Test Duration: 60min

Paper Code
CA12B

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. If an electron is placed in a uniform electric field, then the electron will :
(a) experience no force.
(b) moving with constant velocity in the direction of the field.
(c) move with constant velocity in the direction opposite to the field.
(d) accelerate in direction opposite to field.

2. In the given figure, the equivalent resistance between the points A and B is

(a) 8 Ω
(b) 6 Ω
(c) 4 Ω
(d) 2 Ω

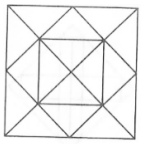
3. The electric current passes through a metallic wire produces heat because of
(a) collisions of conduction electrons with each other
(b) collisions of the atoms of the metal with each other
(c) the energy released in the ionization of the atoms of the metal
(d) collisions of the conduction electrons with the atoms of the metallic wire

4. As the temperature increases, the electrical resistance
(a) Increases for both conductors and semiconductors
(b) Decreases for both conductors and semiconductors
(c) Increases for conductors but decrease for semiconductors
(d) decreases for conductors but increases for semiconductors

5. Consider the following two statement
(a) Kirchhoff's junction law follows from the conservation of charge.

(a) 24 A6 B10 = 5 D 6 C 16
(b) 60 − 4 D 6 = 4 B 2 D 6
(c) 30 D 4 A 12 = 30A 12 D 4
(d) 108 C 72 = 78 C 42

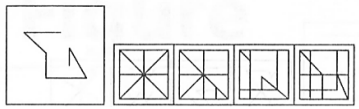
37. How many squares are there in the following figure?



(a) 5
(b) 4
(c) 7
(d) 6

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.

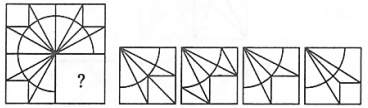
Problem Figure Answer Figure



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

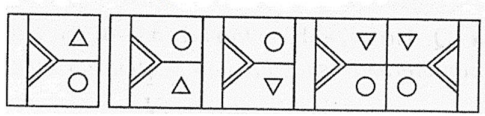
39. In these question, a problem figure is given on the left side of the line, which is incomplete. One out of the four answer figures (a), (b), (c) and (d) can complete the same. You have to locate the answer figure which is inserted in the problem figure, without changing the direction, complete the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

Problem Figure Answer Figure



(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)

MENTAL ABILITY

31. In a certain code, 'POLISH' is written as 'MLIFPE', then 'DIG' is the code for which word?
(a) GLJ
(b) CHI
(c) ECH
(d) AFD

32. $KM5, IP8, GS11, EV14, ?$
(a) $BY17$
(b) $CY18$
(c) $CZ17$
(d) $CY17$

33. A husband and wife had five married sons and each of them had four children. How many numbers are there in the family?
(a) 50
(b) 40
(c) 32
(d) 36

34. Insert the missing number or numerical value in the given question

4	20	25
27	81	9
11	44	?

(a) 4
(b) 30
(c) 55
(d) 16

35. Rakesh obtained more marks than Suresh but less than Santosh. Ramesh obtained more than Rajesh but less than Harish. Santosh obtained less than Rajesh. Who obtained the highest marks?
(a) Harish
(b) Santosh
(c) Ramesh
(d) Rakesh

36. If A denotes $\div$, B denote $+$, C denotes – and D denotes $\times$, then which of the following is not true?

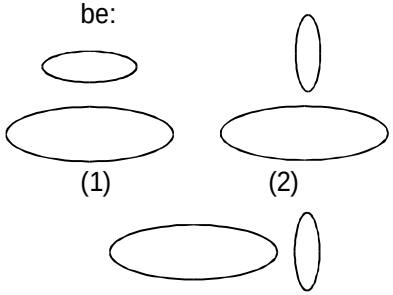
(b) Kirchhoff's loop law follows from the conservation of energy. Which of the following is correct?
(a) Both (a) and (b) are wrong.
(b) (a) is correct and (b) is wrong.
(c) (a) is wrong and (b) is correct.
(d) Both (a) and (b) are correct.

6. The vector form of Biot-Savart's law for a current carrying element is
(a) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\sin\phi}{r^2}$
(b) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\hat{r}}{r^2}$
(c) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{l}\times\hat{r}}{r^3}$
(d) $d\vec{B} = \frac{\mu_0}{4\pi}\frac{|d\vec{l}\times\hat{r}}{r^2}$

7. Specific resistance of a wire depends on the
(a) length of the wire
(b) area of cross–section of the wire
(c) resistance of the wire
(d) material of the wire

8. Lenz's law is based on the law of conservation of -
(a) charge
(b) momentum
(c) mass
(d) energy

9. Two circular coils can be arranged in any of the three situations shown in the figure. Their mutual inductance will be:



(1) (2) (3)

(a) maximum in situation (1)
(b) maximum in situation (2)
(c) maximum in situation (3)
(d) the same in all situations

10. With increase in frequency of an AC

supply, the inductive reactance :
(a) decreases
(b) increases as it is directly proportional to frequency
(c) increases as square of frequency
(d) decreases inversely with frequency.

CHEMISTRY

11. Excess of potassium makes KCl crystals violet due to formation of
(a) Cation vacancies
(b) Anion vacancies
(c) F-centers
(d) Interstitial defect

12. A 5% (by mass) solution of glucose (molar mass = 180 g mol^{-1}) is isotonic with 1% solution (by mass) of a substance 'X'. The molar mass of 'X' is
(a) 36 $gmol^{-1}$
(b) 18 gmol-1
(c) 72 $gmol^{-1}$
(d) 900 mol^{-1}

13. When of the following conditions is correct for an ideal solution?
(a) $\Delta H_{mix} = 0$ **and** $\Delta V_{mix} = 0$
(b) $\Delta H_{mix} > 0$ and $\Delta V_{mix} = 0$
(c) $\Delta H_{mix} < 0$ and $\Delta V_{mix} < 0$
(d) $\Delta H_{mix} > 0$ and $\Delta V_{mix} = 0$

14. What is the molar conductivity of a solution when the conductivity of 0.20 M KCL solution at 298 K is 0.025 $Scm^2\ mol^{-1}$
(a) 125 $Scm^2\ mol^{-1}$
(b) 0.25 $Scm^2\ mol^{-1}$
(c) 0.25 Scm^2
(d) 0.2 $Scm^2\ mol^{-1}$

15. The potential of SHE is assumed as
(a) zero volt

25. If $siny = x\cos(a + y)$, then $\frac{dy}{dx}$ is equal to
(a) $\frac{\cos^2(a+y)}{\cos a}$
(b) $\frac{\cos a}{\cos^2(a+y)}$
(c) $\frac{\sin^2 y}{\cos a}$
(d) none of these

26. The function $f(x) = 4\sin^3 x - 6\sin^2 x + 12\sin x + 100$ is strictly
(a) increasing in $[\pi, \frac{3\pi}{2})$
(b) decreasing in $\left(\frac{\pi}{2}, \pi\right)$
(c) decreasing in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
(d) decreasing in $\left[0, \frac{\pi}{2}\right]$

27. $\int \frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}} dx = ax + b\log_e|4e^x + 5e^{-x}| + C$, then
(a) $a = -\frac{1}{8}, b = \frac{7}{8}$
(b) $a = \frac{1}{8}, b = \frac{7}{8}$
(c) $a = -\frac{1}{8}, b = -\frac{7}{8}$
(d) $a = \frac{1}{8}, b = -\frac{7}{8}$

28. The tangent to the curve $y = ax^2 + bx$ at $(2, -8)$ is parallel to x-axis. Then
(a) $a = 2, b = -2$
(b) $a = 2, b = -4$
(c) $a = 2, b = -8$
(d) $a = 4, b = -4$

29. The value of the integral $\int_{1/2}^{2} \frac{\tan^{-1} x}{x} dx$ is equal to
(a) $\frac{1}{2}\log_e 2$
(b) $\pi\log_e 2$
(c) $\frac{\pi}{4}\log_e 2$
(d) $\frac{\pi}{2}\log_e 2$

30. The domain of the function $cosec^{-1}\left(\frac{1+x}{x}\right)$ is:
(a) $(-1, -\frac{1}{2}] \cup (0, \infty)$
(b) $\left[-\frac{1}{2}, 0\right) \cup [1, \infty)$
(c) $\left(-\frac{1}{2}, \infty\right) - \{0\}$
(d) $\left[-\frac{1}{2}, \infty\right) - \{0\}$

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29. Match the hominids with their correct brain size:

	Column – I		Column –II
(A)	Homo habilis	(i)	900 cc
(B)	Homo neanderthalensis	(ii)	1350 cc
(C)	Homo erectus	(iii)	650–800 cc
(D)	Homo sapiens	(iv)	1400 cc

Codes:

	A	B	C	D
(a)	iii	ii	I	iv
(b)	**iii**	**iv**	**I**	**ii**
(c)	iv	iii	I	ii
(d)	iii	I	iv	ii.

30. Virus-free plants can be formed by:
(a) Meristem culture
(b) Callus culture
(c) Somatic cell culture
(d) Protoplast fusion.

MATHEMATICS

21. Let $A = \{1, 2, 3\}$ consider the relation $R =$ $\{(1,1), (2,2), (3,3), (1,2), (2,3), (1,3)\}$. Then, R is
(a) reflexive but not symmetric
(b) reflexive but not transitive
(c) symmetric and transitive
(d) neither symmetric nor transitive

22. IF $\alpha \leq 2\,sin^{-1}x + cos^{-1}x \leq \beta$, then
(a) $\alpha = -\frac{\pi}{2}, \beta = \frac{\pi}{2}$
(b) $\alpha = 0, \beta = \pi$
(c) $\alpha = -\frac{\pi}{2}, \beta = \frac{3\pi}{2}$
(d) $\alpha = 0, \beta = 2\pi$

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

24. The value of the determinant
$$\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$$
is
(a) $9x^2(x + y)$
(b) $9y^2(x + y)$
(c) $3y^2(x + y)$
(d) $7x^2(x + y)$

(b) 1.10 volt
(c) 1 volt
(d) None of these

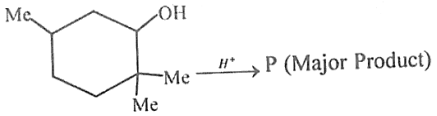
16. A reaction was found to be a second order with respect to concentration of Carbon monoxide. If the concentration of Carbon monoxide is doubled, the rate of reaction will
(a) Triple
(b) Increase by a factor of 4
(c) double
(d) remain unchanged

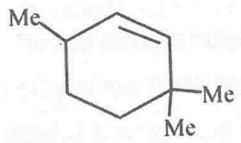
17. Which of the following complexes has coordination number six?
(a) $[Ni(NH_3)_4]^{2+}$
(b) $[Ni(CO)_4]$
(c) $[PtCl_6]^{2-}$
(d) $[PtCl_2(NH_3)_2]$

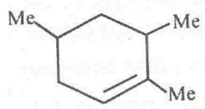
18. Which of the following oxoacids of sulphur contains "S" in two different oxidation states?
(a) $H_2S_2O_3$
(b) $H_2S_2O_6$
(c) $H_2S_2O_7$
(d) $H_2S_2O_8$

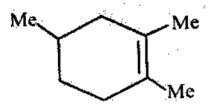
19. The oxoacid of phosphorus that is easily obtained form a reaction of alkali and white phosphorus and has two P-H bonds, is:
(a) Phosphonic acid
(b) Phosphonic acid
(c) Pyrophosphorus acid
(d) Hypophosphhoric acid

20. The major product (P) of the given reaction is (where, Me is – CH_3)



(a) 

(b) 

(c) 

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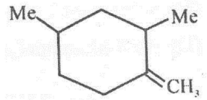
(d)



BIOLOGY

21. Match the column and select the correct option:

	Name of organism		**Chromosome number in meiocyte (2n)**
(A)	House fly	(i)	78
(B)	Rat	(ii)	38
(C)	Dog	(iii)	12
(D)	Cat	(iv)	42
(E)	Fruit fly	(v)	8

(a) (A)-(i), (B)-(ii), (C)-(iii), (D)-(iv) and (E)-(v)
(b) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i) and (E)-(v)
(c) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii) and (E)-(v)
(d) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii) and (E)-(v).

22. From among the sets of terms given below, identify those that are associated with the gynoecium.

(a) Stigma, ovule, embryo sac, placenta
(b) Thalamus, pistil, style, ovule
(c) Ovule, ovary, embryo sac, tapetum
(d) Ovule, stamen, ovary, embryo sac.

23. Match between the following representing parts of the sperm and their functions and choose the correct option.

	Column A		**Column B**
(A)	Head	(i)	Enzymes
(B)	Middle piece	(ii)	Sperm motility
(C)	Acrosome	(iii)	Energy
(D)	Tail	(iv)	Genetic material

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

24. Choose the correct statement regarding the ZIFT procedure:

(a) Ova collected from a female donor are transferred to the fallopian tube to facilitate zygote formation
(b) Zygote is collected from a female donor and transferred to the fallopian tube
(c) Zygote is collected from a female donor and transferred to the uterus
(d) Ova collected from a female donor and transferred to the uterus.

25. Test cross is:
(a) Tt × Tt
(b) Tt × TT
(c) TT × TT
(d) Tt × tt.

26. Monosomy are:
(a) n
(b) 2n + 1
(c) 2n – 2
(d) 2n – 1.

27. Which of the following correctly represents the flow of genetic informations ?
(a) RNA → DNA → Protein
(b) Protein → RNA → DNA
(c) DNA → RNA → Protein
(d) RNA → Protein → DNA.

28. Which one of the following experiments of Frederic Griffith resulted in the discovery of bacterial transformation?
(a) R-stain → injected into Mice → Mice lived
(b) S-strain (heat killed) → Injected into mice → Mice lived
(c) S-strain (heat killed) + R-strain (lived) → Injected into Mice → Mice died
(d) S-strain → injected into Mice → Mice died.

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