VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Main - 1 | JEE 2024

Date: 25/07/2022 **Maximum Marks: 300**

Timing: 04:00 PM to 07:00 PM

General Instructions

1. The test is of **3 hours** duration and the maximum marks is **300.**
2. The question paper consists of **3 Parts** (Part I: **Physics**, Part II: **Chemistry**, Part III: **Mathematics**). Each Part has **two** sections (Section 1 & Section 2).
3. **Section 1** contains **20 Multiple Choice Questions**. Each question has 4 choices **(A)**, **(B)**, **(C)** and **(D)**, out of which **ONLY ONE CHOICE** is correct.
4. **Section 2** contains **5 Numerical Value Type Questions**. The answer to each question is an **integer** ranging from 0 to 99.
5. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
6. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
7. On 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 mark on the Answer Sheet (OMR).**

Marking Scheme

1. **Section – 1:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.
2. **Section – 2:** +4 for correct answer, –1 (negative marking) for incorrect answer, 0 for all other cases.

Name of the Candidate (In CAPITALS) : . . . . . .

Roll Number : . . . . . .

OMR Bar Code Number : . . . . . .

Candidate's Signature : . . . . . **Invigilator's Signature** . . . . . .

PART - I : PHYSICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. The resultant of 2 forces of magnitude 30 N each, acting at an angle of 120° on a particle will be:

(A) 30 N at an angle of 30° with either force

(B) 30 N at an angle of 60° with either force

(C) $30\sqrt{3}$ N at an angle of 60° with either force

(D) 60 N at an angle of 60° with either force

2. A particle is acted upon by a force $\overline{F} = (\hat{i} - 2\hat{j} + \hat{k})N$. If the particle is at $P(-1m, 2m, 3m)$, then torque of the force about $Q(2m, 3m, 1m)$ is :

(A) zero **(B)** $(\hat{i} - 3\hat{j} + \hat{k})\,Nm$

(C) $(3\hat{i} + 5\hat{j} + 7\hat{k})\,Nm$ **(D)** $(2\hat{i} + 3\hat{j} - \hat{k})\,Nm$

3. Which of the following set of non collinear forces can be acting on a particle in equilibrium?

(A) 2N, 3N, 8N **(B)** 3N, 4N, 9N **(C)** 5N, 6N, 20N **(D)** 4N, 5N, 8N

4. The vector $\overline{a} = \frac{1}{4}(2\hat{i} - 2\hat{j} + \hat{k})$:

(A) is a unit vector

(B) Makes an angle $\frac{\pi}{3}$ with $\vec{b}\left(\hat{i} + \frac{\hat{j}}{2} - \hat{k}\right)$

(C) is parallel to the vector $\left(\frac{7}{4}\hat{i} - \frac{7}{4}\hat{j} + \frac{7}{8}\hat{k}\right)$

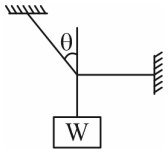
(D) None of these

5. $|\overline{A} \times \overline{B}| = \sqrt{3}\overline{A}.\overline{B}$, then the value of $|\overline{A} + \overline{B}|$ is:

(A) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$ **(B)** $A + B$

(C) $\left(A^2 + B^2 + \sqrt{3}\ AB\right)^{1/2}$ **(D)** $(A^2 + B^2 + AB)^{1/2}$

6. The tension in the horizontal string is 5N. The weight of block is 12 N. Tension in diagonal string is: (Strings are massless and inextensible.)



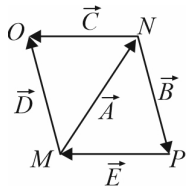
(A) 17 N **(B)** 7 N **(C)** 13 N **(D)** 10 N

7. The value of $\overline{a} \cdot (\overline{a} \times \overline{b})$ will be:

(A) 0 **(B)** $\overline{a}.\overline{a} + \overline{a}.b$

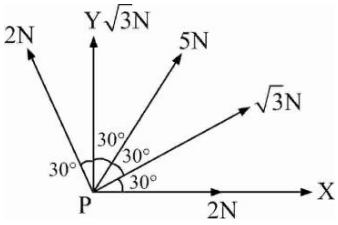
(C) $a^2 b$ **(D)** Depends on $|\overline{a}|$ & $|\overline{b}|$

8. From figure, the correct relation is:



(A) $\vec{A}+\vec{B}-\vec{E}=\vec{0}$ **(B)** $\vec{C}-\vec{D}=-\vec{A}$ **(C)** $\vec{B}+\vec{E}=\vec{D}$ **(D)** All of these

9. Five forces $2N$, $\sqrt{3}N$, $5N$, $\sqrt{3}N$ and 2N respectively act at a particle P as shown in the figure :



The resultant force on the particle P is :

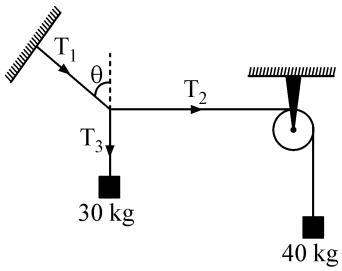
(A) 10 N making angle 60° with X-axis

(B) 10 N making angle 60° with Y-axis

(C) 20 N along Y-axis

(D) None of these

10. In the arrangement shown in the figure if system is in equilibrium, then T_1 and θ are : $(g=10m/s^2)$:



(A) $T_1=50N,\ \theta=37°$

(B) $T_1=500N,\ \theta=53°$

(C) $T_1=50N,\ \theta=53°$

(D) $T_1=500N,\ \theta=37°$

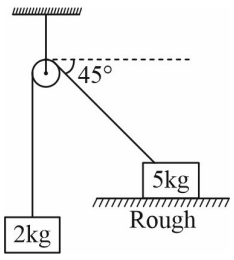
11. The resultant of two vector $\bar{P}$ and $\bar{Q}$ acting at a point inclined to each other at angle θ is $\bar{R}$. If the magnitude of vector $\bar{Q}$ is doubled magnitude of new resultant is doubled. If the vector $\bar{Q}$ is reversed in direction, the magnitude of new resultant is again doubled. Then $|\bar{P}|:|\bar{Q}|$ is:

(A) 1 : 2 **(B)** 2 : 1 **(C)** $\sqrt{2}:\sqrt{3}$ **(D)** $\sqrt{3}:\sqrt{2}$

12. The projection of $\bar{P}=2\hat{i}-\hat{j}+2\hat{k}$ along $\bar{Q}=3\hat{i}+4\hat{j}+12\hat{k}$ will be:

(A) $\frac{34}{13}$ **(B)** 2 **(C)** $\frac{2}{\sqrt{5}}$ **(D)** $\frac{26}{\sqrt{5}}$

13. In the given arrangement, 5 kg block is at rest on a rough surface. 2kg block is hanging vertically. What will be the friction force on 5kg block ? $\{g=10\ \text{m/s}^2\}$



(A) 20 N **(B)** 30 N

(C) $5\sqrt{2}\ N$ **(D)** $10\sqrt{2}\ N$

14. The value of λ so that the unit vectors $\frac{2\hat{i}+\lambda\hat{j}+\hat{k}}{\sqrt{5+\lambda^2}}$ and $\frac{\hat{i}-2\hat{j}+3\hat{k}}{\sqrt{14}}$ are orthogonal is :

(A) $\frac{3}{7}$ **(B)** $\frac{5}{2}$ **(C)** $\frac{2}{5}$ **(D)** $\frac{2}{7}$

15. If $\vec{P}+\vec{Q}+\vec{R}=0$ and angle between $\vec{P}$ and $\vec{Q}$ is $\frac{2\pi}{3}$ and angle between $\vec{Q}$ and $\vec{R}$ is $\frac{\pi}{2}$. Then angle between $\vec{R}$ and $\vec{P}$ will be:

(A) 150° **(B)** 90° **(C)** 60° **(D)** 30°

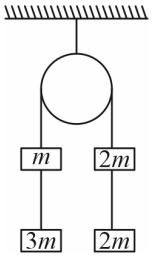
16. A force of magnitude 10 N is acting on a particle along $\hat{i}+\hat{j}-\hat{k}$. The particle displaces from $A(1, 2, 3)$ m to $B(4, 5, 6)$ m. The work done by force on the particle is :

(A) 30 J **(B)** $10\sqrt{3}J$ **(C)** $-10\sqrt{3}J$ **(D)** 10 J

17. The angle between $2\hat{i}+\hat{j}+2\hat{k}$ and $\hat{i}-\hat{j}+\hat{k}$ is :

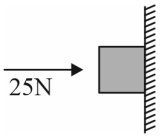
(A) 30° **(B)** 60° **(C)** $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ **(D)** $\cos^{-1}\left(\frac{2}{3}\right)$

18. The given system is in equilibrium. Find force by clamp on pulley. (Pulleys are massless & frictionless, and strings are massless and inextensible.)



(A) 4mg **(B)** 2mg **(C)** 8mg **(D)** mg

19. A horizontal force of 25 N is necessary to just hold a block stationary against a wall. The coefficient of friction between the block and wall is 0.4. Find the weight of the block.



(A) 100 N **(B)** 10 N **(C)** 1 N **(D)** 25 N

20. The area of a parallelogram whose sides are $\vec{a}=\left(\hat{i}+2\hat{j}+2\hat{k}\right)m$ and $\vec{b}=\left(2\hat{i}+4\hat{j}+5\hat{k}\right)m$, is :

(A) $\frac{\sqrt{5}}{2}m^2$ **(B)** $\sqrt{5}m^2$ **(C)** $2m^2$ **(D)** $4m^2$

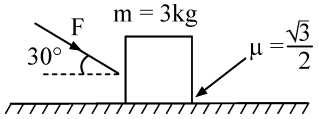
SPACE FOR ROUGH WORK

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 99 (both inclusive).

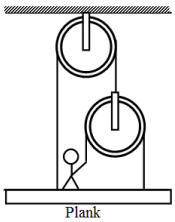
21. If $\bar{a}$ and $\bar{b}$ are two unit vector such that $\bar{a} + 2\bar{b}$ and $5\bar{a} - 4\bar{b}$ are perpendicular to each other, then the angle (in degree) between $\bar{a}$ and $\bar{b}$ is :

22. What is the maximum value of the force F (in Newton) such that block shown in the arrangement does not move? (Take $g = 10\ \text{m/s}^2$)

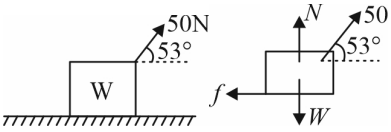


23. In the figure, the force with which the man should pull the rope to hold the plank in position is F Newton. If weight of the man is 60 kg f, the plank and pulleys have negligible masses, then value of $\frac{F}{10}$ will be :

$(g = 10\ \text{m/s}^2)$



24. A boy pulls a box of weight 80N with a force of 50N at an angle 53° with the horizontal. The surface is rough and the box moves with a constant velocity under the action of the given forces. Find the net force applied by the ground (in Newton).



25. A vector $\vec{A}$ when added to the vector $\vec{B} = 3\hat{i} + 4\hat{j}$ yields a resultant vector that is in positive y-direction and has magnitude equal to that of $\vec{B}$. The magnitude of $\vec{A}$ is $\sqrt{x}$, find x:

SPACE FOR ROUGH WORK

PART - II : CHEMISTRY 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. The normality of mixture obtained by mixing 100 mL of 0.2 M H_2SO_4 + 100 mL of 0.2 M NaOH is:

(A) 0.2 **(B)** 0.01 **(C)** 0.1 **(D)** 0.3

2. Arrange the following in order of increasing masses.

i. 1 molecule of oxygen **ii.** 1 atom of nitrogen

iii. 1 mol of water **iv.** 1×10^{-10} g of iron

(A) ii < i < iii < iv **(B)** i < ii < iv < iii **(C)** ii < i < iv < iii **(D)** i < ii < iii < iv

3. 1.0 gm of a mixture of $CaCO_3$ and NaCl required 30 mL of $\frac{1}{15}$M H_2SO_4 solution for complete reaction.

The percentage of NaCl is: (Atomic mass: Ca = 40, C = 12, O = 16, Na = 23, Cl = 35.5)

(A) 40% **(B)** 80% **(C)** 60% **(D)** 20%

4. The volume of a drop of water is 0.04 mL. How many H_2O Molecules are there in a drop of water?

$[d = 1.0\,g\ mL^{-1}]$ $(N_A = 6.023\times10^{23})$

(A) 1.34×10^{21} **(B)** 6.02×10^{23} **(C)** 5.5×10^{20} **(D)** 3.01×10^{23}

5. To neutralise completely 20 mL of 0.1 M aqueous solution of phosphorous acid (H_3PO_3), the volume of 0.2 M aqueous KOH solution required is:

(A) 10 mL **(B)** 20 mL **(C)** 40 mL **(D)** 60 mL

6. The volume of water to be added to $\frac{N}{4}$HCl to prepare 1000 cm^3 of $\frac{N}{10}$ solution is:

(A) 600 cm^3 **(B)** 100 cm^3 **(C)** 45 cm^3 **(D)** 400 cm^3

7. If 5g $H_2(g)$ is mixed with 14 g of $N_2(g)$ for the following reaction:

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$

At the end, mass of $H_2(g)$ left unreacted is:

(A) 2 g **(B)** 1 g **(C)** 3 g **(D)** 1.5 g

8. 100 cc of 0.3 N H_2SO_4 and 100 cc of 0.3 N HCl were mixed together. The normality of the solution i.e. final concentration of H^+ ions is:

(A) 0.2 N **(B)** 0.4 N **(C)** 0.3 N **(D)** 0.6 N

9. In certain reaction 1.88 moles of $TiCl_4$ is reacted with 4 moles of Mg. Calculate % yield of Ti if only $\frac{2}{3}$ moles of Ti is actually obtained. (Reaction involved $TiCl_4 + 2Mg \longrightarrow Ti + 2MgCl_2$)

(A) 35.46% **(B)** 66.6% **(C)** 100% **(D)** 60%

10. The following process has been used to obtained iodine from oil-field brines in California.

$$NaI + AgNO_3 \longrightarrow AgI + NaNO_3$$

$$2AgI + Fe \longrightarrow FeI_2 + 2Ag$$

$$2FeI_2 + 3Cl_2 \longrightarrow 2FeCl_3 + 2I_2$$

How many grams of $AgNO_3$ are required in the first step for every 254 kg I_2 produced in the third step? (Molar mass of $I_2 = 254\,g$, $AgNO_3 = 170\,g$)

(A) 340×10^4 **(B)** 340×10^3 **(C)** 34×10^3 **(D)** 34×10^2

11. If 20.0 g of $CaCO_3$ is treated with 20.0g of HCl. How many grams of CO_2 can be produced according to the reaction:

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$

(A) 8.80 g **(B)** 7.70 g **(C)** 8.00 g **(D)** 7.20 g

12. The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000g of solvent.

(A) 1000 g **(B)** 1098.6 g **(C)** 980.4 g **(D)** 1019.6 g

13. Select the correct statement(s) out of following.

I. Molality and mole-fraction are independent of small change in temperature.

II. Molar volume of an ideal gas is 22.4 L under all conditions of T and P.

(A) Statement-I is correct and statement-II is incorrect

(B) Statement-I is incorrect and statement-II is correct

(C) Statement-I and statement-II both are correct

(D) Statement-I and statement-II both are incorrect

14. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample?
(Atomic mass : Mg = 24)

(A) 60 **(B)** 84 **(C)** 75 **(D)** 86

15. There are two isotopes of an element with average atomic mass z. The heavier one has atomic mass $'z+1'$ and lighter one has $'z-2'$, then abundance of lighter one is:

(A) 66.6% **(B)** 96.7% **(C)** 6.67% **(D)** 33.3%

16. 0.4 moles of $AgNO_3$ is heated strongly to leave residue behind. Find volume of gases collected at STP.

[Reaction involved : $AgNO_3 \xrightarrow{\Delta} Ag(s) + NO_2(g) + \frac{1}{2}O_2(g)$]

(A) 134.4 L **(B)** 1.344 L **(C)** 17.92 L **(D)** 13.44 L

17. 50 mL of a solution containing 1g each of Na_2CO_3 and $NaHCO_3$ was titrated with 1 N HCl. What will be the titre value when only phenolphthalein is used as indicator?

[Molar mass : $Na_2CO_3 = 106\,g\ mol^{-1}$, $NaHCO_3 = 84\,g\ mol^{-1}$]

(A) 35 mL **(B)** 32.5 mL **(C)** 24.5 mL **(D)** 9.43 mL

18. Chalk is mainly $CaCO_3$ with some impurity of $CaSO_4$. 2 gm of the chalk is dissolved in 290 mL of $\frac{M}{5}H_2SO_4$ and 310 mL of $\frac{M}{10}Al(OH)_3$ is required to neutralize the remaining sulphuric acid. The percentage of $CaCO_3$ in the chalk is:

(A) 28.75 % **(B)** 57.5 % **(C)** 86.5 % **(D)** None of these

19. Consider titration of NaOH solution versus 1.25 M oxalic acid $(H_2C_2O_4)$ solution. At the end point following burette readings (Volume of NaOH) were obtained.

(i) 5.5 mL **(ii)** 5.2 mL **(iii)** 5 mL

(iv) 5 mL **(v)** 5 mL

If the volume of oxalic acid taken was 10.0 mL then the molarity of the NaOH solution is:

(A) 4 M **(B)** 5 M **(C)** 10 M **(D)** 4.5 M

20. An aqueous solution contains NaOH and Na_2CO_3. In a neutralisation titration, a certain volume of the above solution required 20 ml of 1 M HCl solution to reach the phenolphthalein end point. Methyl orange was then added and a further 5 ml of the same HCl solution was required to make it just red. Molar ratio of NaOH to Na_2CO_3 present in the original sample is:

(A) 1 : 1 **(B)** 4 : 1 **(C)** 3 : 1 **(D)** 2 : 1

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 99 (both inclusive).

21. The hydrated salt $Na_2SO_4 \cdot nH_2O$ undergoes 50.3% loss in weight on heating and become anhydrous. The value of 'n' will be _____. (Atomic mass: Na = 23, S = 32, O = 16)

22. If a protein has 0.07% Fe(M = 56) by weight as the only metal, its molar mass would be at least $M \times 10^4$ g. Here M is _____.

23. What volume of 90% alcohol by weight $(d = 0.8\ g\ mL^{-1})$ must be used to prepare 80 mL of 10% alcohol by weight $(d = 0.9\ g\ mL^{-1})$?

24. The neutralization occurs when 10 mL of 0.1 M acid 'A' is allowed to react with 30 mL of 0.05 M base $M(OH)_2$. The basicity of the acid 'A' is _____.

25. HCl gas is passed into water, yielding a solution of density $0.365\,g\ mL^{-1}$ and containing 30% HCl by weight. Calculate the molarity of the solution.

SPACE FOR ROUGH WORK

PART - III : MATHEMATICS 100 MARKS

SECTION-1

This section contains 20 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which ONLY ONE CHOICE is correct.

1. If $\alpha^2 = 5\alpha - 3$ and $\beta^2 = 5\beta - 3$, $(\alpha \neq \beta)$ then the equation having $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ as its roots is:

(A) $3x^2 - 19x + 3 = 0$ **(B)** $3x^2 + 19x - 3 = 0$

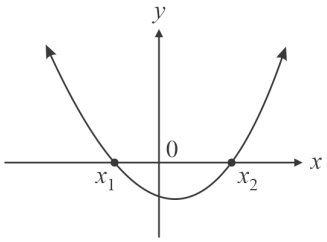
(C) $3x^2 - 19x - 3 = 0$ **(D)** $x^2 - 5x + 3 = 0$

2. The solution of the inequality $\frac{x+7}{x-5} + \frac{3x+1}{2} \geq 0$ is:

(A) $[1, 3] \cup (5, \infty)$ **(B)** $(1, 3) \cup (5, \infty)$

(C) $(-\infty, 1) \cup (5, \infty)$ **(D)** None of these

3. Figure shows graph of $y = ax^2 + bx + c$. Then which one of the following is not true? $(|x_1| < |x_2|)$



(A) $a > 0$ **(B)** $c < 0$

(C) $b^2 - 4ac > 0$ **(D)** $b > 0$

4. The solution set of the inequality $|x+2| - |x-1| < x - \frac{3}{2}$ is:

(A) $\left(\frac{9}{2}, \infty\right)$ **(B)** $\left(-\infty, \frac{3}{2}\right)$ **(C)** $\left(-2, -\frac{3}{2}\right)$ **(D)** $\left(-1, \frac{3}{2}\right)$

5. Set of values of x satisfying the inequality $\frac{x^2 + 6x - 7}{|x+4|} < 0$ is(are):

(A) $(-\infty, -7)$ **(B)** $(-7, 4)$

(C) $(-7, -4) \cup (-4, 1)$ **(D)** $(1, \infty)$

6. The solution set of the inequality $log_{0.8} log_6 \left(\frac{x^2 + x}{x+4}\right) < 0$ is:

(A) $[-4, -2] \cup (8, \infty)$ **(B)** $(-4, -3) \cup [8, \infty)$

(C) $(-4, -3) \cup (8, \infty)$ **(D)** None of these

7. If $log_{245} 175 = a$, $log_{1715} 875 = b$, then $\frac{1-ab}{a-b} =$

(A) 5 **(B)** 6 **(C)** 2 **(D)** 1

8. Consider the following statements.

I. Solution set of the inequality $-15 < \frac{3(x-2)}{5} \le 0$ is $(-23, 2]$

II. Solution set of the inequality $7 \le \frac{3x+11}{2} \le 11$ is $\left[1, \frac{11}{3}\right]$

III. Solution set of the inequality $-5 \le \frac{2-3x}{4} \le 9$ is $[-1, 1] \cup [3, 5]$

Choose the correct option:

(A) Only I and II are true **(B)** Only II and III are true

(C) Only I and III are true **(D)** All are true

9. If a, b, c are all distinct, then $a\frac{(x-b)(x-c)}{(a-b)(a-c)} + b\frac{(x-c)(x-a)}{(b-c)(b-a)} + c\frac{(x-a)(x-b)}{(c-a)(c-b)} - x$, is equal to:

(A) 0 **(B)** $ax^2 + bx + c$

(C) $(a+b+c)(x^2+x+1)$ **(D)** $\frac{x^2}{a} + \frac{x}{b} + \frac{1}{c}$

10. If the equation $x^2 + 2|a|x + 4 = 0$ has integral roots, then the minimum value of a is:

(A) 4 **(B)** $-\frac{5}{2}$ **(C)** 0 **(D)** -4

11. Suppose $a, b, c \in R$ and $b \ne c$. If α, β are roots of $x^2 + ax + b = 0$ and γ, δ are roots of $x^2 + ax + c = 0$, then value of $\frac{(\alpha-\gamma)(\alpha-\delta)}{(\beta-\gamma)(\beta-\delta)}$ is:

(A) 0 **(B)** 2 **(C)** 1 **(D)** -1

12. If the roots of the equation $2x^2 - (a^3+1)x + (a^2-2a) = 0$ are of opposite signs, then the set of possible value of a is:

(A) (0, 2) **(B)** [0, 2] **(C)** (0, 2] **(D)** [0, 2)

13. If x be real and $b < c$, then $\frac{x^2 - bc}{2x - b - c}$ lies in:

(A) (b, c) **(B)** $[b, c]$

(C) $(-\infty, b] \cup [c, \infty)$ **(D)** $(-\infty, b) \cup (c, \infty)$

14. If α, β are the roots of $ax^2 - 2bx + c = 0$, then $\alpha^3\beta^3 + \alpha^2\beta^3 + \alpha^3\beta^2$ is:

(A) $\frac{c^2(c+2b)}{a^3}$ **(B)** $\frac{bc^2}{a^3}$ **(C)** $\frac{c^2}{a^3}$ **(D)** None of these

15. If a and b are the non-zero distinct roots of $x^2 + ax + b = 0$, then the least value of $x^2 + ax + b$ is:

(A) $\frac{2}{3}$ **(B)** $\frac{9}{4}$ **(C)** $-\frac{9}{4}$ **(D)** 1

16. If both the roots of the equation $x^2 - 2kx + k^2 - 4 = 0$ lie between -3 and 5, if and only if k is given by:

(A) $-2 < k < 2$ **(B)** $-5 < k < 3$

(C) $-3 < k < 5$ **(D)** $-1 < k < 3$

17. Suppose the quadratic equations $x^2 + px + q = 0$ and $x^2 + rx + s = 0$ are such that p, q, r, s and real and $pr = 2(q + s)$. Then:

(A) Both the equations always have real roots

(B) At least one equation always has real roots

(C) Both the equation always have non-real roots

(D) Atleast one equation always has real and equal roots

18. If $b > a$, and $c > 0$ then the equation $(x - a)(x - b) - c = 0$ has:

(A) Both roots in $(-\infty, a)$

(B) Both roots in $(a, b]$

(C) One root in $(-\infty, a)$ and other root in (b, ∞)

(D) One root in $(-\infty, a)$ and other root in $[a, b]$

19. If α and $\beta(\alpha < \beta)$ are the roots of the equation $x^2 + bx + c = 0$, where $c < 0 < b$, then:

(A) $0 < \alpha < \beta$ **(B)** $\alpha < 0 < \beta < |\alpha|$

(C) $\alpha < \beta < 0$ **(D)** $\alpha < 0 < |\alpha| < \beta$

20. If the roots of $ax^2 + bx + c = 0$ are the reciprocals of those $\ell x^2 + mx + n = 0$ then $a : b : c =$

(A) $n : m : \ell$ **(B)** $\ell : m : n$ **(C)** $m : n : \ell$ **(D)** $n : \ell : m$

SECTION-2

This section contains Five (05) Numerical Value Type Questions. The answer to each question is an integer ranging from 0 to 99 (both inclusive).

21. For the equation $3x^2 + px + 3 = 0,\ p > 0$, if one of the root is square of the other, then p is equal to _____.

22. Suppose a and b are real numbers with $ab \neq 0$. If the three quadratic equations $x^2 + ax + 12 = 0$, $x^2 + bx + 15 = 0$ and $x^2 + (a + b)x + 36 = 0$ have a common positive root then $|a| + |b| =$ _____.

23. If α and β are the roots of the equation $x^2 - ax + b = 0$ where $a = 69$ and $A_n = \alpha^n + \beta^n$, then $\frac{(A_{n+1} + bA_{n-1})}{A_n}$ is _____.

24. The number of real values of parameter k for which $(\log_{16} x)^2 - \log_{16} x + \log_{16} k = 0$ will have exactly one solution is _____.

25. The value of a for which the equations $x^2 - 3x + a = 0$ and $x^2 + ax - 3 = 0$ have only one common root is _____.

SPACE FOR ROUGH WORK

••• End of JEE Main – 1 [JEE - 2024] •••