Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 08/04/2024

Time: 3 hours **Max. Marks:** 300

PRATHAM-1 (24-25)_MPT-1

Physics

Single Choice Question

Q1 If $y = \sin(x) + \ell n(x) + e^{2x}$ then $\frac{dy}{dx}$ will be :

a) $\cos x + \frac{1}{x} + e^{2x}$ b) $\cos x + \frac{1}{x} + 2e^{2x}$ c) $-\cos(x) + \frac{2}{x^2} + e^{2x}$

d) $-\cos x - \frac{2}{x^2} + e^{2x}$

Q2 If $y = \frac{x^2 + 2x}{3x - 4}$, then the value of $\frac{dy}{dx}$ is :

a) $\frac{3x^2 - 8x - 8}{(3x-4)^2}$ b) $\frac{x^2 + 8x - 8}{(3x-4)^2}$ c) $\frac{3x^2 + 8x - 8}{(3x-4)^2}$ d) $\frac{3x^2 - 8x - 8}{(3x+4)^2}$

Q3 Convert 18 degree in to radians.

a) $\frac{\pi}{10}$rad b) $\frac{\pi}{180}$rad c) $\frac{\pi}{18}$rad d) $\frac{18}{\pi}$

Q4 Value of sin (37°) cos (53°) is -

a) $\frac{9}{25}$ b) $\frac{12}{25}$ c) $\frac{16}{25}$ d) $\frac{3}{5}$

Q5 $\sin(90^o + \theta)$ is -

a) $\sin\theta$ b) $\cos\theta$ c) $-\cos\theta$ d) $-\sin\theta$

Q6 Value of $\tan 315^0$ is

a) 1 b) –1 c) 1.732 d) –1.732

Q7 The displacement of a particle is given by the equation
$s = t^3 - 6t^2 + 9t$
where t is measured in seconds and s in meters.
What is the velocity after 1 sec (velocity is rate of change of displacement with respect to time):

a) 1 m/sec. b) 0m/sec c) 2 m/sec. d) 3 m/sec

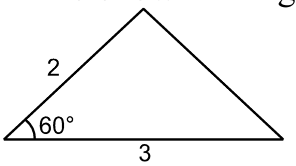
Q8 If $f(x) = \sin^2 x - \cos^2 x$ then $\frac{df}{dx}$ is :

a) $\sin 2x$ b) $\cos 2x$ c) $2 \sin (2x)$ d) $-2\sin(2x)$

Q9 Find value of $\frac{d}{dx}$ $(\cos 45^\circ)$

a) 1 b) 0 c) $\frac{1}{\sqrt{2}}$ d) $-\sin 45^\circ$

Q10 In the shown triangle two sides and one angle is given. The third side is :



a) 49 b) 7 c) $(49)^{1/4}$ d) $\sqrt{7}$

Q11 The displacement of a body at any time 't' after starting is given by $x = \frac{t^3}{3} - \frac{3}{2}t^2 + 2t$. The velocity of the body is zero at t : (velocity is rate of change of displacement with respect to time)

a) 3 sec. b) 4 sec. c) 2 sec. d) zero

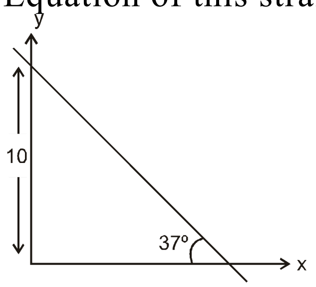
Q12 The radius 'r' of a cylinder increases with time at a constant rate of 2m/sec and its height decreases with time at constant rate of 3 m/sec. The rate of change of volume of cylinder at a time when radius and height of cylinder are 3m and 2m respectively will be :

a) $3\pi m^3/sec.$ b) $-3\pi m^3/sec.$ c) $5\pi m^3/sec.$ d) $-10\pi m^3/sec.$

Q13 $y = x^2 \log x$, then $\frac{dy}{dx}$ will be :

a) $x + 2x \log(x)$ b) $x \log x + 2x$ c) $2x$ d) $x - 2 \log x$

Q14 Equation of this straight line is :



a) $3x + 4y = 40$ b) $3x - 4y = 40$ c) $4x - 3y = 40$ d) $4x + 3y = 40$

Q15 Differentiate $\frac{\sin x}{1 + \cos x}$ with respect to x

a) $\frac{1}{1-\cos x}$ b) $\frac{1}{1+\cos x}$ c) $-\frac{1}{1+\cos x}$ d) $-\frac{1}{1-\cos x}$

Q16 $\cos 2\theta =$

a) $2\cos^2\theta - 1$ b) $1-2\sin^2\theta$ c) $\cos^2\theta - \sin^2\theta$ d) All of the above

Q17 Value of $\sin 15^\circ \cdot \cos 15^\circ$ is :

a) 1 b) $\frac{1}{2}$ c) $\frac{1}{4}$ d) $\frac{\sqrt{3}}{2}$

Q18 If $\sin\theta = \frac{1}{3}$, then $\cos\theta$ will be -

a) $\frac{8}{9}$ b) $\frac{4}{3}$ c) $\frac{2\sqrt{2}}{3}$ d) $\frac{3}{4}$

Q19 If $y = \sqrt{\sin\sqrt{x}}$ then $\frac{dy}{dx}$ is :

a) $\sqrt{\cos\sqrt{x}}$ b) $\frac{\sqrt{\cos\sqrt{x}}}{4\sqrt{x}}$ c) $\frac{\cos\sqrt{x}}{4\sqrt{x\sin\sqrt{x}}}$ d) $\frac{\cos\sqrt{x}}{4\sqrt{\sin\sqrt{x}}}$

Q20 If sides of a rectangle with given perimeter are a &b , then find the relation between a & b for which area of the given rectangle is maximum -

a) $a + b = 0$ b) $a = b$ c) $a.\, b = 1$ d) $a = 4\,b$

Numerical

Q21 Find two positive numbers x & y such that $x + y = 10$ and xy is maximum –

Q22 Value of $\tan 585^\circ$ is :

Q23 The maximum value of xy subject to $x + y = 8$, is:

Q24 Slope of graph $y = \tan x$ drawn between y and x, at $x = \frac{\pi}{4}$ is :

Q25 If $f(x) = x + 2$, then $f[f(3)]$ is :

Q26 Find value of $\sin^2 15^\circ + \sin^2 645^\circ$:

Q27 If $\sin\theta = \frac{1}{3}$, then $\cos\theta$ will be $\frac{x\sqrt{2}}{3}$. Find the value of x

Q28 Value of $\sin(37^\circ)\cos(53^\circ)$ is $\frac{x}{25}$. Then find the value of x.

Q29 Maximum value of $f(x) = \sin x + \cos x$ is $\sqrt{x}$ .Then find the value of x.

Q30 If $y = 3t^2 - 4t$; then minima of y will be at t is equal to x/3. Then find the value of x

Chemistry

Single Choice Question

Q31 Consider various unit system for PV = nRT, select incorrect option :

a) Physical quantity $\rightarrow$ P; SI or MKS $\rightarrow \frac{N}{m^2} or Pa$; CGS $\rightarrow \frac{dyne}{cm^2}$; Other Unit system (atm-L) $\rightarrow$ atm

b) Physical quantity $\rightarrow$ V; SI or MKS $\rightarrow$ dm^3; CGS $\rightarrow$ mL; Other Unit system (atm-L) $\rightarrow$ L

c) Physical quantity $\rightarrow$ n; SI or MKS $\rightarrow$ mol; CGS $\rightarrow$ mol; Other Unit system (atm-L) $\rightarrow$ mol

d) Physical quantity $\rightarrow$ T; SI or MKS $\rightarrow$ K; CGS $\rightarrow$ K; Other Unit system (atm-L) $\rightarrow$ K

Q32 Calculate total number of atoms in 115 g of sodium.

a) 5 **b)** 3 **c)** 5 N_A **d)** 7 N_A

Q33 Determine total numbers of moles of acetone (C_3H_6O) in a sample having58 g of acetone C_3H_6O+ 6.02 × 10^{23} C_3H_6O molecules + 11.2 L acetone vapour at STP +2 mol acetone.
[Take molar volume of gas = 22.4 lit/mol]

a) 1.5 mol **b)** 4.5 mol **c)** 2.5 mol **d)** None of these

Q34 Calculate average molar mass (in g/mol) of a gaseous mixture which contains 2 mol of O_2, 3 mol of CO_2& 5 Mol of SO_2.

a) 44 **b)** 48 **c)** 51.6 **d)** 75.6

Q35 If an atom of an element B contain equal no. of protons and neutrons. Its atomic number (Z) and mass number (A) are related as 2A + 3Z = 140 then the total number of nucleons present in one atom of element is :

a) 60 **b)** 80 **c)** 40 **d)** 50

Q36 Which of the following is not correctly matched?

a) mega (M) = 10^6 **b)** zeta (Z) = 10^{21} **c)** hecto (h) = 10^2 **d)** pico (p) = 10^{-10}

Q37 Three different containers contain three different gases with following parameter.
Container 1 of 67.2 L containing gas X at 0^0C and 1.01325 bar
Container 2 of 44.8 L containing gas Y at 546 K & 760 mm of Hg
Container 3 of 89.6 L containing Z gas at 101325 N/m^2& 0^0C.
Now they are mixed in single container. If gram molecular mass of X, Y & Z are 20 g, 40 g and 80 g respectively. Then which of the following statements are correct.
[Take molar volume of gas = 22.4 lit/mol]
(I) Mole percent of gas Z in final mixture is 50%
(II) Average molecular mass of final mixture is 26.25 amu.
(III) Mole ratio of gas X and gas Z is 3 : 4
(IV) Number of molecules present in final mixture is equal to number of atoms in 300 g Ca.

a) I, II, III **b)** I, II, III, IV **c)** II, III, IV **d)** I, III

Q38 Which of the following gas molecule has atomicity 3 ?

a) Sulphur dioxide **b)** Ozone **c)** Both (A) and (B) **d)** None of these

Q39 A gas sample is having 2280 mm of Hg pressure, determine corresponding pressure in atm.

a) 6 atm **b)** 2 atm **c)** 3 atm **d)** 4 atm

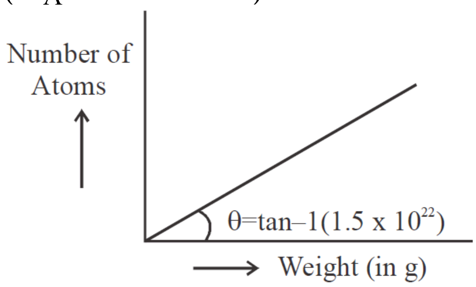
Q40 8 g of O^{2-} ion has amount of charge equal to : ($N_A = 6.02 \times 10^{23}$)

a) 5 $N_A e$ **b)** 2 $N_A e$ **c)** $N_A e$ **d)** $\frac{1}{2} N_A e$

Q41 The volume occupied by 1.5 g of ethane (C_2H_6) gas at 2.46 atm pressure and 27ºC temperature is:

a) 200 cm^3 **b)** 500 mL **c)** 0.2 dm^3 **d)** 0.5 m^3

Q42 A graph is plotted for different samples of an element, by taking its weight (in gram) on X-axis and number of atoms present on Y-axis. Determine the atomic weight of element (in u).
($N_A = 6.0 \times 10^{23}$)



a) 20 u **b)** 40 u **c)** 60 u **d)** 80 u

Q43 Which of the following sample must have average molar mass greater than that of a mixture of N_2 and CO_2?

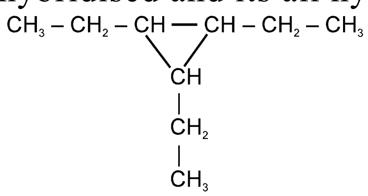
a) Mixture of H_2 and SO_3 **b)** Mixture of CH_4& SO_3 **c)** Mixture of SO_2 and SO_3

d) None of these

Q44 In $\overset{1}{C}H_2 = \overset{2}{C} = \overset{3}{C}H - \overset{4}{C}H_3$ molecule, the hybridization of carbon 1, 2, 3 and 4 respectively are :

a) sp^3, sp, sp^3, sp^3 **b)** sp^2, sp^2, sp^2, sp^3 **c)** sp^2, sp, sp^2, sp^3 **d)** sp^2, sp^3, sp^2, sp^3

Q45 An organic compound has molecular formula C_9H_{18}. Its all carbon atoms are sp^3hybridised and its all hydrogen atoms are identical. Its structure can be :

a)


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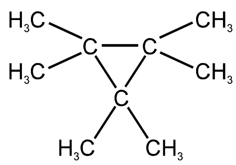
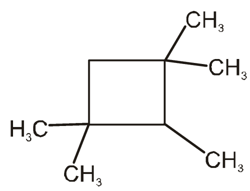
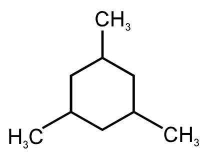


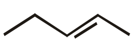
c)


d)


Q46 All the members of a homologous series have same -

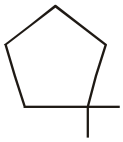
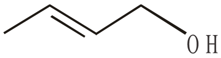
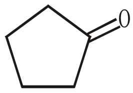
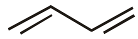
a) Molecular mass **b)** Molecular formula **c)** Physical properties

d) General molecular formula

Q47  and  are :

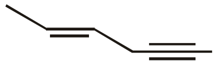
a) Identical **b)** Homologous **c)** Alkane **d)** Saturated hydrocarbon

Q48 Which of the following is unsaturated hydrocarbon ?

a) 
b) 
c) 
d) 

Q49 A primary amine has amino($-NH_2$) group attached to :

a) A primary carbon atom only
b) A secondary carbon atom only
c) A tertiary carbon atom only
d) Primary, secondary, tertiary carbon atoms

Q50 Which of the following is molecular formula of  ?

a) C_7H_{14}
b) C_7H_{12}
c) C_7H_{10}
d) C_7H_8

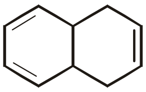
Numerical

Q51 The no. of molecules present in a drop of water with volume 0.06 cm^3 having density 1 gm/cm^3 is approximately $x \times 10^{21}$. Value of x is :

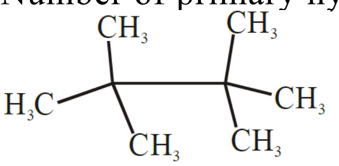
Q52 How many N_A electron is present in 5.1 g NH_3 ?

Q53 The total cationic charge in coulomb present in 51gm of Al_2O_3 is x Faraday. x is :

Q54 Number of hydrogen atoms in the given compound is :



Q55 Number of primary hydrogen is the given compound are



Q56 An element is found in nature in two isotopic forms with mass numbers (A – 1) and (A + 3). If the average atomic mass of the element is found to be A, then the relative abundance (in %) of the heavier isotope in the nature will be :

Q57 Calculate mass of carbon in 0.01 mole of $K_4[Fe(CN)_6]$. Report your answer after dividing by 0.08.

Q58 What is the number of gram atoms of oxygen in 6.023×10^{24} CO-molecule.

Q59 A gaseous mixture contains $SO_3(g)$ and $CH_4(g)$ in 25 : 1 ratio by mass. What is ratio of total number of atoms present in $SO_3(g)$ to total number of atoms present in $CH_4(g)$ in the mixture.

Q60 A gaseous mixture is composed of equal number of moles of CH_4, C_2H_6 and C_2H_2. Determine the average molecular mass of mixture (in amu).

Mathematics

Single Choice Question

Q61 An investigator interviewed 100 students to determine their preferences for the three drinks; milk (M), coffee (C) and Tea (T). He reported the following : 10 students had all the three drinks M.C.T. 20 had M and C; 30 had C and T, 25 has M and T; 12 had M only, 5 had C only and 8 had T only. Number of students did not take any of the three drinks

a) 0 **b)** 20 **c)** 40 **d)** 80

Q62 If $A \subseteq B$, then $B' - A'$ is equal to

a) A' **b)** B' **c)** A **d)** ϕ

Q63 Which of the following is true?

a) $\{2, 3\} \in \{1, 2, 3, 4\}$ **b)** $\{1,2, 3\} \subseteq \{\{1, 2, 3\}, 4,5,6\}$ **c)** $\{\{1\}\} \in \{\{1\}, 2, 3, 4\}$

d) $\{\{1, 2\}\} \subseteq \{\{1, 2\}, 3, 4\}$

Q64 If A and B are two sets, then $A \cap (A \cup B)'$ is equal to

a) A **b)** B **c)** ϕ **d)** None of these

Q65 In a school there are 20 teachers who teach mathematics or physics. Of these, 12 teach mathematics and 4 teach both physics and mathematics, the number of teachers who teach physics are-

a) 12 **b)** 16 **c)** 8 **d)** 4

Q66 For any two sets A and B which of the following is pair wise disjoint family of sets

a) $A \cap B, A - B, A \cup B$ **b)** $A \cap B, B - A, A \cup B$ **c)** $A - B, A \cap B, B - A$

d) None of these

Q67 Number of integral value of x satisfying $\frac{(x+3)^2(x^2+x+1)}{(4-x)x} \geq 0$

a) 1 **b)** 3 **c)** 2 **d)** 4

Q68 The solution of the inequality $(x^2 - 3x + 2)(x^3 - 3x^2)(4 - x^2) \geq 0$ is

a) $x \in (-\infty, -2) \cup (2, 3)$ **b)** $x \in (-\infty, -2)$ **c)** $x \in (-\infty, -2] \cup \{0\} \cup [1, 3]$

d) $x \in [-2, 1] \cup [3, \infty) \cup \{2\}$

Q69 The largest integral value of x which satisfies the inequality $\frac{4x+19}{x+5} < \frac{4x-17}{x-3}$ is:

a) 1 **b)** 3 **c)** 4 **d)** 2

Q70 If x is an integer satisfying $x^2 - 6x + 5 \leq 0$ and $x^2 - 2x > 0$ then the number of possible values of x is

a) 3 **b)** 4 **c)** 2 **d)** infinite

Q71 Least natural number satisfying the inequation $\frac{x^2-x-6}{x^2+6x} \geq 0$ is

a) 1 b) 2 c) 3 d) 4

Q72 Solution set of the inequation $\frac{1}{x^2+x+1} \geq -10$ is

a) $(-1, 0) \cup (1, \infty)$ b) $(-\infty, \infty)$ c) $(-1, 0) \cup (1, 2)$ d) $(-\infty, 0) \cup (0, \infty)$

Q73 Which of the following sets satisfy, $\frac{14x}{x+1} < \frac{9x-30}{x-4}$?

a) $[0, 2)$ b) $(4, 7]$ c) $[5, 6)$ d) $[2, 4)$

Q74 The complete solution set of the inequality $\frac{x^4-3x^3+2x^2}{x^3-x^2-30x} \geq 0$ is

a) $(-\infty, -5) \cup (1, 2) \cup (6, \infty) \cup \{0\}$
b) $(-\infty, -5) \cup [1, 2] \cup (6, \infty) \cup \{0\}$
c) $(-\infty, -5] \cup [1, 2] \cup [6, \infty) \cup \{0\}$
d) $(-5, 0) \cup [1, 2] \cup (6, \infty)$

Q75 If $x = \sqrt{20+\sqrt{20+\sqrt{20+\ldots\ldots\infty}}}$, then the value(s) of x is/are ….. (x> 0)

a) 5, –4 b) 4 c) 5 d) 4, –5

Q76 If $x = 3 - \sqrt{8}$, then $x^3 + \frac{1}{x^3}$ is equal to

a) 6 b) 198 c) $6\sqrt{2}$ d) 102

Q77 Which of the following number is irrational

a) $\sqrt{\frac{4}{9}}$ b) $\sqrt[3]{\frac{8}{27}}$ c) $\frac{7\pi}{22}$ d) $\pi+\sqrt{16-8\pi+\pi^2}$

Q78 The value of $\frac{4}{9^{1/3}-3^{1/3}+1}$ is equal to

a) $3^{1/3}+1$ b) $3^{1/3}-1$ c) $3^{1/3}+2$ d) $3^{1/3}-2$

Q79 The expression $\left[\sqrt[3]{\sqrt[6]{a^9}}\right]^4\left[\sqrt[6]{\sqrt[3]{a^9}}\right]^4$ is simplified to

a) a^{16} b) a^{12} c) a^8 d) a^4

Q80 Which of the following sets is empty set?

a) $A = \{x : x \in N, 3 < x \leq 4\}$
b) $B = \{x : x \text{ is prime}, 90 < x < 96\}$
c) $C = \{x : x \text{ is an even prime}\}$
d) $D = \{x : x \in \text{Rational numbers } \& \ 1 < x < 2\}$

Numerical

Q81 If in a class there are 200 students in which 120 take Mathematics, 90 take Physics, 60 take Chemistry, 50 take Mathematics & Physics, 50 take Mathematics & Chemistry, 43 take Physics & Chemistry and 38 take Mathematics, Physics & Chemistry, then the number of students who have taken exactly one subject is

Q82 Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. Find the values of m + n.

Q83 Given the sets A = {1, 2, 3}, B = {3, 4}, C = {4, 5, 6}, then number of element in $A \cup (B \cap C)$ is.

Q84 Find the sum of all the solutions of inequality $\dfrac{(x-8)^4(x-2)^5(x-1)^3(x+1)^2(x+5)^2}{x^4-2x^3-x+2} \leq 0$.

Q85 If $\dfrac{2x}{2x^2+5x+2} > \dfrac{1}{x+1}$, then complete solution set is $(a, -1) \cup (b, c)$. Find a – 3b – 12c.

Q86 If n, m ∈ N and $m = \dfrac{n^2-n-35}{n-4}$, then find the value of m.

Q87 The number of positive integral solution of, $\dfrac{x^2(4-3x)^3(x-2)^4}{(x-5)^5 \cdot (2x-7)^6} \geq 0$ is

Q88 If n(A) = 12, n(B) = 15, If x and y are minimum and maximum of $n(A' \cap B)$ then x + y =

Q89 The number of subsets of the power set of set A = {10, 11} is

Q90 Let n(U) = 700, n(A) = 200, n(B) = 300 and $n(A \cap B)$ = 100. Find the value of $\dfrac{n(A' \cap B')}{10} =$

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**B**	**A**	**A**	**A**	**B**	**B**	**B**	**C**	**B**	**D**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**C**	**B**	**A**	**A**	**B**	**D**	**C**	**C**	**C**	**B**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**25**	**1**	**16**	**2**	**7**	**1**	**2**	**9**	**2**	**2**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**B**	**C**	**B**	**C**	**C**	**D**	**D**	**C**	**C**	**C**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**B**	**B**	**C**	**C**	**B**	**D**	**B**	**D**	**D**	**C**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**2**	**3**	**3**	**12**	**18**	**25**	**9**	**10**	**4**	**24**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**B**	**D**	**D**	**A**	**A**	**C**	**D**	**C**	**D**	**A**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**C**	**B**	**C**	**D**	**C**	**B**	**C**	**A**	**D**	**B**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**98**	**9**	**4**	**2**	**6**	**29**	**3**	**18**	**16**	**30**