Monthly Progessive Test (Solution)

Class: XI

Subject: PCMB

Academic Excellence Programme TECHNO ACE

Test Booklet No.: MPT02 | Test Date: 10052024

Physics

1. Ⓑ

$$F = G\cdot\frac{m_1\cdot m_2}{r^2} \Rightarrow [F\cdot r] = [E] = \left[G\cdot\frac{m_1\cdot m_2}{r}\right] \qquad \left[\frac{E}{G}\right] = \frac{M^2}{L}$$

2. Ⓓ

$$\frac{F}{A} = \frac{ML}{T^2}\cdot\frac{1}{L^2} = ML^{-1}T^{-2}$$

3. Ⓑ

$$H = mc\theta \qquad [mc] = \frac{ML^2}{T^2k} = ML^2T^{-2}k^{-1}$$

4. Ⓒ

$n \propto u^{-1}$

5. Ⓒ
6. Ⓒ
7. Ⓒ

newton

8. Ⓒ

36 km/hr $\Rightarrow$ 10 m/s

$\frac{18}{5}$ km/hr $\Rightarrow$ 1 m/s

9. Ⓓ

$0.8 \times 1000 = 800$ kg/m^3

10. Ⓐ

Parsec

11. Ⓒ

1 Fermi = 10^{-15} m

12. Ⓒ

$$\frac{V}{\text{length}} = \frac{L}{T} \times \frac{1}{L} = T^{-1}$$

13. Ⓑ

$$[mv] = \left[\frac{\text{ML}}{\text{T}}\right]$$

14. Ⓒ

[escape velocity] = $L/T = LT^{-1}$

15. Ⓐ

$[\mu] = M^0L^0T^0$

16. Ⓑ

1 N = 10^5 dyne

17. Ⓓ

1 joule = 10^7 erg

18. Ⓒ

1 l = 1000 c.c.

19. Ⓐ

$R^2 = p^2 + p^2 + 2 \cdot p \cdot p \cdot \cos 120°$
$\therefore R = p$

20. Ⓑ

$s^2 = 3^2 + 4^2$ $\quad s = 5$ m

21. Ⓐ

MLT^{-2}

22. Ⓑ

Dimensionless

23. Ⓓ

FA^{-1}

24. Ⓐ

$$V = \frac{\text{Length}}{T} \qquad [\text{length}] = VT$$

25. Ⓒ

1% + 0.5% = 1.5%

Chemistry

26. Ⓐ

	Fe_2O_3	FeO
Fe : O	$(2\times 56):(3\times 16)$	$56:16$ or $(2\times 56):(2\times 16)$

So, iron is kept constant. Hence,

Oxygen from Fe_2O_3 : Oxygen from FeO = (48 : 32) = 3 : 2

27. Ⓑ

In $(NH_4)_3PO_4$,

12 mole hydrogen ≡ 4 mole oxygen

$$\therefore \quad 6.36 \text{ mole hydrogen} \equiv \left[\frac{4\times 6.36}{12}\right] = 2.12 \text{ mole oxygen}$$

28. Ⓒ

63.5 gm copper $\equiv 6.02 \times 10^{23}$ atoms

$$\therefore \quad 0.635 \text{ gm copper} \equiv \left[\frac{6.02\times 10^{23}\times 0.635}{63.5}\right] = 6.02\times 10^{21} \text{ atoms}$$

29. Ⓓ

12×10^3 gm carbon $\equiv 6.02 \times 10^{23}$ atoms

$$1.2 \text{ mg carbon} \equiv \left[\frac{6.02\times 10^{23}\times 1.2}{12\times 10^3}\right] = 6.02\times 10^{19} \text{ atoms}$$

30. Ⓐ

In the given number, there are three significant numbers and these are 6, 0, 2

31. Ⓐ

22.4 L H_2 at STP $\equiv 6.02 \times 10^{23}$ molecules

$$\therefore \quad 15 \text{ L } H_2 \text{ at STP} \equiv \left[\frac{6.02\times 10^{23}\times 15}{22.4}\right] = 4.031\times 10^{23} \text{ molecules}$$

22.4 L N_2 at STP $\equiv 6.02 \times 10^{23}$ molecules

$\therefore \quad 5 \text{ L } N_2 \text{ at STP} \equiv \left[\frac{6.02 \times 10^{23} \times 5}{22.4}\right] = 1.34 \times 10^{23}$ molecules

2 gm $H_2 \equiv 6.02 \times 10^{23}$ molecules

$\therefore \quad 0.5 \text{ gm } H_2 \equiv \left[\frac{6.02 \times 10^{23} \times 0.5}{2}\right] = 1.505 \times 10^{23}$ molecules

32 gm $O_2 \equiv 6.02 \times 10^{23}$ molecules

$\therefore \quad 10 \text{ gm } O_2 \equiv \left[\frac{6.02 \times 10^{23} \times 10}{32}\right] = 1.881 \times 10^{23}$ molecules

32. Ⓐ

22.4 L = 22400 mL

22400 mL $CH_4 \equiv 16$ gm CH_4

$\therefore \quad 112 \text{ mL } CH_4 \equiv \left[\frac{16 \times 112}{22400}\right] = 0.08 \text{ gm } CH_4$

33. Ⓐ

$2H_2 + O_2 \longrightarrow H_2O_2$

According to this equation, 2 gm H_2 reacts with 32 gm O_2. So, 4 gm H_2 reacts with 64 gm O_2

$H_2 + O_2 \longrightarrow 2H_2O$

According to this equation, 4 gm H_2 reacts with 32 gm O_2.

Now, hydrogen is constant

So, (oxygen combine to form H_2O_2 : oxygen combine to form H_2O) = 32 : 64 = 1 : 2

34. Ⓒ

28 gm N_2 produces (2 × 17) gm NH_3

$\therefore \quad 5.6 \text{ gm } N_2 \text{ produces } \left(\frac{2 \times 17 \times 5.6}{28}\right) = 6.8 \text{ gm } NH_3$

35. Ⓐ

$N_2 + 2H_2 \longrightarrow 2NH_3$

150 mL H_2 reats with 50 mL N_2. So, 100 mL NH_3 is produced. Now, total volume of gases in reactant side is 200 mL.

36. Ⓓ

The balanced equation is $2H_2 + O_2 \longrightarrow 2H_2O$

So, 2 volume H_2 is reacting with 1 volume O_2 gas. Hence, both H_2 and O_2 are completely consumed. So, no unreacted gas will be there

37. Ⓓ

32 gm $O_2 \equiv 6.02 \times 10^{23}$ O_2 molecules

$$0.016 \text{ gm } O_2 \equiv \left[\frac{6.02 \times 10^{23} \times 0.016}{32}\right] = 3.01 \times 10^{20} \text{ } O_2 \text{ molecules}$$

38. Ⓓ

Atomic mass unit is defined as one atom is how much heavier than $\frac{1}{12}$th mass of one C - 12 carbon atom

39. Ⓑ

Molecular weight of $CaCO_3 = (40 + 12 + 48) = 100$

$100 \text{ gm } CaCO_3 \equiv 6.02 \times 10^{23} \text{ } CaCO_3$ molecules

$$1 \text{ gm } CaCO_3 \equiv \left[\frac{6.02 \times 10^{23}}{100}\right] = 6.02 \times 10^{21} \text{ molecules}$$

40. Ⓐ

$$0.355 \text{ gm } Cl_2 \equiv \frac{0.355}{71} = 0.005 \text{ mole } Cl_2$$

$$0.071 \text{ gm } Cl_2 \equiv \frac{0.071}{71} = 0.001 \text{ mole } Cl_2$$

$$6.02 \times 10^{20} \text{ } Cl_2 \text{ molecules} \equiv \frac{6.02 \times 10^{20}}{6.02 \times 10^{23}} = 0.001 \text{ mole } Cl_2$$

41. Ⓒ

Zetta = 10^{21} and Yocto = 10^{-24}

So, $(X + Y) = [21 + (-24)] = -3$

42. Ⓒ

$$\text{Correct atomic mass of carbon} = \frac{(36 \times 7.1) + (38 \times 16.3) + (40 \times 76.6)}{100} = 39.39$$

43. Ⓑ

One H_2 molecule contains 2 electrons

1 mole $H_2 \equiv 2g \text{ } H_2$

$\therefore$ 2 gm H_2 contain $(2 \times 6.02 \times 10^{23})$ electrons

$$\therefore \quad 0.05 \text{ gm } H_2 \text{ contain } \left(\frac{0.05 \times 2 \times 6.02 \times 10^{23}}{2}\right) = 301 \times 10^{20} \text{ electrons}$$

44. Ⓑ

Percentage of oxygen is calculated below

$NO_2 \longrightarrow \frac{3200}{46} = 69.56\%$

$NO \longrightarrow \frac{1600}{30} = 53.33\%$

$N_2O \longrightarrow \frac{1600}{44} = 36.36\%$

So, the correct order of oxygen is $NO_2 > NO > N_2O$

45. Ⓑ

Molecular weight of $H_2SO_4 = [2 + 32 + 64] = 98$

So, percentage of oxygen = $\frac{6400}{98} = 65.3\%$

46. Ⓒ

One $CaCO_3$ molecule contains 5 atoms and molecular weight of $CaCO_3 = [40 + 12 + 48] = 100$

100 gm $CaCO_3$ contain $(5 \times 6.02 \times 10^{23})$ atoms

$\therefore$ 20 gm $CaCO_3$ contain $\left(\frac{5 \times 6.02 \times 10^{23} \times 20}{100}\right) = 6.02 \times 10^{23}$ atoms

47. Ⓓ

For oxygen $= \frac{3.01 \times 10^{22}}{6.02 \times 10^{23}} = \frac{1}{20} = 0.05$ mole

For hydrogen $= \frac{560}{22400} = \frac{1}{20} = 0.025$ mole

So, total number of moles = $(0.05 + 0.025) = 0.075$ mole

48. Ⓑ

0.355 gm $Cl_2 \equiv \frac{0.355}{71} = 0.005$ mole Cl_2

1.204×10^{23} O_2 molecules $\equiv \frac{1.204 \times 10^{20}}{6.02 \times 10^{23}} = 0.2$ mole O_2

0.112 L N_2 at STP $\equiv \frac{0.112}{22.4} = 0.005$ mole N_2

49. Ⓒ

Molecular weight of $Na_2SO_3 = (46 + 32 + 48) = 126$

Now, 126 gm = $\frac{126}{18} = 7$ mole H_2O

So, molecular formula of the salt is $Na_2SO_3.7H_2O$

50. Ⓑ

$$(\text{percentage of carbon})_{CF_4} = \frac{1200}{84} = 14.28\%$$

$$(\text{percentage of carbon})_{CO} = \frac{1200}{28} = 42.85\%$$

$$(\text{percentage of carbon})_{CO(NH_2)_2} = \frac{1200}{60} = 20\%$$

Mathematics

51. Ⓐ

$A = \{1, 2, 3, 4, 5\}$, $B = \{2, 4, 6\}$, $C = \{3, 4, 6\}$

$A \cup B = \{1, 2, 3, 4, 5, 6\}$

$(A \cup B) \cap C = \{3, 4, 6\}$

52. Ⓐ

All parallelograms are trapeziums, but all trapeziums are not parallelogram.

$\therefore\ P \subset T$

$\therefore\ P \cap T = P$

53. Ⓐ

$n[P(A)] = 2^m$ where n(A) = m.

But there is no integral value of m

So that $2^m = 26$

54. Ⓒ

$n(C) = 63$, $n(A) = 76$, $n(C \cap A) = x$

$n(C \cup A) = 63 + 76 - x = 139 - x$

$n(C \cup A) \leq 100$

$\Rightarrow 139 - x \leq 100 \Rightarrow x \geq 39$

Again, $n(C \cap A) \leq \min\{n(C), n(A)\}$

$\Rightarrow\ x \leq 63$

$\therefore\ 39 \leq x \leq 63$

55. Ⓑ

$n(A \times B) = n(A) \times n(B)$

$45 = n(A) \times n(B)$

$n(A)$ cannot be 17 because in that case $n(B)$ will be fraction which is not possible.

56. Ⓐ

No. of relations from A to $B = 2^{mn}$

57. Ⓒ

R be a relation from A to B.

$\therefore\ R \subseteq A \times B$

58. Ⓓ

The set of intelligent students in a class is not a well-defined collection.

59. Ⓑ

$x \in R, x^2 + 1 = 0 \Rightarrow x = \pm\sqrt{-1} = \pm i$ which is not real.

$\therefore$ empty set

60. Ⓓ

$A = \{x : -3 < x < 3, x \in Z\}$

$= \{-2, -1, 0, 1, 2\}$

$\therefore$ No. of subsets $= 2^5 = 32$

61. Ⓒ

A = {2, 3, 5, 7}

62. Ⓒ

$$f(x) = x^3 - \frac{1}{x^3} \quad \therefore\ f\left(\frac{1}{x}\right) = \frac{1}{x^3} - x^3$$

$$\therefore\ f(x) + f\left(\frac{1}{x}\right) = \cancel{x^3} - \frac{1}{\cancel{x^3}} + \frac{1}{\cancel{x^3}} - \cancel{x^3} = 0$$

63. Ⓐ

$f(x) = x^2 + 2 \geq 2 \quad \forall x \in R$

$\therefore$ Range of $f(x) = [2, \infty)$

64. Ⓓ

Two functions f and g are said to be equal if

(i) the domain of f = the domain of g

(ii) the co-domain of f = the co-domain of g

(iii) $f(x) = g(x)\ \forall x$

65. ©

$$f(x) = \frac{1}{x^2 - 3x + 2} = \frac{1}{(x-2)(x-1)}$$

$\therefore$ Domain $= R - \{1, 2\}$

66. Ⓑ

$X = \{4^n - 3n - 1 : n \in N\}$

$= \{0, 9, 54, ...\}$

$Y = \{9(n-1) : n \in N\}$

$= \{0, 9, 18, 27, 54, ...\}$

$\therefore\ X \cup Y = \{0, 9, 18, 27, 54, ...\}$

$= Y$

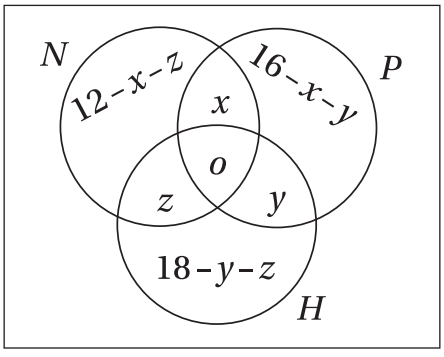
67. ©

$A = \{3, 6, 9, 12, ...\},\ B = \{5, 10, 15, ...\}$

$\therefore\ A \cap B = \{15, 30, 45, ...\}$

68. Ⓐ

$\therefore\ 12 - x - z + 16 - x - y + 18 - y - z + x + y + z = 30$



$\Rightarrow\ 46 - (x + y + z) = 30$

$\Rightarrow\ x + y + z = 16$

69. Ⓑ

$O[P(A)] = 2^n$ where $O(A) = n$

70. ©

$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$= 200 + 300 - 100$

$= 400$

$\therefore\ n(A^C \cap B^C) = n(A \cup B)^C = n(\cup) - n(A \cup B)$

$= 700 - 400$

$= 300$

71. Ⓑ

$-7 + 9 \le 9 - 7\sin x \le 7 + 9$

$\Rightarrow\ 2 \le 9 - 7\sin x \le 16$

$\Rightarrow\ 2 \le f(x) \le 16$

72. Ⓐ

$y = \dfrac{x}{1+x^2} \ \Rightarrow\ yx^2 - x + y = 0$

$\therefore\ 1 - 4y^2 \ge 0$

$\Rightarrow\ y^2 - \left(\dfrac{1}{2}\right)^2 \le 0$

$\Rightarrow\ \left(y + \dfrac{1}{2}\right)\left(y - \dfrac{1}{2}\right) \le 0$

$\Rightarrow\ y \in \left[-\dfrac{1}{2}, \dfrac{1}{2}\right]$

73. Ⓑ

Graph of even function is symmetrical about $x = 0$

74. Ⓐ

$\tan(-x) = -\tan x$

$\Rightarrow$ $\tan x$ is odd function

75. ©

$\{(1, 2), (2, 2), (3, 2), (4, 2)\}$

which is constant function

76. Ⓓ

Systematics

77. Ⓐ

All over the body

78. Ⓓ

Euglena

Autotrophic and saprotrophic

79. Ⓓ

All of the above

80. Ⓐ

Ginkgo

It is referred to as living fossil as it has not shown any change over the years (more than 200 million years), survives with its primitive characters, while its related members or species have become extinct or fossilised.

81. Ⓒ

Pseudocoelom

Its a feature of nematodes.

82. Ⓓ

Earthworm

Exchange of respiratory gases occurs through the skin.

83. Ⓐ

Species

84. Ⓑ

Phylum

Its a Phylum in the Kingdom Animalia.

85. Ⓐ

Halophiles

86. Ⓐ

Mycoplasma

87. Ⓐ

Pteridophytes

Have vascular tissues among cryptogams.

88. Ⓓ

Pteridophytes

Have vascular tissues.

89. Ⓑ

Paralysing the prey

90. Ⓐ

Ostracodermi

They perished about 420 million years ago after the appearance of jawed fishes

91. Ⓑ

Kingdom-Phylum-Class-Order-Family

92. Ⓒ

Generic name and specific epithet

93. Ⓐ

Dinoflagellates

Dinoflagellates multiply rapidly causing the sea surface to become reddish.

94. Ⓒ

Basidiomycetes

95. Ⓒ

Salvinia

96. Ⓑ

capsule

97. Ⓐ

Cycas

98. Ⓓ

Apis and *Bombyx*, respectively

99. Ⓒ

Echinoderms

100. Ⓓ

All of the above