Test Duration: 60min

Paper Code
CA12A

CATSE
TALENT SEARCH EXAM

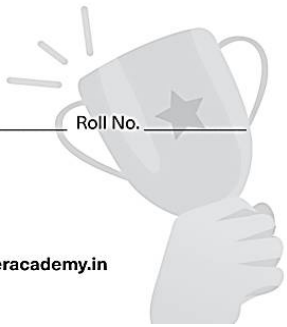
INSTRUCTIONS

1. Immediately fill in the particulars on this page of the Test Booklet with Blue/Black Ball Point Pen. Use of pencil is strictly prohibited.
2. Test duration is ONE HOUR (60MINUTES)
3. The Test Booklet consists of 40 questions of 4 marks each. The maximum marks are 160.
4. There are four sections in the question paper.
   The distribution of questions, subject wise in each part is mentioned below:-

PHYSICS	– 10 Questions
CHEMISTRY	– 10 Questions
MATHEMATICS/BIOLOGY	– 10 Questions
MENTAL ABILITY	– 10 Questions

5. Candidates will be awarded Four marks (+4**)** each for indicated correct response of each Question& One mark (-1) will be deducted for indicated incorrect response. There will be No deduction from the total score if no response is indicated.
6. No candidate is allowed to carry any textual material, printed or written, bits of paper, mobile phone, any electronic device etc.
7. After the completion of the test, the candidate must hand over the Answer Sheet to the Invigilator On duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
8. Do not fold or make any stray marks on the Answer sheet.

Name : _____ Class : _____ Roll No. _____



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PHYSICS

1. In a region where E = 0, the potential (V) varies with distance r as -

(a) $V \propto \frac{1}{r}$

(b) $V \propto r$

(c) $V \propto \frac{1}{r^2}$

(d) V = const. independent of (r)

2. Three charges 2q, –q, –q are located at the vertices of an equilateral triangle. At the center of the triangle -

(a) The field is zero but potential is not zero.

(b) The field is non-zero but the potential is zero.

(c) Both, field and potential are zero.

(d) Both, field and potential are non- zero

3. A wire of resistance 4 Ω is stretched to twice its original length. The resistance of stretched wire would be :

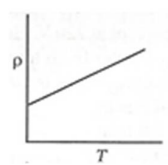
(a) 4 Ω

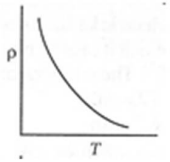
(b) 8 Ω

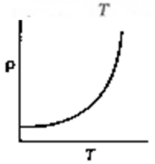
(c) 16 Ω

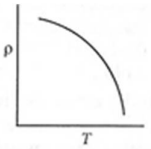
(d) 2 Ω

4. Which of the following graph represents the variation of resistivity (ρ) with temperature (T) for copper?

(a) 

(b) 

(c) 

(d) 

5. Value of 1 tesla in gauss is -

(a) 10^3 (b) 10^6

(c) 10^4 (d) 10^2

6. A proton charge (+e coulomb) enters in a magnetic field of strength B (Tesla) perpendicular to the magnetic lines of force, with speed v. The force on the proton is -

(a) evB

(b) 0

(c) ∞

(d) evB/2

(a) Amalner

(b) Nasik

(c) Jalgaon

(d) Manmad

36. If × stands for +, < stands for –, > stands for ×, + stands for ÷, – stands for =, ÷ stands for >, and = stands for <, then which of the given equations is correct?

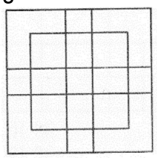
(a) 8 < 4 × 3 – 3 × 2 × 1

(b) 8 > 4 < 3 – 3 > 2 < 1

(c) 8 + 4 < 3 ÷ 3 < 2 < 1

(d) 8 + 4 × 3 = 3 > 2 × 1

37. How many squares does the following figure contain?



(a) 19

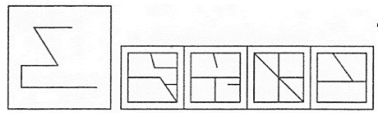
(b) 20

(c) 25

(d) 27

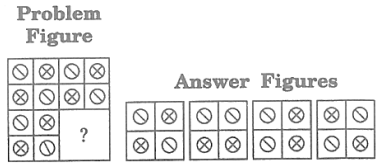
38. In the given question, you are given a figure (X) followed by four figures (a), (b), (c) and (d) such that (X) is embedded in one of them. Trace out the correct alternative.

Problem Figure Answer Figure



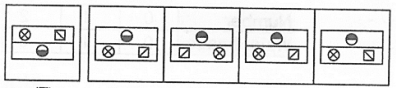
(X) (a) (b) (c) **(d)**

39. In this questions, a problem figure is given on the left side of the line, which is incomplete. One out of the four answer figures(a), (b), (c) and (d) can complete the same. You have to locate the answer figure which if inserted in the problem figure, without changing the direction, completes the same.



(a) (b) (c) (d)

40. In the following question, choose the correct water image of the figure (Z) from amongst the four alternatives (a), (b), (c) and (d) given along with it



(Z) (a) (b) **(c)** (d)

(c) $\frac{1}{2}\ tan^{-1}(2) - \frac{\pi}{8}$
(d) $\frac{1}{2}$

29. The inverse of the function $f: R \to \{x \in R: x < 1\}$ given by $(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$, is
(a) $\frac{1}{2} log \frac{1+x}{1-x}$
(b) $\frac{1}{2} log \frac{2+x}{2-x}$
(c) $\frac{1}{2} log \frac{1-x}{1+x}$
(d) none of these

30. A curve $y = ax^2 + bx + c$ passing through the point $(1, 2)$ has slope at origin equal to 1, then ordered triplet (a, b, c) may be
(a) $(1, 1, 0)$
(b) $\left(\frac{1}{2}, 1, 0\right)$
(c) $\left(-\frac{1}{2}, 1, 1\right)$
(d) $(2, -1, 0)$

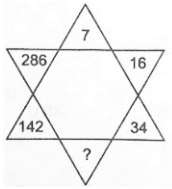
MENTAL ABILITY

31. If $z = 52$ and $ACT = 48$, then BAT will be equal to
(a) 41 (b) 39
(c) 44 **(d) 46**

32. 0, 6, 24, 60, 120, 210, ?
(a) 240 (b) 290
(c) 336 (d) 540

33. Pointing to a man in a photograph, a woman says, "He is the father of my only daughter-in-law's father-in-law". What is the man to the woman?
(a) Father
(b) Brother
(c) Husband
(d) Father-in-law

34. Insert the missing number or letter from among the given alternatives.



(a) 72
(b) 70
(c) 68
(d) 66

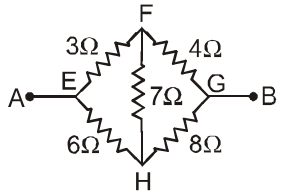
35. Out of six towns, Dhulia is bigger than Amalner, Shrirampur is bigger than Nasik, Jalgaon is not as big as Shrirampur but is bigger than Amalner. Amalner is smaller than Nasik but but bigger than Manmad. Which is the smallest?

7. The unit of mutual inductance is -
(a) Volt
(b) Weber
(c) Tesla
(d) Henry

8. For an AC supply, the capacitive reactance:
(a) varies inversely with frequency
(b) varies directly with frequency
(c) varies directly as square of frequency
(d) remains constant

9. A parallel plate capacitor is charged and the charging battery is then disconnected. The plates of the capacitor are now moved, farther apart. The following things happen :
(a) The charge on the capacitor increases
(b) The electrostatics energy stored in the capacitor increases
(c) The voltage between the plates decreases
(d) The capacitance increases.

10. A bridge circuit is shown in figure.The equivalent resistance between A and B will be :



(a) 21Ω
(b) 7Ω
(c) $\frac{252}{85}\Omega$
(d) $\frac{14}{3}\Omega$

CHEMISTRY

11. An element with molar mass 96 g mol^{-1} forms a cubic unit cell with edge length 4 x 10^{-8} cm. If density is 10 g cm^{-8} cm. If density is 10 g cm^{-3}, the nature of unit cell (N_A = 6 x 10^{23} mol^{-1}) (A) simple cubic
(a) simple cubic
(b) bcc
(c) fcc
(d) End centered cubic

12. When 2.5 g of a non-volatile solute was dissolved in 50 mL of water, if gave boiling point elevation of 0.52°C. The molar mass of the solute is (K_b for water = 0.52 cm^{-1})
(a) 100 g mol^{-1}
(b) 50 g mol^{-1}
(c) 25 g mol^{-1}
(d) 75 g mol^{-1}

13. A solution of a pair of volatile liquids A and B shows negative deviation form Raoult's law. This is because
(a) PA > P°$_A$ x_A and PA > P°$_B$ x_B
(b) The intermolecular forces A – A, B – B < A – B
(c) Both ΔH_{mixing} and ΔV_{mixing} are positive
(d) All of the above

14. If Bf and Eb are the activation energies the forward and reverse reaction and the reaction is known to be exothermic, then
(a) $E_f < E_b$
(b) $E_f > E_b$
(c) $E_f = E_b$
(d) Data insufficient predict

15. For the electrode reaction
Mn+ (aq) + ne$^-$ ⟶ M(s)
Nernst equation is
(a) $E = E° + \frac{RT}{nF} log \frac{1}{[M^{n+}]}$
(b) $E° = E° + RT\ In[Mn^+]$
(c) $E = E° + \frac{RT}{nF} In\ [M^{n+}]$
(d) $\frac{E}{E°} = \frac{RT}{nF} In\ [M^{n+}]$

16. In a reaction, the initial concentration of the reactants increases four fold and the rate becomes sixteen times its initial value. The order of the reaction is
(a) 2.0 (b) 3.5
(c) 1.5 (d) 2.5

(b) R is reflexive and transitive but not symmetric.
(c) R is symmetric and transitive but not reflexive.
(d) R is an equivalence relation.

22. $cos^{-1}\left(cos\frac{7\pi}{6}\right)$ =
(a) $\frac{7\pi}{6}$ **(b) $\frac{5\pi}{6}$**
(c) $\frac{\pi}{6}$ (d) $\frac{3\pi}{2}$

23. If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to
(a) A (b) $I - A$
(c) I (d) $3A$

24. If the system of equation $3x - 2y + z = 0$, $\lambda x - 14y + 15z = 0, x + 2y + 3z = 0$ Have a non-trival solution, then λ =
(a) 5 (b) −5
(c) −29 **(d) 29**

25. If $siny = x\sin(a + y)$, then $\frac{dy}{dx}$ is
(a) $\frac{sina}{sina\ sin^2(a+y)}$
(b) $\frac{sin^2(a+y)}{sin\ a}$
(c) $sina\ sin^2(a + y)$
(d) $\frac{sin^2(a-y)}{sin\ a}$

26. $f(x) = 2x - tan^{-1}x - log\{x + \sqrt{x^2 + 1}\}$ is monotonically increasing when
(a) $x > 0$
(b) $x < 0$
(c) $x \in R$
(d) $x \in R - \{0\}$

27. $\int \frac{x^9}{(4x^2+1)^6} dx$ is equal to
(a) $\frac{1}{5x}\left(4 + \frac{1}{x^2}\right)^{-5} + C$
(b) $\frac{1}{5}\left(4 + \frac{1}{x^2}\right)^{-5} + C$
(c) $\frac{1}{10x}\left(\frac{1}{x^2} + 4\right)^{-5} + C$
(d) $\frac{1}{10}\left(\frac{1}{x^2} + 4\right)^{-5} + C$

28. The integral $\int_0^{\pi/2} \frac{1}{3+2sinx+cosx} dx$ is equal to
(a) $tan^{-1}(2)$
(b) $tan^{-1}(2) - \frac{\pi}{4}$

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29. The most accepted line of descent in human evolution is:
(a) Australopithecus → Ramapithecus → Homo sapiens → Homo habilis
(b) Homo erectus → Homo habilis → Homo sapiens
(c) Ramapithecus → Homo habilis → Homo erectus → Homo sapiens
(d) Australopithecus → Ramapithecus → Homo erectus → Homo habilis → Homo sapiens.

30. Match the columns:

	Column I		Column II
(A)	Inbreeding	(i)	Mating of closely related animals of same breed which have no common ancestor for 4-6 generations
(B)	Cross breeding	(ii)	Mating in between different species
(C)	Interspecific hybridization	(iii)	Mating in between different breeds
(D)	Out-crossing	(iv)	Mating in between the animals of same breed which have common ancestor for 4-6 generations

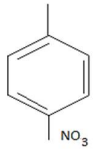
(a) (A)-(iv); (B)-(iii); (C)-(i); (D)-(ii)
(b) (A)-(iv); (B)-(iii); (C)-(ii); (D)-(i)
(c) (A)-(i); (B)-(iii); (C)-(ii); (D)-(iv)
(d) (A)-(i); (B)-(iii); (C)-(iv); (D)-(ii).

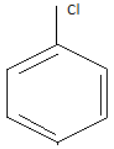
MATHEMATICS

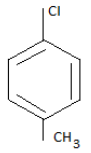
21. Let R be the relation on the set $A = \{1, 2, 3, 4\}$ given by $R = \{(1,2), (2,2), (1,1), (4,4), (1,3), (3,3), (3,2)\}$. Then,
(a) R is reflexible and symmetric but not transitive.

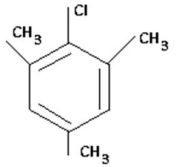
17. In which of the following does the central atom exhibit an oxidation state of +3?
(a) $K_2[Ni(CN)_4]$
(b) $K_4[Fe(CN)_6]$
(c) $[Fe(C_2O_4)_3]^{3-}$
(d) $[Cu(NH_3)_4]^{2+}$

18. Which of the following reactions, is check possible
(a) $2F_2 + 2H_2O \longrightarrow 4H^+ + 4F^- + O_2$
(b) $2I_2 + 2H_2O \longrightarrow 4H^+ + 4I^- + O_2$
(c) $Cl_2 + H_2O \longrightarrow HCl + HOCl$
(d) $Br_2 + H_2O \longrightarrow HBr + HOBr$

19. Which of the following is most reactive towards nucleophilic substitution reaction?
(a) 

(b) 

(c) 

(d) 

20. Given below are two statement
Statement I : Phenols are weakly acidic
Statement II : Therefore they are freely soluble in NaOH solution and are weaker acids than alcohols and water.
Choose the most appropriate option
(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is correct.
(d) Statement I is incorrect but Statement II is correct.

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BIOLOGY

21. Choose the correct option in which all members have correct match:
(a) A-Tuber Potato, B-Rhizome Ginger, C-Eyes *Agave*, D-Leaf bud *Bryophyllum* and E-Offset Hyacinth
(b) A-Eyes Potato, B-Rhizome Ginger, C-Bulbil *Agave*, D-Leaf bud Hyacinth and E- Offset *Bryophyllum*
(c) A-Eyes Potato, B-Rhizome Ginger, C-Bulbil *Agave*, D-Leaf bud *Bryophyllum* and E-Offset Hyacinth
(d) A-Rhizome Potato, B-Tuber Ginger, C-Bulbil *Agave*, D-Leaf bud *Bryophyllum* and E-Offset Hyacinth.

22. Match the columns:

	Column I		**Column II**
(A)	Monoecious	1.	Primula
(B)	Dioecious	2.	Maize
(C)	Cleistogamous	3.	Date palm
(D)	Heterostyle	4.	*Commelina*

	A	**B**	**C**	**D**
(a)	3	2	4	1
(b)	**2**	**3**	**4**	**1**
(c)	2	3	1	4
(d)	1	2	3	4.

23. Choose correct option for given blanks:
(A) Humans reproduce _____.
(B) Humans are _____.
(C) Fertilisation is _____ in humans.
(D) Male and female gametes are _____.
(E) Zygote is _____.
(a) A-Sexually, B-viviparous, C-internal, D-haploid, E-haploid.
(b) A-Sexually, B-viviparous, C-external , D- haploid, E-diploid.
(c) A-Sexually, B-viviparous, C-internal, D-haploid, E-diploid.
(d) A-Sexually, B-ovoviviparous, C-internal, D-haploid, E-haploid.

24. State True/False:
(A) Abortions could happen spontaneously too
(B) Infertility is defined as the inability to produce a viable offspring and is always due to abnormalities /defects in the female partner
(C) Complete lactation could help as a natural method of contraception
(D) Creating awareness about sex related aspects is an effective method to improve reproductive health of the people.
(a) (A)-T, (B)-T, (C)-F. (D)-T
(b) (A)-F, (B)-F, (C)-T, (D)-T
(c) (A)-F, (B)-F, (C)-F, (D)-F
(d) (A)-T, (B)-F, (C)-F, (D)-T.

25. In ABO system a person has:
(a) 3 alleles
(b) 2 alleles
(c) Multiple alleles
(d) No alleles.

26. Trisomy is represented by:
(a) 2n – 1
(b) 2n – 1 – 1
(c) 2n + 1 + 1
(d) 2n + 1.

27. The two strands of DNA are:
(a) Similar in nature and non- complementary
(b) Anti-parallel and complementary
(c) Basically different in nature and parallel to each other
(d) Anti-parallel and non-complementary.

28. Which of the following are all nuclcotides?
(a) Adenosine, cytidilic acid, cytosine
(b) Adenylic acid, cytidilic acid, guanylic acid
(c) Cytidine, adenine, adenylic acid
(d) Uracil, thymidine, thymidylic acid.

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