

AERO CET SAMPLE PAPER 3



PHYSICS

1. A gas mixture consists of 3 moles of oxygen and 5 moles of argon at temperature T . Considering only translational and rotational modes, the total internal energy of the system is

- A) $20 RT$
- B) $12 RT$
- C) $4 RT$
- D) $15 RT$

ANS:(D)

2. An ideal gas is enclosed in a cylinder at a pressure of 2 atm and temperature, 300 K. The mean time between two successive collisions is 6×10^{-8} s. If the pressure is doubled and the temperature is increased to 500 K, the mean time between two successive collisions will be close to

- A) 4×10^{-8} s
- B) 3×10^{-6} s
- C) 0.5×10^{-8} s
- D) 2×10^{-7} s

ANS:(A)

3. The specific heats, C_p and C_v of gas of diatomic molecules, A, is given (in units of

$J \text{ mol}^{-1} \text{ K}^{-1}$) by 29 and 22, respectively. Another gas of diatomic molecules, B, has the corresponding values 30 and 21. If they are treated as ideal gases, then

- A) A has a vibrational mode but B has none.
- B) A has one vibrational mode and B has two.
- C) A is rigid but B has a vibrational mode.
- D) Both A and B have a vibrational mode each.

ANS:(A)

4. A piece of wood of mass 0.03 kg is dropped from the top of a 100 m height building. At the same time, a bullet of mass 0.02 Kg is fired vertically upward, with a velocity 100 m/s, from the ground. The bullet gets embedded in the wood. Then the maximum height to which the combined system reaches above the top of the building before falling below is ($g = 10 \text{ m/s}^2$)

- A) 10 m
- B) 30 m
- C) 20 m
- D) 40 m

ANS:(D)

5. A passenger train of length 60 m travels at a speed of 80 km/hr. Another freight train of length 120 m travels at a speed of 30 km/hr. The ratio of times taken by the passenger train to completely cross the freight train when: (i) they are moving in the same direction, and (ii) in the opposite direction, is

- A) 25/11
- B) 3/2
- C) 5/2
- D) 11/5

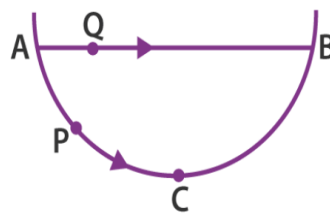
ANS: (D)

6. A river is flowing from west to east at a speed of 5 metres per minute. A man on the south bank of the river, capable of swimming at 10 metres per minute in still water, wants to swim across the river in the shortest time. He should swim in a direction.

- A) due north
- B) 30° east of north
- C) 30° west of north
- D) 60° east of north

ANS: (A)

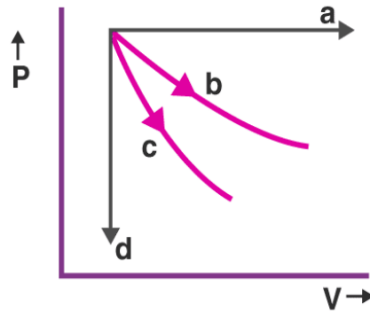
7. A particle P is sliding down a frictionless hemispherical bowl. It passes point A at $t = 0$. At this instant of time, the horizontal component of its velocity is v . A bead Q of the same mass as P is ejected from A at $t = 0$ along the horizontal string AB, with speed v . Friction between the bead and the string may be neglected. Let t_p and t_q be the respective times taken by P and Q to reach point B.



- A) $t_p < t_q$
- B) $t_p > t_q$
- C) $t_p = t_q$
- D) $t_p/t_q = (\text{length of arc ABC} / \text{length of chord AB})$

ANS:(A).

8. The given diagram shows four processes i.e., isochoric, isobaric, isothermal and adiabatic. The correct assignment of the processes, in the same order, is given by



- A) d a c b
- B) d a b c
- C) a d b c

ANS: (B)

9. The ratio of work done by an ideal monoatomic gas to the heat supplied to it in an isobaric process is

- A) $2/5$
- B) $3/2$
- C) $3/5$
- D) $2/3$

ANS: (A)

10. In a process, temperature and volume of one mole of an ideal monoatomic gas are varied according to the relation $VT = K$, where K is a constant. In this process, the temperature of the gas is increased by T . The amount of heat absorbed by gas is given by (R is gas constant)

- A) $(2K/3)\Delta T$
- B) $\frac{1}{2}R\Delta T$
- C) $(3/2)R\Delta T$
- D) $(\frac{1}{2})KR\Delta T$

ANS: (B)

11. A cylinder with a fixed capacity of 67.2 lit contains helium gas at STP. The amount of heat needed to raise the temperature of the gas by 20°C is [Given that $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$]

- A) 350 J
- B) 700 J
- C) 748 J
- D) 374 J

ANS: (c)

12. "Heat cannot by itself flow from a body at a lower temperature to a body at a higher temperature" is a statement or consequence of

- A) The second law of thermodynamics
- B) conservation of momentum
- C) conservation of mass
- D) The first law of thermodynamics

ANS:(a)

13. Which of the following is incorrect regarding the first law of thermodynamics?

- A) It introduces the concept of internal energy
- B) It introduces the concept of entropy
- C) It is not applicable to any cyclic process
- D) It is a restatement of the principle of conservation of energy

ANS: (B) and (C)

14. A magnetic compass needle oscillates 30 times per minute at a place where the dip is 45° , and 40 times per minute where the dip is 30° . If B_1 and B_2 are, respectively the total magnetic field due to the earth at the two places, then the ratio B_1/B_2 is best given by

- A) 0.7
- B) 3.6
- C) 1.8
- D) 2.2

ANS: (A)

15. A magnetic needle of magnetic moment $6.7 \times 10^{-2} \text{ A m}^2$ and moment of inertia $7.5 \times 10^{-6} \text{ kg m}^2$ is performing simple harmonic oscillations in a magnetic field of 0.01 T. Time taken for 10 complete oscillations is

- A) 6.65 s
- B) 8.89 s
- C) 6.98 s
- D) 8.76 s

ANS: (A)

16. The parallel combination of two air filled parallel plate capacitors of capacitance C and nC is connected to a battery of voltage, V . When the capacitors are fully charged, the battery is removed and after that a dielectric material of dielectric constant K is placed between the two plates of the first capacitor. The new potential difference of the combined system is

- A) V
- B) $(n+1)V/(K+n)$
- C) $(nV)/(K+n)$
- D) $V/(K+n)$

ANS: (B)

17. A parallel plate capacitor is made by stacking n equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is C then the resultant capacitance is

- A) C
- B) nC
- C) $(n - 1) C$
- D) $(n + 1) C$

ANS: (c)

18. An unstable heavy nucleus at rest breaks into two nuclei which move away with velocities in the ratio of 8: 27. The ratio of the radii of the nuclei (assumed to be spherical) is

- A) 3: 2
- B) 2: 3
- C) 4: 9
- D) 8: 27

ANS: (A)

19. According to Bohr's theory, the time-averaged magnetic field at the centre (i.e. nucleus) of a hydrogen atom due to the motion of electrons in the n^{th} orbit is proportional to (n = principal quantum number)

- A) n^{-2}
- B) n^{-3}
- C) n^{-4}
- D) n^{-5}

ANS: (D)

20.The energy band gap is maximum in

- A) metals
- B) superconductors
- C) insulators
- D) semiconductors

ANS:(c)

21. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of

- A) each of them increases
- B) each of them decreases
- C) copper decreases and germanium increases
- D) copper increases and germanium decreases

ANS: (c)

22. The wavelength of the carrier waves in a modern optical fibre communication network is close to

- A) 600 nm
- B) 2400 nm
- C) 1500 nm
- D) 900 nm

ANS: (c)

23.The physical sizes of the transmitter and receiver antenna in a communication system are

- A) inversely proportional to the modulation frequency
- B) proportional to the carrier frequency
- C) independent of both carrier and modulation frequency
- D) inversely proportional to the carrier frequency

ANS: (D)

24.A series AC circuit containing an inductor (20 mH), a capacitor (120 μ F) and a resistor (60 Ω) is driven by an AC source of 24 V/50 Hz. The energy dissipated in the circuit in 60 s is

- A) 3.39×10^3 J
- B) 5.65×10^2 J
- C) 2.26×10^3 J

D) 5.17×10^2 J

ANS: (D)

25. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is

A) NAB

B) NABR

C) $NAB\omega$

D) NABRc

ANS: (c)

CHEMISTRY

1. If the kinetic energy of an electron is increased four times, the wavelength of the de-Broglie wave associated with it would become

A) Two times

B) Half

C) One fourth

D) Four times

ANS:(B)

2. Calculate the wavelength (in nanometre) associated with a proton moving at $1.0 \times 10^3 \text{ms}^{-1}$ (Mass of proton = $1.67 \times 10^{-27} \text{kg}$ and $h = 6.63 \times 10^{-34} \text{Js}$)

A) 2.5 nm

B) 14.0 nm

C) 0.032 nm

D) 0.40 nm

ANS:(D)

3. The bond dissociation energy of B–F in BF_3 is 646 kJ mol^{-1} whereas that of C–F in CF_4 is 515 kJ mol^{-1} . The correct reason for higher B–F bond dissociation energy as compared to that of C–F is

A) Significant $p\pi - p\pi$ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4 .

B) Lower degree of $p\pi - p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4

C) Smaller size of B-atom as compared to that of C-atom

D) Stronger bond between B and F in BF_3 as compared to that between C and F in CF_4 .

ANS: (A)

4. Among the following species which two have a trigonal bipyramia shape?

(A) NI_3 (2) I_3^- (3) SO_3^{2-} (4) NO_3^-

A) II and III

B) III and IV

c) I and IV

D) I and III

ANS: (D)

5. Number of atoms in the following samples of substances is the largest in:

A) 127.0g of iodine

B) 48.0g of magnesium

C) 71.0g of chlorine

D) 4.0g of hydrogen

ANS: (D)

6. The ratio of mass percent of C and H of an organic compound ($\text{C}_x\text{H}_y\text{O}_z$) is 6: 1. If one molecule of the above compound ($\text{C}_x\text{H}_y\text{O}_z$) contains half as much oxygen as required to burn one molecule of compound C_xH_y completely to CO_2 and H_2O . The empirical formula of compound $\text{C}_x\text{H}_y\text{O}_z$ is:

A) $\text{C}_2\text{H}_4\text{O}$

B) $\text{C}_3\text{H}_4\text{O}_2$

C) $\text{C}_2\text{H}_4\text{O}_3$

D) $\text{C}_3\text{H}_6\text{O}_3$

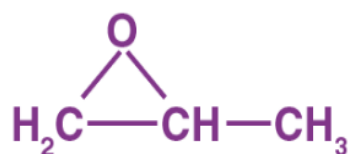
ANS: (c)

7. The IUPAC name of neopentane is:

- A) 2-methyl propane
- B) 2, 2-dimethyl butane
- C) 2-methyl butane
- D) 2, 2-dimethyl propane

ANS: (D)

8. The IUPAC name of the compound is:



- A) 1, 2-Epoxy propane
- B) Propylene oxide
- C) 1, 2-Oxo propane
- D) 1, 2-Propoxid

ANS: (A)

9. Which one of the following compounds will not be soluble in sodium bicarbonate?

- A) Benzene sulphonic acid
- B) Benzoic acid
- C) o-Nitrophenol
- D) 2, 4, 6 – Trinitrophenol

ANS: (c)

10. The compound formed in the positive test for nitrogen with the Lassaigne solution of an organic compound is

- A) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$
- B) $\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$
- C) $\text{Fe}(\text{CN})_3$
- D) $\text{Na}_3[\text{Fe}(\text{CN})_6]$

ANS: (A)

11. The synthesis of alkyl fluorides is best accomplished by

- A) Finkelstein reaction
- B) Swart's reaction
- C) free radical fluorination
- D) Sandmeyer's reaction.

ANS: (B)

12. A solution of (-)-1-chloro-1-phenylethane in toluene racemises slowly in the presence of a small amount of SbCl_5 , due to the formation of

- A) free radical
- B) carbanion
- C) carbene
- D) carbocation

ANS: (D)

13. For the equilibrium, $\text{A}(\text{g}) \rightleftharpoons \text{B}(\text{g})$, ΔH is -40 kJ/mol . If the ratio of the activation energies of the forward (E_f) and reverse (E_b) reactions is $2/3$ then:

- A) $E_f = 60 \text{ kJ/mol}$; $E_b = 100 \text{ kJ/mol}$
- B) $E_f = 30 \text{ kJ/mol}$; $E_b = 70 \text{ kJ/mol}$
- C) $E_f = 80 \text{ kJ/mol}$; $E_b = 120 \text{ kJ/mol}$
- D) $E_f = 70 \text{ kJ/mol}$; $E_b = 30 \text{ kJ/mol}$

ANS: (c)

14. At 518°C , the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 1.00 s^{-1} when 5% had reacted and 0.5 Torr s^{-1} when 33% had reacted. The order of the reaction is:

- A) 3
- B) 1
- C) 0
- D) 2

ANS: (D)

15. In Goldschmidt aluminothermic process, which of the following reducing agents is used?

- A) Calcium
- B) Coke

- C) Sodium
- D) Al-powder

ANS: (D)

16. The metal that cannot be obtained by electrolysis of an aqueous solution of its salts is:

- A) Cu
- B) Cr
- C) Ag
- D) Ca

ANS: (D)

17. In the Victor-Meyer's test, the colour given by 1^o, 2^o and 3^o alcohols are respectively: -

- A) Red, blue, colourless
- B) Colourless, red, blue
- C) Red, blue, violet
- D) Red, colourless, blue

ANS: (A)

18. The most suitable reagent for the conversion of $R - CH_2 - OH \rightarrow R - CHO$ is:

- A) CrO_3
- B) PCC (Pyridinium chlorochromate)
- C) $KMnO_4$
- D) $K_2Cr_2O_7$

ANS: (B)

19. Copper wire test for halogens is known as: -

- A) Duma's Test
- B) Beilstein's Test
- C) Lassigne's Test
- D) Liebig's Test

ANS: (B)

20. Beilstein test is used for estimation of which one of the following elements?

- A) S
- B) Cl
- C) C and H
- D) N

ANS: (B)

21. The correct decreasing order for acid strength is

- A) $\text{FCH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{NO}_2\text{CH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
- B) $\text{CNCH}_2\text{COOH} > \text{O}_2\text{NCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
- C) $\text{NO}_2\text{CH}_2\text{COOH} > \text{NCCH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$
- D) $\text{NO}_2\text{CH}_2\text{COOH} > \text{FCH}_2\text{COOH} > \text{CNCH}_2\text{COOH} > \text{ClCH}_2\text{COOH}$

ANS: (c)

22. In the chemical reactions,



The compounds 'A' and 'B' are respectively:

- A) Nitrobenzene and chlorobenzene
- B) Nitrobenzene and fluorobenzene
- C) Phenol and benzene
- D) Benzene diazonium chloride and fluorobenzene

ANS: (D)

23. Polymer formation from monomers starts by

- A) condensation reaction between monomers
- B) coordinate reaction between monomers
- C) conversion of monomer to monomer ions by protons •
- D) hydrolysis of monomers

ANS: (B)

24. Which of the following is a polyamide?

- A) Teflon
- B) Nylon – 6,6
- C) Terylene
- D) Bakelite

ANS:(B)

25. Which of the following is fully fluorinated polymer?

- A) Neoprene
- B) Teflon
- C) Thiokol
- D) PVC

ANS:(B)

MATHEMATICS

1. Consider the system of equations $x + y + z = 1$, $2x + 3y + 2z = 1$, $2x + 3y + (a^2 - 1)z = a + 1$ then

- A) System has a unique solution for $|a| = \sqrt{3}$
- B) System is inconsistent for $|a| = \sqrt{3}$
- C) System is inconsistent for $a = 4$
- D) System is inconsistent for $a = 3$

ANS :(B)

2. If the system of linear equations are

$$2x + 2ay + az = 0$$

$$2x + 3by + bz = 0 \text{ and}$$

$$2x + 4cy + cz = 0,$$

where $a, b, c \in \mathbb{R}$ are non-zero and distinct; has a non-zero solution, then

- A) $a + b + c = 0$
- B) $1/a, 1/b, 1/c$ are in A.P.
- C) a, b, c are in A.P.
- D) a, b, c are in G.P.

ANS: (B)

3. Let R_1 and R_2 be two relations defined on \mathbb{R} by a $R_1b \Leftrightarrow ab \geq 0$ and $aR_2b \Leftrightarrow a \geq b$. Then,

- A) R_1 is an equivalence relation but not R_2
- B) R_2 is an equivalence relation but not R_1
- C) Both R_1 and R_2 are equivalence relations
- D) Neither R_1 nor R_2 is an equivalence relation

ANS: (D)

4. Let

$f, g : \mathbb{N} - \{1\} \rightarrow \mathbb{N}$ be functions defined by

$f(a) = \alpha$, where α is the maximum of the powers of those primes p such that p^α divides a , and $g(a) = a + 1$, for all $a \in \mathbb{N} - \{1\}$. Then, the function $f + g$ is

- A) One-one but not onto
- B) Onto but not one-one
- C) Both one-one and onto
- D) Neither one-one nor onto

ANS:(D)

5. Let the minimum value v_0 of

$$v = |z|^2 + |z-3|^2 + |z-6i|^2, z \in \mathbb{C}$$

is attained at $z = z_0$. Then

$$|2z_0^2 - \bar{z}_0^3 + 3|^2 + v_0^2$$

is equal to

- A) 1000
- B) 1024
- C) 1105
- D) 1196

ANS: (A)

6. Considering only the principal values of the inverse trigonometric functions, the domain of the function

$$f(x) = \cos^{-1} \left(\frac{x^2 - 4x + 2}{x^2 + 3} \right)$$

is

- (A) $(-\infty, \frac{1}{4}]$
- (B) $[-\frac{1}{4}, \infty)$
- (C) $(\frac{-1}{3}, \infty)$
- (C) $(-\infty, \frac{1}{3}]$

ANS:(B)

7. Let the operations $*, \odot \in \{\wedge, \vee\}$. If $(p * q) \odot (p \odot \sim q)$ is a tautology, then the ordered pair $(*, \odot)$ is

- (A) (\vee, \wedge)
- (B) (\vee, \vee)
- (C) (\wedge, \wedge)
- (D) (\wedge, \vee)

ANS: (B)

8. For $\alpha \in \mathbb{N}$, consider a relation R on \mathbb{N} given by $R = \{(x, y) : 3x + \alpha y \text{ is a multiple of } 7\}$. The relation R is an equivalence relation if and only if

- (A) $\alpha = 14$
- (B) α is a multiple of 4
- (C) 4 is the remainder when α is divided by 10
- (D) 4 is the remainder when α is divided by 7

ANS: (D)

9. If $y = y(x)$, $x \in (0, \pi/2)$ be the solution curve of the differential equation

$$(\sin^2 2x) \frac{dy}{dx} + (8 \sin^2 2x + 2 \sin 4x)y = 2e^{-4x}(2 \sin 2x + \cos 2x),$$

with $y\left(\frac{\pi}{4}\right) = e^{-\pi}$, then $y\left(\frac{\pi}{6}\right)$

is equal to

- (A) $\frac{2}{\sqrt{3}}e^{-2\pi/3}$
 (B) $\frac{2}{\sqrt{3}}e^{2\pi/3}$
 (C) $\frac{1}{\sqrt{3}}e^{-2\pi/3}$
 (D) $\frac{1}{\sqrt{3}}e^{2\pi/3}$

ANS:(A)

10. If the tangents drawn at the points P and Q on the parabola $y^2 = 2x - 3$ intersect at the point $R(0, 1)$, then the orthocentre of the triangle PQR is :

- (A) (0, 1)
 (B) (2, -1)
 (C) (6, 3)
 (D) (2, 1)

ANS: (B)

11. Let C be the centre of the circle

$$x^2 + y^2 - x + 2y = \frac{11}{4}$$

and P be a point on the circle. A line passes through the point C , makes an angle of $\pi/4$ with the line CP and intersects the circle at the Q and R . Then the area of the triangle PQR (in unit²) is :

- (A) 2
 (B) $2\sqrt{2}$
 (C) $8 \sin\left(\frac{\pi}{8}\right)$
 (D) $8 \cos\left(\frac{\pi}{8}\right)$

ANS: (B)

12. The remainder $7^{2022} + 3^{2022}$ is divided by 5 is:

- A) 0
 B) 2
 C) 3
 D) 4

ANS:(C)

13. Let the matrix

$$A = \begin{vmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{vmatrix}$$

and the matrix

$$B_0 = A^{49} + 2A^{98}. \text{ If } B_n = \text{Adj}(B_{n-1}) \text{ for all } n \geq 1,$$

then $\det(B_4)$ is equal to :

- A) 3^{28}

B) 3^{30}

C) 3^{32}

D) 3^{36}

ANS: (C)

14. The foot of the perpendicular from a point on the circle $x^2 + y^2 = 1, z = 0$ to the plane $2x + 3y + z = 6$ lies on which one of the following curves?

(A) $(6x + 5y - 12)^2 + 4(3x + 7y - 8)^2 = 1, z = 6 - 2x - 3y$

(B) $(5x + 6y - 12)^2 + 4(3x + 5y - 9)^2 = 1, z = 6 - 2x - 3y$

(C) $(6x + 5y - 14)^2 + 9(3x + 5y - 7)^2 = 1, z = 6 - 2x - 3y$

(D) $(5x + 6y - 14)^2 + 9(3x + 7y - 8)^2 = 1, z = 6 - 2x - 3y$

ANS: (B)

15. If the minimum value of

$$f(x) = \frac{5x^2}{2} + \frac{\alpha}{x^5}, x > 0$$

is 14, then the value of α is equal to

A) 32

B) 64

C) 128

D) 256

ANS: (C)

16. Let α, β and γ be three positive real numbers.

Let $f(x) = \alpha x^5 + \beta x^3 + \gamma x, x \in \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}$ be such that $g(f(x)) = x$ for all $x \in \mathbb{R}$.

If $a_1, a_2, a_3, \dots, a_n$ be in arithmetic progression with mean zero, then the value of

$$f\left(g\left(\frac{1}{n} \sum_{i=1}^n f(a_i)\right)\right)$$

is equal to

A) 0

B) 3

C) 9

D) 27

ANS: (A)

17. Consider the sequence a_1, a_2, a_3, \dots such that $a_1 = 1, a_2 = 2$ and

$$a_{n+2} = \frac{2}{a_{n+1}} + a_n \text{ for } n = 1, 2, 3, \dots$$

If

$$\left(\frac{a_1 + \frac{1}{a_2}}{a_3}\right) \left(\frac{a_2 + \frac{1}{a_3}}{a_4}\right) \left(\frac{a_3 + \frac{1}{a_4}}{a_5}\right) \dots \left(\frac{a_{30} + \frac{1}{a_{31}}}{a_{32}}\right) = 2^\alpha ({}^{61}C_{31}),$$

then α is equal to

- A) -30
- B) -31
- C) -60
- D) -61

ANS:(C)

18. The minimum value of the twice differentiable function

$$f(x) = \int_0^x e^{x-t} f'(t) dt - (x^2 - x + 1)e^x, x \in \mathbb{R}$$

is

- (A) $-\frac{2}{\sqrt{e}}$
- (B) $-2\sqrt{e}$
- (C) $-\sqrt{e}$
- (D) $\frac{2}{\sqrt{e}}$

ANS: (A)

19. Let α, β be the roots of the equation

$$x^2 - \sqrt{2}x + \sqrt{6} = 0 \text{ and } \frac{1}{\alpha^2} + 1, \frac{1}{\beta^2} + 1$$

be the roots of the equation $x^2 + ax + b = 0$. Then the roots of the equation $x^2 - (a + b - 2)x + (a + b + 2) = 0$ are

- A) Non-real complex number
- B) Real and both negative
- C) Real and both positive
- D) Real and exactly one of them is positive

ANS: (B)

20. Let A and B be any two 3×3 symmetric and skew symmetric matrices, respectively. Then Which of the following is NOT true?

- A) $A^4 - B^4$ is a symmetric matrix
- B) $AB - BA$ is a symmetric matrix
- C) $B^5 - A^5$ is a skew-symmetric matrix
- D) $AB + BA$ is a skew-symmetric matrix

ANS:(C)

21. Let $f(x) = ax^2 + bx + c$ be such that $f(1) = 3$, $f(-2) = \lambda$ and $f(3) = 4$. If $f(0) + f(1) + f(-2) + f(3) = 14$, then λ is equal to

- (A) -4
- (B) $\frac{13}{2}$
- (C) $\frac{23}{2}$
- (D) 4

ANS: (D)

22. The function

$$f(x) = xe^{x(1-x)}, x \in \mathbb{R}$$

is

- (A) Increasing in $(-\frac{1}{2}, 1)$
- (B) Decreasing in $(\frac{1}{2}, 2)$
- (C) Increasing in $(-1, -\frac{1}{2})$
- (D) Decreasing in $(-\frac{1}{2}, \frac{1}{2})$

ANS: (A)

22. The sum of the absolute maximum and absolute minimum values of the function

$$f(x) = \tan^{-1}(\sin x - \cos x)$$

in the interval $[0, \pi]$ is

- (A) 0
- (B) $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right) - \frac{\pi}{4}$
- (C) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right) - \frac{\pi}{4}$
- (D) $\frac{-\pi}{12}$

ANS: (C)

23. Let the hyperbola

$$H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1 \text{ pass through the point } (2\sqrt{2}, -2\sqrt{2}).$$

A parabola is drawn whose focus is same as the focus of H with positive abscissa and the directrix of the parabola passes through the other focus of H . If the length of the latus rectum of the parabola is e times the length of the latus rectum of H , where e is the eccentricity of H , then which of the following points lies on the parabola?

- (A) $(2\sqrt{3}, 3\sqrt{2})$
- (B) $(3\sqrt{3}, -6\sqrt{2})$
- (C) $(\sqrt{3}, -\sqrt{6})$
- (D) $(3\sqrt{6}, 6\sqrt{2})$

ANS: (B)

24. Let the lines

$$\frac{x-1}{\lambda} = \frac{y-2}{1} = \frac{z-3}{2} \text{ and } \frac{x+26}{-2} = \frac{y+18}{3} = \frac{z+28}{\lambda}$$

be coplanar and P be the plane containing these two lines. Then which of the following points does NOT lie on P ?

- A) (0, -2, -2)
- B) (-5, 0, -1)
- C) (3, -1, 0)
- D) (0, 4, 5)

ANS: (D)

25. A plane P is parallel to two lines whose direction ratios are $-2, 1, -3$ and $-1, 2, -2$ and it contains the point $(2, 2, -2)$. Let P intersect the co-ordinate axes at the points A, B, C making the intercepts α, β, γ . If V is the volume of the tetrahedron $OABC$, where O is the origin and $\rho = \alpha + \beta + \gamma$, then the ordered pair (V, ρ) is equal to :

- A) (48, -13)
- B) (24, -13)
- C) (48, 11)
- D) (24, -5)

ANS:(B)

APPTITUDE

1. A person can row 750 metres against the stream in $11 \frac{1}{4}$ minutes and returns in $7 \frac{1}{2}$ minutes. The speed of the person in still water is:

- A) 2 km/hr
- B) 3 km/hr
- C) 4km/hr
- D) 5 km/hr

ANS: (D)

2. If a man rows at the rate of 6 kmph in still water and his rate against the current is 4.5 kmph, then the man's rate along the current is

- A) 6 kmph
- B) 7.5 kmph
- C) 6.5kmph
- D) 8 kmph

ANS: (B)

3. A man can row a boat at 10 kmph in still water and the speed of the stream is 8 kmph. What is the time taken to row a distance of 90 km down the stream?

- A) 8 hrs
- B) 5 hrs
- C) 15 hrs
- D) 20 hrs

ANS: (B)

4. Find the average of first 40 natural numbers.

- A) 20.5
- B) 18
- C) 19.5
- D) 19

ANS: (A)

5. Find the value of ${}^{85}P_3$.

- A) 565350
- B) 595650
- C) 535950
- D) 565350

ANS: (B)

6. Find the value of ${}^{20}C_{18} * {}^{20}C_{20}$.

- A) 400
- B) 380
- C) 360
- D) 350

ANS: (B)

7. In how many ways can a committee consisting of 4 men and 5 women be formed from a group of 7 men and 9 women?

- A) ${}^7C_4 {}^9C_5$
- B) ${}^4C_7 {}^5C_9$
- C) ${}^7C_5 {}^9C_4$
- D) ${}^9C_4 {}^7C_5$

ANS: (A)

8. In how many ways can 5 boys and 3 girls sit around a table in such a way that no two girls sit together?

- A) 1000
- B) 1400
- C) 1440
- D) 1800

ANS: (B)

9. If $(a - b)$ is 9 more than $(c + d)$ and $(a + b)$ is 3 less than $(c - d)$, then $(a - c)$ is:

- A) 6
- B) 2
- C) 3
- D) None of these

ANS: (C)

10. If $a * b = \frac{a+b}{ab}$, find the value of $5 * (5 * -2)$:

- A) -3
- B) -10
- C) -1.66
- D) $\frac{3}{5}$

ANS: (B)

11. The value of $1 + [1/ (8 \times 2)] + [1/ (8 \times 2^2)] + [1/ (8 \times 2^3)]$ is:

- A) $\frac{71}{64}$
- B) $\frac{1}{16}$
- C) $\frac{1}{4}$
- D) None of these

ANS: (A)

12. If $x = a/(a - 1)$ and $1/(a - 1)$, then:

- A) x is equal to y
- B) x is equal to y only if $a < 1$
- C) x is greater than y
- D) x is greater than y only if $a < 1$

ANS: (C)

Directions-(Q. 13-15) Which of the phrases (A),(B) and (C) given below should replace the phrase given in bold in the following sentence to make the sentence grammatically meaningful and correct. If the sentence is correct as it is and 'No correction is required.' mark (D) as the answer

13. **Each of the loan** must be approved by the Branch Manager-

- A) Every loan
- B) Each one of the loan
- C) Any of the loans
- D) No correction required

ANS: (A)

14. The issue was **taken before** the Municipal Corporation meeting last week-

- A) Taking place at
- B) Taken after
- C) Taken up at
- D) No correction required

ANS: (C)

15. **He has asked** for the names of those employees involved in the project

- A) had asked
- B) having asked about
- C) was asked that
- D) No correction required

ANS: (D)

Directions- In the question below the sentences have been given in Active/Passive voice. From the given alternatives, choose the one which best expresses the given sentence in Passive/Active voice.

16. I remember my sister taking me to the museum

- A) I remember I was taken to the museum by my sister
- B) I remember being taken to the museum by my sister
- C) I remember myself being taken to the museum by my sister
- D) I remember taken to the museum by my sister

ANS: (B)

17. Who is creating this mess?

- A) Who has been created this mess?
- B) By whom has this mess been created?
- C) By whom this mess is being created?
- D) By whom is this mess being created?

ANS: (D)

18. An oasis always has

- A) Travellers
- B) Water
- C) Sand
- D) Camels

ANS: (B)

19. Which of the following a 'Drama' must have?

- A) Actors
- B) Story
- C) Sets
- D) Director

ANS: (B)

20. Which of the following an animal always has?

- A) Lungs
- B) Skin
- C) Life
- D) Heart

ANS: (C)

21. Which of the following an animal always has?

- A) Lungs

- B) Skin
- C) Life
- D) Heart

ANS: (C)

Directions - 22-23: Supply suitable Adjectives:

22. The _____ prize was won by a Hindu.

- A) Great
- B) First
- C) One
- D) None of the above

ANS: (B)

23. Suddenly there arose a _____ storm.

- A) Violent
- B) Many
- C) Great
- D) None of the above

ANS: (A)

Directions - 24-25: Supply suitable Adjectives:

The words in the box are adjectives (black/foreign etc.) or nouns (air/job etc.) Use an adjective and a noun to complete each sentence.

Air	clouds	foreign	holiday	job	languages	sharp
Black	dangerous	fresh	hot	knife	long	water

24. Do you speak any _____?

ANS: (Foreign languages)

25. Sue works very hard and she's very tired. She needs a _____?

ANS: (Long holiday)

AVIATION AFFAIRS

1. World's first woman to cross Atlantic Ocean solo in a light sports aircraft?

- A) Mohana Singh
- B) Gunjan Saxena
- C) Bhawana Kanth
- D) Arohi Pandit

ANS: (D)

2. Which type of engine I used on Boeing 737 MAX aircraft?

- A) Turboprop engines
- B) Turbojet engines
- C) Jet engines
- D) Both A and C

ANS: (C)

3. What is the most common type of aircraft engine?

- A) Turbo prop engines
- B) Turbojet engines
- C) Jet engine
- D) Turbo shaft engine

ANS: (C)

4. The two primary types of engines on aircraft are?

- A) Jet engine and reciprocating engine
- B) Turbo prop engine and turbo shaft engine
- C) Turbo fan and turbo prop engine
- D) Both A and C

ANS: (A)

5. Which is the fastest jet aircraft in world?

- A) Lockheed YF-12
- B) Lockheed SR-71 Blackbird
- C) McDonnell Douglas F-15 Eagle
- D) MIG-25 Foxbat

ANS: (B)

6. What Mach breaks the sound barrier?

- A) >Mach 1
- B) <Mach 1
- C) Mach 4
- D) Mach 1

ANS: (D)

7. What do pilots hear when they break the sound barrier?

- A) Sonic Boom
- B) Sonic Blast
- C) Ultrasonic Tune
- D) Sonic Beat

ANS: (A)

8. What is four engine jet called as?

- A) Monoplane
- B) Quad jet
- C) Twin engine jet
- D) Airliner

ANS: (B)

9. AAI Stands for?

- A) Airport Aerodrome of India
- B) Airspace Authority of India
- C) Airport Authority of India
- D) Air passengers of Airport of India

ANS: (C)

10. What is squawk 7777?

- A) Emergency
- B) Communication failures
- C) Hijacking
- D) Military Interception

ANS: (D)

11. RADAR Stands for?

- A) Radio Detection and Ranging
- B) Radio Detecting and Range
- C) Radio and Detecting Range
- D) Radio Detection Or Ranging

ANS: (A)

12. INS stands for?

- A) Instrument Navigation System
- B) Inertial Navigation System
- C) Integrated NOTAM system
- D) None of the above

ANS: (B)

13. As of 2022, there are how many space agencies in existence?

- A) 67
- B) 16
- C) 72
- D) 77

ANS: (C)

14. NASA Stands for?

- A) National Aeronautical Space Administration
- B) New Aeronautics and Space Administration
- C) National Aeronautics and Space Admin
- D) National Aeronautics and Space Administration

ANS: (D)

15. ISRO was founded in?

- A) 1970
- B) 1968
- C) 1969
- D) 1965

ANS: (C)

16. Which of the following is the space agency with human spaceflight capability?

- A) NASA
- B) CNSA
- C) Both A and B
- D) Only A

ANS: (C)

17. NASA was established in?

- A) 1858
- B) 1958
- C) 1968
- D) 1969

ANS: (B)

18. Which is the fourth country that did soft landing on moon?

- A) Japan
- B) Russia
- C) India
- D) China

ANS: (C)

19. Which is the first country that sent first female astronaut in space?

- A) Russia
- B) India
- C) America
- D) China

ANS: (A)

20. Who is the founder of SpaceX Company?

- A) Elon Musk
- B) Elin Musk
- C) Barak Obama
- D) None of the above

ANS: (A)

21. The headquarters of Italian space agency is in?

- A) Rome
- B) Venice
- C) Milan
- D) Naples

ANS: (D)

22. How many ISRO centres are there in Bangalore?

- A) 12
- B) 13
- C) 15
- D) 07

ANS: (B)

23. Central RRSC- Regional Remote Sensing Centre is in?

- A) Nagpur
- B) Bangalore
- C) Hyderabad
- D) Hassan

ANS: (A)

24. The first person to walk in space?

- A) Neil Armstrong
- B) Kalpana Chawla
- C) Rakesh Verma
- D) Alexie Leonov

ANS: (D)

25. India's first indigenous sounding rocket was?

- A) RH- 41
- B) RH-75
- C) HR-75
- D) None of the above

ANS: (B)

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Shastri Campus, S.No.85, NDA Road, Shivane, Pune- 4110023

✉ **info@aero.edu.in**

🌐 **www.aero.edu.in**

☎ **+91 9822013633**

+91 8806033119