Fact
34. (1) Fact
35.

**Ans.(2)**

[Sol. $\frac{T_2}{T_2} = \left(\frac{V_1}{V_2}\right)^{\gamma-1}$

$$\Rightarrow \quad T_2 - T_1 \left(\frac{1}{32}\right)^{\frac{7}{5}-1} = 800.\left(\frac{1}{2^5}\right)^{\frac{2}{5}}$$

$$= 800\ (0.5)^2 = 200 \text{ K}$$

$$\Delta H_m = \frac{7}{2} R \times (200\text{–}800) = -2100 \text{ R Joule}$$

36. (3) Fact
37. (1)
In Deacon process, $Cu_2Cl_2$ is used as catalyst
38. (1)
Fact
39. (4)
40. (1)
In all compounds central metal atom can define same colour due to d-d transitions
41. (3) Fact
42. (3)
Li and He has same screening value
43. (4) Fact
44. (3)
Due to hydrogen bonding, the correct order of B.P. is $PH_3 < AsH_3 < SbH_3 < NH_3 \rightarrow$ Boiling point
45. (3) Fact
46. In sodium chloride, each $Na^+$ ion is surrounded by six $Cl^-$ ions and each $Cl^-$ ion is surrounded by six $Na^+$ ions. Thus, both the ions have coordination number six.

47. For a monobasic acid

$[H^+] = C\alpha$

$$= \frac{1}{10} \times 0.001 = 10^{-4} \Rightarrow pH = 4$$

48. $r = K[A]^n, \ 100r = K[10A]^n$

Thus $\frac{1}{100} = \left(\frac{1}{10}\right)^n$ or $n = 2$

49.
1. $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$
n–hexane
2. $CH_3-\underset{|}{CH}(CH_3)-CH_2-CH_2-CH_3$
2–methyl pentane
3. $CH_3-CH_2-CH(CH_3)-CH_2-CH_3$
3–methyl pentane
4. $CH_3-CH(CH_3)-CH(CH_3)-CH_3$
2,3–Dimethyl butane
5. $CH_3-C(CH_3)_2-CH_2-CH_3$
2,2,–dimethyl butane

50. Two isomers $CH_3-CH(Cl)-CH_3$ and $CH_3-CH_2-CH_2Cl$ are possible for $C_3H_7Cl$.

# [MATHEMATICS]

51. **Ans. (1)**

$$\left.\frac{dy}{dx}\right|_{x=0} = 2$$

Normal : $2y + x - 2 = 0$

$$\text{distance } = \left|\frac{2+1-2}{\sqrt{5}}\right|$$

52. **Ans. (4)**

Given expression is

$4\sin^2\theta + 4\sin^2 2\theta + 4\sin^2 4\theta$

(use : $\sin\theta = -\sin 8\theta$ at $\theta = \frac{\pi}{7}$)

$$4\left[\frac{1-\cos 2\theta}{2} + \frac{1-\cos 4\theta}{2} + \frac{1-\cos 8\theta}{2}\right]$$

$$6 - 2\left[\cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{8\pi}{7}\right]$$

$$6 - 2.\frac{\sin\frac{3\pi}{7}\cos\frac{4\pi}{7}}{\sin\frac{\pi}{7}}$$

$6 + 1 = 7$

53. **Ans. (3)**

$$\frac{ax+b}{x^2+1} \le 20 \forall x \in R$$

$20x^2 - ax + (20 - b) \ge 0 \ \forall \ x \in R$

$a^2 - 80(20 - b) = 0$

$a^2 + 80b = 1600$

54.

**Ans. (1)**

$a_1, a_2, a_3, \ldots\ldots$ are in A.P

$d = 2,\ a_{10} = 21 \Rightarrow a_1 = 3,\ a_n = 2n + 1$

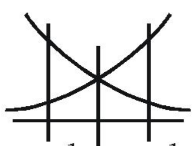
$$\sum_{n=1}^{\infty} T_n = \sum_{n=1}^{\infty} \frac{1}{(2n+1)(2n+5)}$$

$$= \frac{1}{4}\sum_{n=1}^{\infty}\left(\frac{1}{2n+1} - \frac{1}{2n+5}\right)$$

$$= \frac{1}{4}\left[\frac{1}{3} + \frac{1}{5}\right] = \frac{2}{15}$$

55.

**Ans. (4)**




$$\text{Area} = 2\int_0^1 \left(e^x - e^{-x}\right)dx$$

$$= 2\left[e + \frac{1}{e} - 2\right]$$

56.

**Ans. (2)**

$$\frac{\left(1-x^2\right)^3\left(1-x^3\right)\left(1-x^4\right)}{(1-x)^5}$$

$$= \frac{(1-x)^3(1+x)^3(1-x)\left(1+x^2+x\right)(1-x)(1+x)\left(1+x^2\right)}{(1-x)^5}$$

$= (1 + x)^4(x^4 + x^3 + 2x^2 + x + 1)$

$= {}^4C_1 + {}^4C_2 + 2\,{}^4C_3 + {}^4C_4 = 19$

57.

**Ans. (3)**

$4!\ {}^5C_4 = 120$

58.

**Ans. (4)**

We get $S_1 \equiv x^2 + y^2 - 100 = 0$

$\therefore$ it touches $S_2$ internally

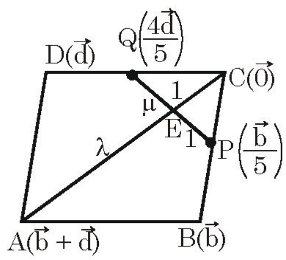
Power of point $P\left(5\sqrt{2}, 5\sqrt{2}\right)$ w.r.t circle

$S_2 = 100 + 10\sqrt{2} > 0$

$\therefore$ lie outside.

59.

**Ans. (1)**




$$\vec{E} = \frac{\vec{b} + \vec{d}}{\lambda + 1} = \frac{\frac{\mu\vec{b}}{5} + \frac{4\vec{d}}{5}}{\mu + 1}$$

$$\therefore \frac{\mu}{5(\mu+1)} = \frac{1}{\lambda+1} \text{ and } \frac{4}{5(\mu+1)} = \frac{1}{\lambda+1}$$

$$\Rightarrow \mu = 4 \text{ and } \lambda = \frac{21}{4}$$

$$\overline{AE} = \left(\frac{\lambda}{\lambda+1}\right)^{\overline{AC}} = \frac{21}{25}\overline{AC}$$

60.

**Ans. (3)**

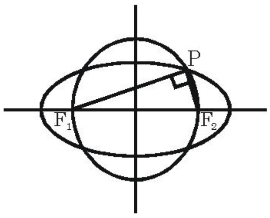
$PF_1 + PF_2 = 21$

$PF_1 . PF_2 = 108$

$\therefore PF_1 = 9, PF_2 = 12$

$\Rightarrow F_1F_2 = 15$

$\Rightarrow 21e = 15 \Rightarrow e = \frac{5}{7}$




61.

**Ans. (3)**

Focus of ellipse $\left(\pm 5\sqrt{3}, 0\right)$

Let hyperbola $\frac{x^2}{A^2} - \frac{y^2}{B^2} = 1$

$A^2 + B^2 = 75$ and $\frac{36}{A^2} - \frac{16}{B^2} = 1$

$\Rightarrow 36\left(75 - A^2\right) - 16A^2 = A^2\left(75 - A^2\right)$

$A^4 - 127A^2 + 2700 = 0$

$A^2 = 100$ or $27$

$B^2 = -25$ or $48$

$\therefore LR = \frac{2B^2}{A} = \frac{2.48}{3\sqrt{3}} = \frac{32}{\sqrt{3}}$

62. **Ans. (1)**

$$\begin{vmatrix} a+1 & 2 & -1 \\ 0 & a & -2 \\ 0 & 0 & a+2 \end{vmatrix} \neq 0$$

$\Rightarrow a(a + 1)(a + 2) \neq 0$

$a \neq 0, -1, -2$

63. **Ans. (3)**

$n = 20, 21$

64.

**Ans. (4)**

Let parabola $(ax + by)^2 + dx + cy + f = 0$, where $ax + by + c = 0$ is axis.

put given point in equation

we get $b^2 + e + f = 0$ ......(1)

$4a^2 + 2d + f = 0$ ......(2)

$4b^2 + 2e + f = 0$ ......(3)

$4a^2 + 4b^2 + 8ab + 2d + 2e + f = 0$ ......(4)

from (1) & (3) $e = -3b^2$,

from (1) $f = 2b^2$

$\therefore$ from (2) $4a^2 + 2d = -2b^2$

Now eq (4) $-2b^2 + 4b^2 + 8ab = 0$

$b = 0$ or $2b + 8a = 0$

$\therefore \quad m = -\frac{a}{b} = \frac{1}{4}$

65. **Ans. (1)**

negation is $p \wedge \sim\left(\left(\sim p\right) \vee \left(\sim q\right)\right)$

$p \wedge \left(p \wedge q\right)$

$p \wedge q$

66. **Ans. (2)**

$\left(\frac{e^x - e^{-x}}{2}\right)\left(dx + dy\right) = \left(\frac{e^x + e^{-x}}{2}\right)\left(dx - dy\right)$

$2e^x dy = 2e^{-x} dx$

$dy = e^{-2x} dx$

$y = -\frac{e^{-2x}}{2} + C$

$2ye^{2x} = -1 + Ce^{2x}$

67. **Ans. (1)**

$I_0 = \int_{\pi/4}^{\pi/2} \frac{\cos x}{\sin x} dx = \frac{1}{2} \ell n2$

$I_n - I_{n-1} = \int_{\pi/4}^{\pi/2} \frac{\cos(2n+1)x - \cos(2n+1)x}{\sin x} dx = \frac{1}{n}\left[\cos 2nx\right]_{\pi/4}^{\pi/2}$

$I_1 - I_0 = -1$

$I_2 - I_1 = 1$

$I_3 - I_2 = -\frac{1}{3}$

on add $I_3 = -\frac{1}{3} + I_0$

68. **Ans. (1)**

$f(x) = \log_e((ax^2 + bx + c)(x - 2))$

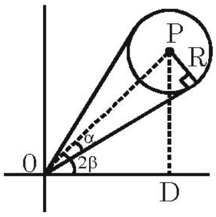
$\therefore\ (ax^2 + bx + c)(x - 2) > 0$

$\left(x + \frac{b}{2a}\right)^2 (x - 2) > 0$

$\therefore x \in (2, \infty)$

69.

**Ans. (4)**




PD = OP sin2β

$= \frac{R}{\sin\alpha} . \sin 2\beta$

$= R\ \text{cosec}\alpha\ \sin 2\beta$

70.

**Ans. (2)**

Let $2\tan^{-1}3 - 3\cot(\tan^{-1}2) = \alpha$

$3\cot(\tan^{-1}2) = \beta$

given expression $\sin\alpha\cos\beta + \cos\alpha\sin\beta$

$\sin(\alpha + \beta)$

$\sin(2\tan^{-1}3)$

$= \frac{2.(3)}{1 + (3)^2} = \frac{3}{5}$

71.

$\frac{\sin^3 x - \cos^3 x}{\sin x + \cos x} = \frac{1 - \cos x \sin x - 2\cos^2 x \sin^2 x}{\sin^2 x - \cos^2 x}$

$\sin^3 x - \cos^3 x = \frac{1 - \cos x \sin x - 2\cos^2 x \sin^2 x}{\sin x - \cos x}$

$\sin^4 x - \cos x \sin^3 x - \cos^3 x \sin x + \cos^4 x$

$= 1 - \cos x \sin x - 2\cos^2 x \sin^2 x$

$(\sin^2 x + \cos^2 x)^2 - 2\cos^2 x \sin^2 x$

$- \cos x \sin x(\sin^2 x + \cos^2 x)$

$= 1 - \cos x \sin x - 2\cos^2 x \sin^2 x$

$0 = 0$

it is always true wherever defined

72.

$P(\sqrt{-1}) = 0$

$\therefore\ P(x) = (x^2 + 1)(ax^2 + bx + e)$

$\therefore\ c = e + a$

$d = b$

$Q(x) = 4ax^3 + 3bx^2 + 2cx + d$

$= (2x^2 + 1)(2ax + d)$

$\therefore\ 2d = 3b$

$2c = 2c$

$\Rightarrow\ e = b = d = 0$

$a = c$

$\therefore\ P(x) = ax^4 + ax^2$

$\because\ \int_0^1 P(x)dx = \frac{16}{15} \Rightarrow \frac{a}{5} + \frac{a}{3} = \frac{16}{15}$

$\Rightarrow\ a = 2$

$\therefore\ a + b + c + d + e = 4$

73.

$0 < x, y, z < 2$

$x + y + z \leq 2$

$\therefore\ P = \frac{8}{6 \times 8} = \frac{1}{6}$

74.

$f(x) = \sin^3 x + \lambda \sin^2 x$

$f'(x) = 3\sin^2 x \cos x + 2\lambda \sin x \cos x$

$= \sin x \cos x(3\sin x + 2\lambda)$

$\because f(x)$ has exactly one minimum and exactly one maximum

$3\sin x + 2\lambda = 0$ and $\sin x \neq 0$

$\sin x = -\frac{2\lambda}{3}$ and $\lambda \neq 0$

$\therefore\ \lambda \in \left(-\frac{3}{2}, \frac{3}{2}\right) - \{0\}$

75.

$|M|^2 = k$

$|M|\sqrt{k}$ or $|M| = -\sqrt{k}$

$x(x-4) + x(x+6) = \sqrt{k}$

$2x^2 + 2x = \sqrt{k}$

$2x^2 + 2x - \sqrt{k} = 0$

always two reals solutions

or $x(x-4) + x(x+6) = -\sqrt{k}$

$2x^2 + 2x + \sqrt{k} = 0$

for no solution

$D < 0$

$4 - 8\sqrt{k} < 0$

$\frac{1}{2} < \sqrt{k}$

$\therefore \quad 9k > \frac{9}{4}$