Read all the instructions carefully before answering your questions.
You are not allowed to leave the exam hall before the end of the test.

GENERAL INSTRUCTIONS

- This booklet is your question paper. Answers are to be marked in the provided OMR sheet.
- This question paper contains FIVE sections.
  - Section- I is **MATHEMATICS**,
  - Section - II is **PHYSICS**,
  - Section - III is **CHEMISTRY**,
  - Section–IV IS **BIOLOGY**,
  - Section – V is **APTITUDE**.
- There are a total of 100 questions.
- All questions are **Multiple Choice questions with single answer correct**.
- Each question carries **+4 marks** for correct answer, **No negative marks**

FILLING OMR SHEET

Ensure all details in the OMR are filled before you start marking your answers.

On the OMR sheet, darken the appropriate bubble with **BALL POINT PEN ONLY**

Name of the Candidate	:		
Roll Number	:		
Date of Examination	:	***Centre :***	

Useful Data

PHYSICS

Acceleration due to gravity	: g = 10 m/s^2
Planck constant	: h = 6.6 × 10^{-34} $J-s$
Charge of electron	: e = 1.6 × 10^{-19} C
Mass of electron	: $m_e = 9.1\times10^{-31}\,kg$
Permittivity of free space	: $\varepsilon_0 = 8.85\times10^{-12}\,C^2/N-m^2$
Density of water	: $\rho_{water} = 10^3\,kg/m^3$
Atmospheric pressure	: $Pa = 10^5\,N/m^2$
Gas constant:	R = 8.314 J K^{-1} mol^{-1}

CHEMISTRY

Gas Constant R	=	8.314 J $K^{-1}mol^{-1}$
	=	0.0821 Lit atm $K^{-1}mol^{-1}$
	=	1.987 ≈ 2 Cal $K^{-1}mol^{-1}$
Avogadro's number N_a	=	6.023 × 10^{23}
Planck's constant h	=	6.625 ×10^{-34} $J.s$
	=	6.625 ×10^{-27} $erg.s$
1 Faraday	=	96500 coulomb
1 calorie	=	4.2 joule
1 amu	=	1.66 ×10^{-27} kg
1 eV	=	$1.6\times10^{-19}\,J$

Atomic No: H = 1, He = 2, Li = 3, Be = 4, B = 5, C = 6, N = 7, O = 8, F = 9, Ne = 10, Na = 11, Mg = 12, Si = 14, Al = 13, P = 15, S = 16, Cl = 17, Ar = 18, K = 19, Ca = 20, Cr = 24, Mn = 25, Fe = 26, Co = 27, Ni = 28, Cu = 29, Zn = 30, As = 33, Br = 35, Ag = 47, Sn = 50, I = 53, Xe = 54, Ba = 56, Pb = 82, U = 92.

Atomic masses: H = 1, He = 4, Li = 7, Be = 9, B = 11, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Si = 28, Al = 27, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Co= 59, Ni = 58.7, Cu = 63.5, Zn = 65.4, As = 75, Br = 80, Ag = 108, Sn = 118.7, I = 127, Xe = 131, Ba = 137, Pb = 207, U = 238.

Section – I – MATHEMATICS

1. In a survey of 800 candidates, 250 played Cricket, 300 played Football, and 220 played Hockey. 60 played both Cricket and Football, 50 played both Football and Hockey, and 70 played both Cricket and Hockey. If 30 candidates played all three sports, how many candidates did not play any of the three sports?
   (a) 120 (b) 150 (c) 180 (d) 210

2. Find the range of the function $f(x)=\frac{x^2}{x^2+1}$ for $x \in \mathbb{R}$.
   (a) $(0,1]$ (b) $[0,1]$ (c) $[0,1)$ (d) $(-\infty,1)$

3. If $[x]^2-5[x]+6=0$, where [.]denotes the greatest integer function, then –
   (a) $x \in [3,4]$ (b) $x \in (2,3]$ (c) $x \in [2,3]$ (d) $x \in [2,4)$

4. Evaluate the exact value of the product: $\cos 20°\cos 40°\cos 60°\cos 80°$.
   (a) $\frac{1}{8}$ (b) $\frac{1}{4}$ (c) $\frac{1}{32}$ (d) $\frac{1}{16}$

5. If A + B = 225° then $\frac{\cot A}{1+\cot A}\cdot\frac{\cot B}{1+\cot B}=$
   (a) 1 (b) – 1 (c) 0 (d) $\frac{1}{2}$

6. If α and β are the roots of the quadratic equation $x^2-\sqrt{3}x+1=0$, what is the value of $\alpha^{18}+\beta^{18}$?
   (a) – 2 (b) 2 (c) 0 (d) $2\sqrt{3}$

7. If $z+\frac{1}{z}=1$, then the value of $z^{2000}+\frac{1}{z^{2000}}$ is –
   (a) 1 (b) 0 (c) – 1 (d) 2

8. If z satisfies $|z-2-3i| \le 2$, then the greatest and least values of $|z|$ are respectively –
   (a) $\sqrt{13}+4$ and $\sqrt{13}-4$ (b) $\sqrt{13}+2$ and $\sqrt{13}-2$
   (c) 13 and 5 (d) $\sqrt{17}$ and $\sqrt{5}$

9. Let the sum of the first n terms of an A.P. be $3n^2+5n$ Then the sum of squares of the first 10 terms of the A.P. is –
   (a) 10220 (b) 12860 (c) 15220 (d) 19780

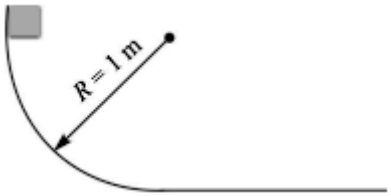
10. If the sum of n numbers in the GP 5,10,20, … is 1275 then n is?
    (a) 6 (b) 7 (c) 8 (d) 9

Section – II – PHYSICS

11. Let the angle between two nonzero vectors $\vec{A}$ and $\vec{B}$ be 120° and resultant be $\vec{C}$
(a) $\vec{C}$ must be equal to $|\vec{A}-\vec{B}|$ (b) $\vec{C}$ must be less than $|\vec{A}-\vec{B}|$
(c) $\vec{C}$ must be greater than $|\vec{A}-\vec{B}|$ (d) $\vec{C}$ may be equal to $|\vec{A}-\vec{B}|$

12. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces –
(a) Are equal to each other in magnitude (b) Are not equal to each other in magnitude
(c) Cannot be predicted (d) Are equal to each other

13. A block of mass of 1 kg slides down a curved track that is one quadrant of a circle of radius 1 m. Its speed at the bottom is 2 m/s. The work done by the frictional force is –



(a) 8 J (b) – 8 J (c) 4 J (d) – 4 J

14. A body sliding on a smooth inclined plane requires 4 seconds to reach the bottom starting from rest at the top. How much time does it take to cover one-fourth distance starting from rest at the top (assume it us uniformly accelerating down)
(a) 1 s (b) 2 s (c) 4 s (d) 16 s

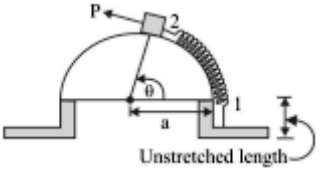
15. A body thrown vertically upwards with an initial velocity u reaches maximum height in 6 seconds. The ratio of the distances travelled by the body in the first second and the seventh second is –
(a) 1 : 1 (b) 11 : 1 (c) 1 : 2 (d) 1 : 11

16. A very large number of balls are thrown vertically upwards in quick succession in such a way that the next ball is thrown when the previous one is at the maximum height. If the maximum height is $5m$, the number of balls thrown per minute is – (take $g = 10ms^{-2}$)
(a) 120 (b) 80 (c) 60 (d) 40

17. The coordinates of a moving particle at any time are given by $x = at^2$ and $y = bt^2$. The speed of the particle at any moment is ___.
(a) $2t(a+b)$ (b) $2t\sqrt{(a^2-b^2)}$ (c) $t\sqrt{a^2+b^2}$ (d) $2t\sqrt{(a^2+b^2)}$

18. A particle starts moving rectilinearly at $t = 0$ such that its velocity as function of time is $v = t^2 - t$, where v is in ms^{-1} and t is in seconds. The time interval in which the particle decelerates is ___
(a) $t > 1s$ (b) $t < \frac{1}{2}$ (c) $\frac{1}{2}s < t < 1s$ (d) $t < \frac{1}{2}s$ and $t > 1s$

19. A variable force P is maintained tangent to a frictionless cylindrical surface of radius a as shown in figure. By slowly varying this force, a block of weight W is moved and the spring to which it is stretched from position 1 to position 2. The work done by the force P is –



(a) $W\,a\sin\theta$ (b) $\frac{1}{2}ka^2\theta^2$ (c) $W\,a\sin\theta + k\,a^2\theta^2$ (d) $W\,a\sin\theta + \frac{1}{2}k\,a^2\theta^2$

20. A ball of mass m is thrown vertically upwards. Another ball of mass $2m$ is thrown at an angle θ with the vertical. Both of them stay in air for same period of time. The heights attained by the two balls are in the ratio of –
(a) 2 : 1 (b) 1: cos θ (c) 1 : 1 (d) cos θ: 1

Section – III – CHEMISTRY

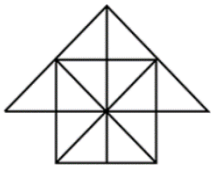
21. 1000g NH_4NO_2 substance contains _____ g of oxygen
(a) 250 g (b) 750 g (c) 500 g (d) 400 g
22. In the reaction $4A+2B+3C \rightarrow A_4B_2C_3$. What will be the number of moles of product formed, starting from one mole of A, 0.6 mole of B and 0.72 mole of C?
(a) 0.25 (b) 0.3 (c) 0.24 (d) 2.32
23. If 0.5 mol of $BaCl_2$ is mixed with 0.2 mol of Na_3PO_4, the maximum number of mol of $Ba_3(PO_4)_2$ that can be formed is –
(a) 0.7 (b) 0.5 (c) 0.30 (d) 0.10
24. If 3L of 0.1 M HCl is added to 2 L of 0.5 M HCl, calculate the molarity of resultant solution?
(a) 0.48 (b) 0.26 (c) 0.12 (d) 0.4
25. In the ground state of Cu^+ the number of shells occupied, sub–shells occupied, filled orbitals and unpaired electrons respectively are –
(a) 4, 8, 15, 0 (b) 3, 6, 15, 1 (c) 3, 6, 14, 0 (d) 4, 7, 14, 2
26. The amount of energy required to remove electron from a Li^{2+} in its ground state is how many times greater than the amount of energy needed to remove the electron from H atom in its ground state?
(a) 9 (b) 6 (c) 4 (d) 3
27. Which of the following molecule involves more than six orbitals in hybridization?
(a) IF_5 (b) IF_7 (c) XeF_4 (d) XeO_4
28. Which of the following molecule is having only one lone pair of electrons on the central atom?
(a) OF_2 (b) ClF_3 (c) XeF_4 (d) SF_4
29. Which element has highest electron affinity in the periodic table?
(a) F (b) Cl (c) Br (d) I
30. Imaginary element with atomic number 119 belongs to which block of the periodic table?
(a) s (b) p (c) d (d) f

Section – IV – Biology

31. Which of the following organisms belongs to Kingdom Monera?
    (a) Amoeba (b) Nostoc (c) Yeast (d) Paramecium
32. Which statement about viruses is correct?
    (a) They have a cellular organization
    (b) They can reproduce independently outside a host
    (c) They contain either DNA or RNA as genetic material
    (d) They always behave as living organisms
33. Which group of plants is known as the amphibians of the plant kingdom?
    (a) Algae (b) Bryophytes (c) Pteridophytes (d) Gymnosperms
34. In gymnosperms, the seeds are called "naked" because:
    (a) They lack a seed coat (b) They are not enclosed within an ovary
    (c) They do not contain an embryo (d) They are produced without fertilization
35. Which of the following represents the correct sequence in the evolution of plant groups?
    (a) Bryophytes → Algae → Pteridophytes → Gymnosperms
    (b) Algae → Bryophytes → Pteridophytes → Gymnosperms
    (c) Pteridophytes → Bryophytes → Algae → Angiosperms
    (d) Algae → Pteridophytes → Bryophytes → Gymnosperms
36. Which phylum is characterised by the presence of cnidoblasts or nematocysts?
    (a) Porifera (b) Cnidaria (c) Platyhelminthes (d) Annelida
37. Which of the following animals is a pseudocoelomate?
    (a) Earthworm (b) Planaria (c) Ascaris (d) Starfish
38. Which feature is characteristic of Chordata?
    (a) Jointed appendages (b) Notochord
    (c) Water vascular system (d) Flame cells
39. Which tissue is primarily responsible for covering and lining body surfaces?
    (a) Connective tissue (b) Muscular tissue
    (c) Epithelial tissue (d) Neural tissue
40. Which type of muscle tissue is striated, branched and involuntary?
    (a) Skeletal muscle (b) Smooth muscle (c) Cardiac muscle (d) Voluntary muscle

Section – V – Aptitude

41. In the following question, count the number of triangles and squares in the given figure.



(a) 26 triangles, 5 squares (b) 28 triangles, 5 squares
(c) 28 triangles, 6 squares (d) 26 triangles, 6 squares

42. Can you guess this number?
The number is not an odd number.
It has exactly four factors.
If you reverse the digits, a prime number is formed.
The sum of the digits is a two digit prime number.
The number is less than the square root of 104.
One of the digits is a square number.
Then the unit place of the required number is –
(a) 7 (b) 4 (c) 5 (d) 3

43. A child was looking for his father. He went 90 metres in the East before turning to his right. He went 20 metres before turning to his right again to look for his father at his uncle's place 30 metres from this point. His father was not there. From here he went 100 metres to the North before meeting his father in a street. How far did the son meet his father from the starting point?
(a) 80 metres (b) 100 metres (c) 140 metres (d) 260 metres

44. Elizabeth visits her friend Andrew and then returns home by the same route. In her route, she walks 2km/h when going uphill, 6km/h when going downhill and 3km/h when on level ground. If her total walking time is 6 hours, then what is the total distance she walks in km?
(a) 18 km (b) 20 km (c) 16 km (d) 22 km

45. In a certain code language 'BOOK' is coded as 'DMRH' and 'WELL' is coded as 'YCOI'. How will 'TREE' be coded in the same language?
(a) VSHC (b) UPHC (c) VPHB (d) UQHB

46. In a group of 6 persons of unequal heights, D is shorter than A and C, but taller than E and F. Two persons are taller than B, and one person is shorter than E. Which of the following inferences is NOT NECESSARILY valid?
(a) A is the tallest of all (b) C is taller than B
(c) F is the shortest of all (d) B is taller than D

47. Select the option that will correctly replace the question mark (?) in the following series.
W90D, S135H, O180L, K225P, G270T,?
(a) D315X (b) C325X (c) D315Y (d) C315X

48. Find out the missing number in the following number series: 406, 626, 896, 1216, 1586,?
(a) 2006 (b) 2146 (c) 2046 (d) 1956

49. Arrange the following words as per order in the dictionary:
1. Inhabit 2. Ingenious 3. Inherit 4. Influence 5. Infatuation
(a) 1,2,3,4,5 (b) 5,4,1,2,3 (c) 4,5,2,1,3 (d) 5,4,2,1,3

50. If there is rainfall in a village, flowers will bloom. If flowers bloom, celebrations will definitely take place. Flowers did not bloom. Which of the following is certain?
(a) Celebrations took place (b) Celebrations did not take place
(c) It did not rain (d) It rained too much

******

ANSWER KEY

1	2	3	4	5	6	7	8	9	10
C	**C**	**D**	**D**	**D**	**A**	**C**	**B**	**C**	**C**
11	12	13	14	15	16	17	18	19	20
B	**A**	**B**	**B**	**B**	**C**	**D**	**C**	**D**	**C**
21	22	23	24	25	26	27	28	29	30
C	**C**	**D**	**B**	**C**	**A**	**B**	**D**	**B**	**A**
31	32	33	34	35	36	37	38	39	40
B	**C**	**B**	**B**	**B**	**B**	**C**	**B**	**C**	**C**
41	42	43	44	45	46	47	48	49	50
C	**B**	**B**	**A**	**C**	**A**	**D**	**A**	**D**	**C**