

## PHYSICS

1. If momentum $[P]$, area $[A]$ and time $[T]$ are taken as fundamental quantities, then the dimensional formula for the coefficient of viscosity is
A) $\left[\mathrm{PA}^{-1} \mathrm{~T}^{0}\right]$
B) $\left[\mathrm{PAT}^{-1}\right]$
C) $\left[\mathrm{PA}^{-1} \mathrm{~T}\right]$
D) $\left[\mathrm{PA}^{-1} \mathrm{~T}^{-1}\right]$

ANS: (A)
2. Which of the following physical quantities have the same dimensions?
A) Electric displacement $(\vec{D})$ and surface density
B) Displacement current and electric field
C) Current density and surface charge density
D) Electric potential and energy

ANS: (A)
3. A person moved from $\boldsymbol{A}$ to $\boldsymbol{B}$ on a circular path as shown in figure. If the distance travelled by him is 60 m , then the magnitude of displacement would be

(Given $\cos 135^{\circ}=-0.7$ )
A) 42 m
B) 47 m
C) 19 m
D) 40 m

ANS: (B)
4. A body of mass 0.5 kg travels on straight line path with velocity $\boldsymbol{v}=\left(3 \boldsymbol{x}^{2}+4\right) \mathrm{m} / \mathrm{s}$. The network done by the force during its displacement from $\boldsymbol{x}=0$ to $\boldsymbol{x}=2 \mathrm{~m}$ is
A) 64 J
B) 60 J
C) 120 J
D) 128 J

ANS: (B)
5. A solid cylinder and a solid sphere, having same mass $M$ and radius $\boldsymbol{R}$, roll down the same inclined plane from top without slipping. They start from rest. The ratio of velocity of the solid cylinder to that of the solid sphere, with which they reach the ground, will be
A) $\sqrt{\frac{5}{3}}$
B) $\sqrt{\frac{4}{5}}$
C) $\sqrt{\frac{3}{5}}$
D) $\sqrt{\frac{14}{15}}$

ANS: (D)
6. 100 GThree identical particles $\boldsymbol{A}, \boldsymbol{B}$ and $\boldsymbol{C}$ of mass 100 kg each are placed in a straight line with $\boldsymbol{A B}=\boldsymbol{B} \boldsymbol{C}=13$ m . The gravitational force on a fourth particle $\boldsymbol{P}$ of the same mass is $\boldsymbol{F}$, when placed at a distance 13 m from the particle $\boldsymbol{B}$ on the perpendicular bisector of the line $\boldsymbol{A C}$. The value of $\boldsymbol{F}$ will be approximately
A) $21 G$
B) 100 G
C) 59 G
D) $42 G$

ANS: (B)
7. A certain amount of gas of volume $V$ at $27^{\circ} \mathrm{C}$ temperature and pressure
$10^{7} \mathrm{Nm}^{-2}$ expands isothermally until its volume gets doubled. Later it expands adiabatically until its volume gets redoubled. The final pressure of the gas will be (Use, $\gamma=1.5$ )
A) $3.536 \times 10^{5} \mathrm{~Pa}$
B) $3.536 \times 10^{6} \mathrm{~Pa}$
C) $1.25 \times 10^{6} \mathrm{~Pa}$
D) $1.25 \times 10^{5} \mathrm{~Pa}$

ANS: (B)
8. Following statements are given:
(A) The average kinetic energy of a gas molecule decreases when the temperature is reduced.
(B) The average kinetic energy of a gas molecule increases with increase in pressure at constant temperature.
(C) The average kinetic energy of a gas molecule decreases with increase in volume.
(D) Pressure of a gas increases with increase in temperature at constant pressure.
(E) The volume of gas decreases with increase in temperature.

Choose the correct answer from the options given below:
(A) (A) \& (D) only
(B) (A), (B) \& (D) only
(C) (B) \& (D) only
(D) (A), (B) \& (E) only

ANS: (B)
9. In figure ( $\boldsymbol{A}$ ), mass ' $2 \boldsymbol{m}$ 'is fixed on mass ' $\boldsymbol{m}$ ', which is attached to two springs of spring constant $k$. In figure $(\boldsymbol{B})$, mass ' $\boldsymbol{m}$ 'is attached to two springs of spring constant ' $\boldsymbol{k}$ 'and ' $2 \boldsymbol{k}$ '. If mass ' $\boldsymbol{m}$ 'in $(\boldsymbol{A})$ and in ( $\boldsymbol{B})$ are displaced by distance' x' horizontally and then released, then time period $\boldsymbol{T}_{1}$ and $\boldsymbol{T}_{2}$ corresponding to (A) and (B) respectively follow the relation.

(A)

(B)
A) $\frac{T 1}{T 2}=\frac{3}{\sqrt{2}}$
B) $\frac{T 1}{T 2}=\sqrt{\frac{3}{2}}$
C) $\frac{T 1}{T 2}=\sqrt{\frac{2}{3}}$
D) $\frac{T 1}{T 2}=\frac{\sqrt{2}}{3}$

ANS: (A)
10. A condenser of $2 \mu \mathrm{~F}$ capacitance is charged steadily from 0 to 5 C . Which of the following graph represents correctly the variation of potential difference ( $\boldsymbol{V}$ ) across it's plates with respect to the charge $(\boldsymbol{Q}$ ) on the condenser?


ANS: (A)
11. Two charged particles, having same kinetic energy, are allowed to pass through a uniform magnetic field perpendicular to the direction of motion. If the ratio of radii of their circular path is $6: 5$ and their respective masses ratio is $9: 4$. Then, the ratio of their charges will be:
A) $8: 5$
B) $5: 4$
C) $5: 3$
D) $8: 7$

ANS: (B)
12. To increase the resonant frequency in series LCR circuit,
A) Source frequency should be increased.
B) Another resistance should be added in series with the first resistance.
C) Another capacitor should be added in series with the first capacitor.
D) The source frequency should be decreased.

ANS: (C)
13. A small square loop of wire of side $I$ is placed inside a large square loop of wire $L(L \gg I)$. Both loops are coplanar and their centres coincide at point $\boldsymbol{O}$ as shown in figure. The mutual inductance of the system is

A) $\frac{2 \sqrt{2} \mu_{L} L^{2}}{\pi I}$
B) $\frac{\mu_{0}{ }^{2}}{2 \sqrt{2} \pi L}$
C) $\frac{2 \sqrt{2} \mu_{L} I^{2}}{\pi L}$
D) $\frac{\mu_{L} L^{2}}{2 \sqrt{2} \pi L}$

ANS: (C)
14. The rms value of conduction current in a parallel plate capacitor is $6.9 \mu \mathrm{~A}$. The capacity of this capacitor, if it is connected to 230 V ac supply with an angular frequency of $600 \mathrm{rad} / \mathrm{s}$, will be:
A) 5 pF
B) 50 pF
C) 100 pF
D) 200 pF

ANS: (B)
15. Which of the following statement is correct?
A) In primary rainbow, observer sees red colour on the top and violet on the bottom
B) In primary rainbow, observer sees violet colour on the top and red on the bottom
C) In primary rainbow, light wave suffers total internal reflection twice before coming out of water drops
D) Primary rainbow is less bright than secondary rainbow

ANS: (A)
16. Time taken by light to travel in two different materials $\boldsymbol{A}$ and $\boldsymbol{B}$ of refractive indices $\mu_{A}$ and $\mu_{B}$ of same thickness is $\boldsymbol{t}_{1}$ and $\boldsymbol{t}_{2}$ respectively. If $\boldsymbol{t}_{2}-\boldsymbol{t}_{\boldsymbol{1}}=5 \times 10^{-10} \mathrm{~s}$ and the ratio of $\mu_{\boldsymbol{A}}$ to $\mu_{\boldsymbol{B}}$ is $1: 2$. Then, the thickness of material, in meter is: (Given $\boldsymbol{v}_{\boldsymbol{A}}$ and $\boldsymbol{v}_{\boldsymbol{B}}$ are velocities of light in $\boldsymbol{A}$ and $\boldsymbol{B}$ materials, respectively.)
A) $5 \times 10^{-10} \mathrm{v}_{\mathrm{A}} \mathrm{m}$
B) $5 \times 10^{-10} \mathrm{~m}$
C) $1.5 \times 10^{-10} \mathrm{~m}$
D) $5 \times 10^{-10} \mathrm{v}_{\mathrm{B}} \mathrm{m}$

ANS: (A)
17. A metal exposed to light of wavelength 800 nm and emits photoelectrons with a certain kinetic energy. The maximum kinetic energy of photo-electron doubles when light of wavelength 500 nm is used. The work function of the metal is:
(Take hc = 1230 eV -nm)
A) 1.537 eV
B) 2.46 eV
C) 0.615 eV
D) 1.23 eV

ANS: (C)
18. The momentum of an electron revolving in $\boldsymbol{n}^{\text {th }}$ orbit is given by: (Symbols have their usual meanings)
(A) $\frac{n h}{2 \pi r}$
(B) $\frac{n h}{2 r}$
(C) $\frac{n h}{2 \pi}$
(D) $\frac{2 \pi r}{n h}$

ANS: (A)
19. The magnetic moment of an electron (e) revolving in an orbit around nucleus with an orbital angular momentum is given by:
(A) $\overrightarrow{\mu_{L}}=\frac{\overrightarrow{e L}}{2 m}$
(B) $\overrightarrow{\mu_{L}}=-\frac{\overrightarrow{e L}}{2 m}$
(C) $\overrightarrow{\mu_{I}}=-\frac{\overrightarrow{e L}}{m}$
(D) $\overrightarrow{\mu_{I}}=\frac{2 \overrightarrow{e L}}{m}$

## ANS: (B)

20. In the circuit, the logical value of $A=1$ or $B=1$ when potential at $A$ or $B$ is 5 V and the logical value of $A=0$ or $B=0$ when potential at $A$ or $B$ is 0 V .


The truth table of the given circuit will be:
(A) A B Y 000

100
010
111
(B) A B Y

000
101
011
111
(C) A B Y

000
100
010
110
(D) A B Y

001
101

011
110
ANS: (A)
21. In AM modulation, a signal is modulated on a carrier wave such that maximum and minimum amplitudes are found to be 6 V and 2 V , respectively. The modulation index is
A) $100 \%$
B) $80 \%$
C) $60 \%$
D) $50 \%$

ANS: (D)
22. The electric current in a circular coil of 2 turns produces a magnetic induction $B_{1}$ at its centre. The coil is unwound and is rewound into a circular coil of 5 turns and the same current produces a magnetic induction $B_{2}$ at its centre. The ratio of $B_{2} / B_{1}$ is
(A) $\frac{5}{2}$
(B) $\frac{25}{4}$
(C) $\frac{5}{4}$
(C) $\frac{25}{2}$

ANS: (B)
23. A drop of liquid of density $\rho$ is floating half immersed in a liquid of density $\sigma$ and surface tension $7.5 \times 10^{-4} \mathrm{~N}$ $\mathrm{cm}^{-1}$. The radius of drop in cm will be ( $\boldsymbol{g}=10 \mathrm{~ms}^{-2}$ )
(A) $\frac{15}{\sqrt{(2 \rho-\sigma)}}$
(B) $\frac{15}{\sqrt{(\rho-\sigma)}}$
(C) $\frac{3}{2 \sqrt{(\rho-\sigma)}}$
(D) $\frac{3}{20 \sqrt{(2 \rho-\sigma)}}$

ANS: (A)
24. Two billiard balls of mass 0.05 kg each moving in opposite directions with $10 \mathrm{~ms}^{1}$ collide and rebound with the same speed. If the time duration of contact is $t=0.005 \mathrm{~s}$, then what is the force exerted on the ball due to each other?
A) 100 N
B) 200 N
C) 300 N
D) 400 N

ANS: (B)
25. For a free body diagram shown in the figure, the four forces are applied in the ' $x$ ' and ' $y$ ' directions. What additional force must be applied and at what angle with positive $x$-axis so that net acceleration of body is zero?

(A) $\sqrt{2} \mathrm{~N}, 45^{\circ}$
(B) $\sqrt{2} \mathrm{~N}, 135^{\circ}$
(C) $\frac{2}{\sqrt{3}} \mathrm{~N}, 30^{\circ}$
(D) $2 \mathrm{~N}, 45^{\circ}$

ANS: (A)

## CHEMISTRY

1. $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ on reaction with excess of water results into acidic mixture
$\mathrm{SO}_{2} \mathrm{Cl}_{2}+2 \mathrm{H}_{2} \mathrm{O} \rightarrow \mathrm{H}_{2} \mathrm{SO}_{4}+2 \mathrm{HCl}$
16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ used is
A) 16
B) 8
C) 4
D) 2

ANS: (C)
2. Which of the following sets of quantum numbers is not allowed?
(A) $n=3, l=2, m_{l}=0, s=+\frac{1}{2}$
(B) $n=3, l=2, m_{l}=-2, s=+\frac{1}{2}$
(C) $n=3, l=3, m_{l}=-3, s=-\frac{1}{2}$
(D) $n=3, l=0, m_{l}=0, s=-\frac{1}{2}$

ANS: (C)
3. The depression in the freezing point observed for a formic acid solution of concentration $0.5 \mathrm{mLL}^{1}$ is $0.0405^{\circ} \mathrm{C}$. Density of formic acid is $1.05 \mathrm{~g} \mathrm{~mL}^{-1}$. The Van't Hoff factor of the formic acid solution is nearly (Given for water $\mathrm{k}_{\mathrm{f}}=1.86 \mathrm{k} \mathrm{kg} \mathrm{mol}^{-1}$ )
A) 0.8
B) 1.1
C) 1.9
D) 2.4

ANS: (C)
4. 20 mL of $0.1 \mathrm{M} \mathrm{NH}_{4} \mathrm{OH}$ is mixed with 40 mL of 0.05 M HCl . The pH of the mixture is nearest to (Given: $\mathrm{Kb}\left(\mathrm{NH}_{4} \mathrm{OH}\right)=1 \times 10^{-5}, \log 2=0.30, \log 3=0.48, \log 5=0.69, \log 7=0.84, \log 11=1.04$ )
A) 3.2
B) 4.2
C) 5.2
D) 6.2

ANS: (C)
5. Match List-I with List-II.

| List-I | List-II |
| :--- | :--- |
| (A) $\mathrm{N}_{2}(\mathrm{~g})+3 \mathrm{H}_{2}(\mathrm{~g}) \rightarrow 2 \mathrm{NH}_{3}(\mathrm{~g})$ | (I) Cu |
| (B) $\mathrm{CO}(\mathrm{g})+3 \mathrm{H}_{2}(\mathrm{~g}) \rightarrow \mathrm{CH}_{4}(\mathrm{~g})+\mathrm{H}_{2} \mathrm{O}(\mathrm{g})$ | (II) $\mathrm{Cu} / \mathrm{ZnO}-\mathrm{Cr}_{2} \mathrm{O}_{3}$ |
| (C) $\mathrm{CO}(\mathrm{g})+\mathrm{H}_{2}(\mathrm{~g}) \rightarrow \mathrm{HCHO}(\mathrm{g})$ | (III) $\mathrm{Fe}_{x} \mathrm{O}_{y}+\mathrm{K}_{2} \mathrm{O}+\mathrm{Al}_{2} \mathrm{O}_{3}$ |
| (D) $\mathrm{CO}(\mathrm{g})+2 \mathrm{H}_{2}(\mathrm{~g}) \rightarrow \mathrm{CH}_{3} \mathrm{OH}(\mathrm{g})$ | (IV) Ni |

Choose the correct answer from the options given below:
A) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
B) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
C) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
D) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

ANS: (C)
6. The IUPAC nomenclature of an element with electronic configuration [Rn] $5 f^{14} 6 d^{1} 7 s^{2}$ is
(A) Unnilbium
(B) Unnilunium
(C) Unnilquadium
(D) Unniltrium

ANS: (D)
7. The compound(s) that is (are) removed as slag during the extraction of copper is
A) CaO
B) FeO
C) $\mathrm{Al}_{2} \mathrm{O}_{3}$
D) ZnO
E) NiO

Choose the correct answer from the options given below:
A) (C), (D) only
B) (A), (B), (E) only
C) (A), (B) only
D) (B) only

ANS: (D)
8. The reaction of $\mathrm{H}_{2} \mathrm{O}_{2}$ with potassium permanganate in acidic medium leads to the formation of mainly
A) $\mathrm{Mn}^{2+}$
B) $\mathrm{Mn}^{4+}$
C) $\mathrm{Mn}^{3+}$
D) $\mathrm{Mn}^{6+}$

ANS: (A)
9. Choose the correct order of density of the alkali metals.
A) $\mathrm{Li}<\mathrm{K}<\mathrm{Na}<\mathrm{Rb}<\mathrm{Cs}$
B) $\mathrm{Li}<\mathrm{Na}<\mathrm{K}<\mathrm{Rb}<\mathrm{Cs}$
C) $\mathrm{Cs}<\mathrm{Rb}<\mathrm{K}<\mathrm{Na}<\mathrm{Li}$
D) $\mathrm{Li}<\mathrm{Na}<\mathrm{K}<\mathrm{Cs}<\mathrm{Rb}$

ANS: (A)
10. The geometry around boron in the product ' $B$ ' formed from the following reaction is
$\mathrm{BF}_{3}+\mathrm{NaH} \xrightarrow{450 \mathrm{~K}} A+\mathrm{NaF}$
$A+\mathrm{NMe}_{3} \rightarrow B$
A) Trigonal planar
B) Tetrahedral
C) Pyramidal
D) Square planar

ANS: (B)
11. The interhalogen compound formed from the reaction of bromine with excess of fluorine is a:
(A) Hypo halite
(B) halate
(C) perhalate
(D) halite

ANS: (B)
12. The photochemical smog does not generally contain:
(A) NO
(B) $\mathrm{NO}_{2}$
(C) $\mathrm{SO}_{2}$
(D) HCHO

ANS: (C)
13. A compound ' $A$ ' on reaction with ' $X$ ' and ' $Y$ ' produces the same major product but different by product ' $a$ ' and 'b'. Oxidation of 'a' gives a substance produced by ants.

' $X$ ' and ' $Y$ ' respectively are
(A) $\mathrm{KMnO}_{4} / \mathrm{H}^{+}$and dil. $\mathrm{KMnO}_{4}, 273 \mathrm{~K}$
(B) $\mathrm{KMnO}_{4}$ (dilute), 273 K and $\mathrm{KMnO}_{4} / \mathrm{H}^{+}$
(C) $\mathrm{KMnO}_{4} / \mathrm{H}^{+}$and $\mathrm{O}_{3}, \mathrm{H}_{2} \mathrm{O} / \mathrm{Zn}$
(D) $\mathrm{O}_{3}, \mathrm{H}_{2} \mathrm{O} / \mathrm{Zn}$ and $\mathrm{KMnO}_{4} / \mathrm{H}^{+}$

ANS: D
14. Most stable product of the following reaction is:

(i) $\mathrm{H}_{3} \mathrm{C}$
(ii) $\mathrm{NaCN}, \mathrm{DMF}$
(A)

(B)

(C)

(D)


ANS: (B)
15. Which one of the following reactions does not represent correct combination of substrate and product under the given conditions?
(A)

(B)


(C)


(D)


ANS: (D)
16. An organic compound ' $A$ ' on reaction with $\mathrm{NH}_{3}$ followed by heating gives compound $B$. Which on further strong heating gives compound $\mathrm{C}\left(\mathrm{C}_{8} \mathrm{H}_{5} \mathrm{NO}_{2}\right)$. Compound C on sequential reaction with ethanolic KOH , alkyl chloride and hydrolysis with alkali gives a primary amine. The compound $A$ is:
(A)

(B)

(C)

(D)


ANS: (C)
17. Melamine polymer is formed by the condensation of:
(A)

$+\mathrm{HCHO}$
(B)

$\mathrm{NH}_{2}$
(C)

$\mathrm{NH}_{2}$
(D)


ANS: (A)
18. During the denaturation of proteins, which of these structures will remain intact?
A) Primary
B) Secondary
C) Tertiary
D) Quaternary

ANS: (A)
19. Drugs used to bind to receptors, inhibiting its natural function and blocking a message are called:
A) Agonists
B) Antagonists
C) Allosterists
D) Anti histaminists

ANS: (B)
20. Given below are two statements:

Statement I: On heating with $\mathrm{KHSO}_{4}$, glycerol is dehydrated and acrolein is formed.
Statement II: Acrolein has fruity odour and can be used to test glycerol's presence.
Choose the correct 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 incorrect.
D) Statement I is incorrect but Statement II is correct.

ANS: (C)
21. If a rocket runs on a fuel $\left(\mathrm{C}_{15} \mathrm{H}_{30}\right)$ and liquid oxygen, the weight of oxygen required and $\mathrm{CO}_{2}$ released for every litre of fuel respectively are:
(Given: density of the fuel is $0.756 \mathrm{~g} / \mathrm{mL}$ )
A) 1188 g and 1296 g
B) 2376 g and 2592 g
C) 2592 g and 2376 g
D) 3429 g and 3142 g

ANS: (C)
22. Consider the following pairs of electrons strong>
(A)
(a) $n=3, l=1, m_{1}=1, m_{s}=+\frac{1}{2}$
(b) $n=3, l=2, m_{1}=1, m_{s}=+\frac{1}{2}$
(B)
(a) $n=3, l=2, m_{1}=-2, m_{s}=-\frac{1}{2}$
(b) $n=3, l=2, m_{1}=-1, m_{s}=-\frac{1}{2}$
(C)
(a) $n=4, l=2, m_{1}=2, m_{s}=+\frac{1}{2}$
(b) $n=3, l=2, m_{1}=2, m_{s}=+\frac{1}{2}$

The pairs of electrons present in degenerate orbitals is /are:
(A) Only (A)
(B) Only (B)
(C) Only (C)
(D) (B) and (C)

ANS: (B)
23. Match List-I with List-II:

| List-I | List-II |  |  |
| :--- | :--- | :--- | :--- |
| (A) | $\left[\mathrm{PtCl}_{4}\right]^{2-}$ | (I) | $s p^{3} d$ |
| (B) | $\mathrm{BrF}_{5}$ | (II) | $d s p^{3}$ |
| (C) | $\mathrm{PCl}_{5}$ | (III) | $d s p^{2}$ |
| (D) | $\left[\mathrm{Co}\left(\mathrm{NH}_{3}\right)_{6}\right]^{3+}$ | (IV) | $s p^{3} d^{2}$ |

Choose the most appropriate answer from the options given below.
A) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
B) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)
C) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
D) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

ANS: (B)
24. For a reaction at equilibrium
$A(g) \rightleftharpoons B(g)+\frac{1}{2}(g)$
the relation between dissociation constant $(K)$, degree of dissociation $(\alpha)$ and equilibrium pressure $(p)$ is given by:
(A)

$$
K=\frac{\alpha^{\frac{1}{2}} p^{\frac{3}{2}}}{\left(1+\frac{3}{2} \alpha\right)^{\frac{1}{2}}(1-\alpha)}
$$

(B)

$$
K=\frac{\alpha^{\frac{3}{2}} p^{\frac{1}{2}}}{(2+\alpha)^{\frac{1}{2}}(1-\alpha)}
$$

(C)

$$
K=\frac{(\alpha p)^{\frac{3}{2}}}{\left(1+\frac{3}{2} \alpha\right)^{\frac{1}{2}}(1-\alpha)}
$$

(D)
$K=\frac{(\alpha p)^{\frac{3}{2}}}{(1+\alpha)(1-\alpha)^{\frac{1}{2}}}$

ANS: (B)
25. Given below are two statements:

Statement I: Emulsion of oil in water are unstable and sometimes they separate into two layers on standing.
Statement II: For stabilisation of an emulsion, excess of electrolyte is added.
In the light of the above statements, choose the most appropriate answer from the options given below:
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 incorrect.
D) Statement I is incorrect but Statement II is correct.

ANS: (C)

## MATHEMATICS

1. The total number of functions, $f .\{1,2,3,4\} \rightarrow\{1,2,3,4,5,6\}$ such that $f(1)+f(2)=f(3)$, is equal to
(A) 60
(B) 90
(C) 108
(D) 126

ANS: (B)
2. If $\alpha, \beta, y, \delta$ are the roots of the equation $x^{4}+x^{3}+x^{2}+x+1=0$, then $\alpha^{2021}+\beta^{2021}+y^{2021}+\delta^{2021}$ is equal to (A) -4
(B) -1
(C) 1
(D) 4

ANS: (B)
3. For $n \in N$ let
$S_{n}=\left\{z \in C:|z-3+2 i|=\frac{n}{4}\right\}$ and $T_{n}=\left\{z \in C:|z-2+3 i|=\frac{1}{n}\right\}$
Then the number of elements in the set
$\left\{n \in N: S_{n} \cap T_{n}=\phi\right\}$
is
(A) 0
(B) 2
(C) 3
(D) 4

ANS: (A)
4. The number of $\mathrm{q} \in(0,4 \pi)$ for which the system of linear equations
$3(\sin 3 \theta) x-y+z=2$
$3(\cos 2 \theta) x+4 y+3 z=3$
$6 x+7 y+7 z=9$
has no solution, is
A) 6
B) 7
C) 8
D) 9

ANS: (B)
5. If

$$
\lim _{n \rightarrow \infty}\left(\sqrt{n^{2}-n-1}+n \alpha+\beta\right)=0
$$

Then $8(\alpha+\beta)$ is equal to
A) 4
B) -8
C) -4
D) 8

ANS: (C)
6. If the absolute maximum value of the function
$f(x)=\left(x^{2}-2 x+7\right) e^{\left(4 x^{3}-12 x^{2}-180 x+31\right)}$
In the interval $[-3,0]$ is $f(\alpha)$, then
A) $\alpha=0$
B) $a=-3$
C) $\alpha \in(-1,0)$
D) $a \in(-3,-1]$

ANS: (B)
7. The curve $y(x)=a x^{3}+b x^{2}+c x+5$ touches the $x$-axis at the point $P(-2,0)$ and cuts the $y$-axis at the point $Q$, where $y^{\prime}$ is equal to 3 . Then the local maximum value of $y(x)$ is
(A) $\frac{27}{4}$
(B) $\frac{29}{4}$
(C) $\frac{37}{4}$
(D) $\frac{9}{2}$

ANS: (A)
8. The area of the region given by

$$
A=\left\{(x, y) ; x^{2} \leq y \leq \min \{x+2,4-3 x\}\right\}
$$

Is
(A) $\frac{31}{8}$
(B) $\frac{17}{6}$
(C) $\frac{19}{6}$
(D) $\frac{27}{8}$

ANS: (B)
9. For any real number $x$, let $[x]$ denote the largest integer less than equal to $x$. Let $f$ be a real valued function defined on the interval $[-10,10]$ by

$$
f(x)=\left\{\begin{array}{c}
x-[x], \text { if }[x] \text { is odd } \\
1+[x]-x, \text { if }[x] \text { is even }
\end{array}\right.
$$

Then the value of

$$
\frac{\pi^{2}}{10} \int_{-10}^{10} f(x) \cos \pi x d x
$$

A) 4
B) 2
C) 1
D) 0

## ANS: (A)

10. The slope of the tangent to a curve $C: y=y(x)$ at any point $(x, y)$ on it is
$\frac{2 e^{2 x}-6 e^{-x}+9}{2+9 e^{-2 x}}$
If $C$ passes through the points

$$
\left(0, \frac{1}{2}+\frac{\pi}{2 \sqrt{2}}\right) \text { and }\left(\alpha, \frac{1}{2} e^{2 \alpha}\right)
$$

then $e^{\alpha}$ is equal to
(A) $\frac{3+\sqrt{2}}{3-\sqrt{2}}$
(B) $\frac{3}{\sqrt{2}}\left(\frac{3+\sqrt{2}}{3-\sqrt{2}}\right)$
(C) $\frac{1}{\sqrt{2}}\left(\frac{\sqrt{2}+1}{\sqrt{2}-1}\right)$
(D) $\frac{\sqrt{2}+1}{\sqrt{2}-1}$

ANS: (B)
11. The general solution of the differential equation $\left(x-y^{2}\right) d x+y\left(5 x+y^{2}\right) d y=0$ is:
(A) $\left(y^{2}+x\right)^{4}=C\left|\left(y^{2}+2 x\right)^{3}\right|$
(B) $\left(y^{2}+2 x\right)^{4}=C\left|\left(y^{2}+x\right)^{3}\right|$
(C) $\left|\left(y^{2}+x\right)^{3}\right|=C\left(2 y^{2}+x\right)^{4}$
(D) $\left|\left(y^{2}+2 x\right)^{3}\right|=C\left(2 y^{2}+x\right)^{4}$

ANS: (A)
12. A line, with the slope greater than one, passes through the point $A(4,3)$ and intersects the line $x-y-2=0$ at the point $B$. If the length of the line segment $A B$ is
<br>(lbegin\{array\}\{|\} \frac \{\sqrt \{29\}\}\{3\}, \ \text \{then $B$ also lies on the line:\} \end\{array\} \) }
(A) $2 x+y=9$
(B) $3 x-2 y=7$
(C) $x+2 y=6$
(D) $2 x-3 y=3$

ANS: (C)
13. Let the locus of the centre $(\alpha, \beta), \beta>0$, of the circle which touches the circle $\boldsymbol{x}^{2}+(\boldsymbol{y}-1)^{2}=1$ externally and also touches the $\boldsymbol{x}$-axis be $L$. Then the area bounded by $L$ and the line $\boldsymbol{y}=4$ is:
(A) $\frac{32 \sqrt{2}}{3}$
(B) $\frac{40 \sqrt{2}}{3}$
(C) $\frac{64}{3}$
(D) $\frac{32}{3}$

ANS: (C)
14. Let $P$ be the plane containing the straight line
$\frac{x-3}{9}=\frac{y+4}{-1}=\frac{z-7}{-5}$
and perpendicular to the plane containing the straight lines
$\frac{x}{2}=\frac{y}{3}=\frac{z}{5}$
And

$$
\frac{x}{3}=\frac{y}{7}=\frac{z}{8} .
$$

If $d$ is the distance $P$ from the point $(2,-5,11)$, then $d^{R}$ is equal to:
(A) $\frac{147}{2}$
(B) 96
(C) $\frac{32}{3}$
(D) 54

## ANS: (C)

15. Let $A B C$ be a triangle such that

$$
\overrightarrow{B C}=\vec{a}, \overrightarrow{C A}=\vec{b}, \overrightarrow{A B}=\vec{c},|\vec{a}|=6 \sqrt{2},|\vec{b}|=2 \sqrt{3}
$$

And
$\vec{b} \cdot \vec{c}=12$.
Consider the statements:
$(S 1):|(\vec{a} \times \vec{b})+(\vec{c} \times \vec{b})|-|\vec{c}|=6(2 \sqrt{2}-1)$
$(S 2): \angle A C B=\cos ^{-1}\left(\sqrt{\frac{2}{3}}\right)$
Then
A) Both (S1) and (S2) are true
B) Only (S1) is true
C) Only (S2) is true
D) Both (S1) and (S2) are false

ANS: (C)
16. If the sum and the product of mean and variance of a binomial distribution are 24 and 128 respectively, then the probability of one or two successes is:
(A) $\frac{33}{2^{32}}$
(B) $\frac{33}{2^{29}}$
(C) $\frac{33}{2^{28}}$
(C) $\frac{33}{2^{27}}$

ANS: (C)
17. If the numbers appeared on the two throws of a fair six faced die are $\alpha$ and $\beta$, then the probability that $x^{2}+$ $\alpha x+\beta>0$, for all $x \in R$, is:
(A) $\frac{17}{36}$
(B) $\frac{4}{9}$
(C) $\frac{1}{2}$
(D) $\frac{19}{36}$

ANS: (A)
18. The number of solutions of $|\cos x|=\sin x$, such that $-4 \pi \leq x \leq 4 \pi$ is:
A) 4
B) 6
C) 8
D) 12

ANS: (C)
19. A tower $P Q$ stands on a horizontal ground with base $Q$ on the ground. The point $R$ divides the tower in two parts such that $Q R=15 \mathrm{~m}$. If from a point $A$ on the ground the angle of elevation of $R$ is $60^{\circ}$ and the part $P R$ of the tower subtends an angle of $15^{\circ}$ at $A$, then the height of the tower is:
(A) $5(2 \sqrt{3}+3) \mathrm{m}$
(B) $5(\sqrt{3}+3) \mathrm{m}$
(C) $10(\sqrt{3}+1) \mathrm{m}$
(D) $10(2 \sqrt{3}+1) \mathrm{m}$

ANS: (A)
20. Which of the following statements is a tautology?
(A) $((\sim p) \vee q) \Rightarrow p$
(B) $p \Rightarrow((\sim p) \vee q)$
(C) $((\sim p) \vee q) \Rightarrow q$
(D) $q \Rightarrow((\sim p) \vee q)$

ANS: (D)
21. For
$z \in \mathbb{C}$ if the minimum value of $(|z-3 \sqrt{2}|+|z-p \sqrt{2} i|)$
Is $5 \sqrt{ } 2$, then a value of $p$ is $\qquad$ .
(A) 3
(B) $\frac{7}{2}$
(C) 4
(D) $\frac{9}{2}$

ANS: (C)
22. The number of real values of $\lambda$, such that the system of linear equations
$2 x-3 y+5 z=9$
$x+3 y-z=-18$
$3 x-y+\left(\lambda^{2}-|\lambda|\right) z=16$
Has no solutions, is
A) 0
B) 1
C) 2
D) 4

ANS: (C)
23. The number of bijective functions $f .\{1,3,5,7, \ldots, 99\} \rightarrow\{2,4,6,8, \ldots ., 100\}$ such that

$$
f(3) \geq f(9) \geq f(15) \geq f(21) \geq \ldots \geq f(99)
$$

is $\qquad$ .
(A) ${ }^{50} P_{17}$
(B) ${ }^{50} P_{33}$
(C) $33!\times 17$ !
(D) $\frac{50!}{9}$

ANS: (B)
24. The remainder when $(11)^{1011}+(1011)^{11}$ is divided by 9 is
A) 1
B) 4
C) 6
D) 8

ANS: (D)
25. The sum
$\sum_{n=1}^{21} \frac{3}{(4 n-1)(4 n+3)}$
is equal to
(A) $\frac{7}{87}$
(B) $\frac{7}{29}$
(C) $\frac{14}{87}$
(D) $\frac{21}{29}$

ANS: (B)

## APTITUDE

1．When a number is subtracted from the number 8,12 and 20 ，the remainders are in continued proportion，Find the number？

A） 4
B） 3
C） 2
D） 8
ANS：（A）

2．The sum of the digits of a 2 －digit number is 11 ．If we add 45 to the number，the new number obtained is a number formed by interchange of the digits．What is the number？

A）$x=3$ and $y=8$
B）$x=5$ and $y=8$
C）$x=4$ and $y=8$
D）$x=8$ and $y=3$
ANS：（A）

3．Among three numbers，the first is twice the second and thrice the third，if the average of three numbers is 517 ， then what is the difference between the first and the third number？

A） 564
B） 364
C） 764
D） 864
ANS：（A）

4．If the numbers â＾〉9，â＾œ20，（25）（1／6）are arranged in ascending order，then the right arrangement is $\qquad$ ．

A）$(25)(1 / 6)<$ â＾œ20＜â＾） 9
B）â＾＞9＜â＾œ20＜（25）（1／6）
C）（25）$(1 / 6)<$ â＾〉 $9<$ â＾œ20
D）â＾œ20＜â＾〉9＜（25）（1／6）
ANS：（C）

5．Find the total number of factors of 15120 ？
A） 30
B） 50
C） 80
D） 70
ANS：（C）

6．Find the unit digit of the product of all the prime numbers between 1 and（17） 17 ？
A) 9
B) 8
C) 7
D) 0

ANS: (D)
7. If $\left(a^{*} b\right)=6 a-4 b+3 a b$, then $\left((6 * 3)+\left(4^{*} 3\right)\right)$ is equals to.
A) 121
B) 122
C) 124
D) 126

ANS: (D)
8. What is the greatest number that will divide 1204,3664 and 5904 leaving the same remainder?
A) 15
B) 14
C) 13
D) 20

ANS: (D)
9. If $p$ is prime number, then which of the following may also be a prime number?
A) $2 p$
B) $3 p$
C) $(p-3)$
D) $(p-2)$

ANS: (D)
10. Which of the following cannot be the number of zeroes at the end of any factorial?
A) 7
B) 6
C) 5
D) 3

ANS: (C)
11. A number when divided by the sum of 555 and 445 gives two times their difference as quotient and 30 as the remainder. The number is $\qquad$ .
A) 220030
B) 22030
C) 1220
D) 1250

ANS: (A)
12. The greatest among the numbers $3 \sqrt{ } 2,3 \sqrt{ } 7,6 \sqrt{ } 5,2 \sqrt{ } 20$ is:
A) $3 \sqrt{ } 2$
B) $3 \sqrt{ } 7$
C) $6 \sqrt{ } 5$
D) $2 \sqrt{ } 20$

ANS: (C)
13. A 4-digit number is formed by repeating a 2 -digit number such as 2525,3232 , etc., any number of this form is always exactly divisible by:
A) 7
B) 11
C) 13
D) Smallest 3-digit prime number

ANS: (D)
14. Fourth number is missing in the below series. Can you find the Fourth number in the below series?

117, 140, 163, X, 209, 232
A) 185
B) 184
C) 188
D) 186

ANS: (D)
15. Find a number below 20 which can divide 19 and 22 perfectly?
A) 4
B) 2
C) 3
D) 1

ANS: (D)
16. Find the LCM of 41,3 ?
A) 123
B) 42
C) 246
D) 164

ANS: (A)
17. Can you find the the missing number in the below series
$117,90,63, X, 9,-18$
A) 35
B) 34
C) 38
D) 36

ANS: (D)
18. A vendor sells 50 percent of apples he had and throws away 20 percent of the remainder. Next day he sells 60 percent of the remainder and throws away the rest. What percent of his apples does the vendor throw?
A) $26 \%$
B) $23 \%$
C) $25 \%$
D) $27 \%$

ANS: (A)
19. Anish had a certain amount with him. He spent $20 \%$ of that to buy a new cell phone and $15 \%$ of the remaining on buying a laptop. Then he donated Rs. 160 in a temple. If he is left with Rs. 1,200, how much did he buy the laptop for?
A) Rs. 220
B) Rs. 240
C) Rs. 320
D) Rs. 350

ANS: (B)
20. In a mixture, the ratio of the alchohol and water is $6: 5$. When 22 litre mixture are replaced by water, the ratio becomes $9: 13$. Find the quantity of water after replacement?
A) 54 litre
B) 56 litre
C) 58 litre
D) 52 litre

ANS: (D)
21. The cost of Type 1 rice is Rs. 30 per kg and Type 2 rice is Rs. 40 per kg. if both Type 1 and Type 2 are mixed in the ratio of $1: 4$, then what will be the price per kg of the mixed variety of rice?
A) 38 per kg
B) 34 per kg
C) 48 per kg
D) 58 per kg

ANS: (A)
22. Two equal vessels $A$ and $B$ contain $60 \%$ of sugar and $40 \%$ of sugar respectively and the remaining Rava. In which 40 kg of mixture is taken out from vessel $A$ and replaced into vessel $B$. Find the initial quantity of vessel if the final ratio of sugar and Rava in vessel $B$ is 16:19
A) 120 litre
B) 150 litre
C) 80 litre
D) 100 litre

ANS: (D)
23. A mixture contains 200 litres Milk and 40 litres water, $\qquad$ litres of mixture are removed and litres of pure water were added to it. If the final quantity of milk is 124 litres more than the final quantity of water. The values given in which of the following options will fill the blanks in the same order in which it is given to make the above statement true:

1) 30,20
2) 18,24
3) 24,20
4) 36,16
A) 1 and 2 only
B) 3 and 2 only
C) 2, 4 and 1 only
D) 2, 3 and 4

ANS: (B)
24. Rice worth Rs. 120 per kg and Rs. 130 per kg are mixed with a third variety in the ratio 1:1:2. If the mixture is worth Rs. 170 per kg, the price of the third variety per kg will be?
A) 120
B) 150
C) 180
D) 160

ANS: (D)
25. A vessel is filled with liquid, 4 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?
A) $9 / 10$
B) $1 / 10$
C) $56 / 9$
D) $4 / 10$

ANS: (B)

## AVIATION AFFAIRS

1. What is the name of the messaging platform to be used by the Indian Army shortly?
A) Secure Application for Internet
B) Safe Messaging Service
C) Secure Instant Messaging
D) Safe Communication Network

ANS: (A)
2. Which institution developed the Pinaka Extended Range (Pinaka-ER) Multiple Launch Rocket System (MLRS)?
A) DRDO
B) NSIL
C) BHEL
D) HAL

ANS: (A)
3. Which institution has developed the supersonic missile assisted torpedo system, recently launched by India?
A) ISRO
B) DRDO
C) NAL
D) NSIL

ANS: (B)
4. Who is India's first woman Rafale fighter jet pilot?
A) Mohana Singh
B) Avani Chaturvedi
C) Bhawana Kanth
D) Shivani Singh

ANS: (D)
5. Khanjar' is a Joint Special Forces Exercise held between India and which country?
A) Oman
B) Singapore
C) Kyrgyzstan
D) Nepal

ANS: (C)
6. What is the name of the High-speed Expendable Aerial Target (HEAT), which was recently tested by DRDO?
A) Akash
B) Abhyas
C) Apsara
D) Akshara

ANS: (B)
7. Which organisation manufactures 'Advanced light helicopter (ALH) MK III' helicopters?
A) BEL
B) NAL
C) HAL
D) DRDO

## ANS: (C)

8. SPRINT Project' which was launched by the Prime Minister, is associated with which field?
A) Taxation
B) Environment
C) Sanitation
D) Defence

## ANS: (D)

9. What is the name of the first indigenously developed light combat helicopters (LCH)?
A) Vikas
B) Prakash
C) Pratabh
D) Prachand

ANS: (D)
10. UDAN Stands for-
A) Udan Scheme
B) Udeshya Desh k Aam Aadmi Sath
C) Ude Desh k Aam Nagrik
D) Ude Desh Ka Aam Nagrik

ANS: (D)
11. When civil aviation did has started?
A) $1^{\text {ST }}$ April 1987
B) $1^{\text {st }}$ March 1987
C) $1^{\text {st }}$ April 1986
D) $1^{\text {st }}$ April 1887

ANS: (A)
12. Who was the first civil aviation minister of India?
A) Lal Bahadur Shastri
B) John Mathhai
C) Hari Vinayak Pataskar
D) N. Gopalaswami Ayyangar

ANS: (B)
13. The first commercial flight in India routed from?
A) Ajmer to Naini
B) Naini to Allahabad
C) Allahabad to Amravati
D) Allahabad to Naini

ANS: (D)
14. Who made first aircraft in India?
A) Wilbur
B) Sir George Calay
C) Shivkar Bāpuji Talpade
D) J.R.D Tata

ANS: (C)
15. Who regulates civil aviation in India?
A. ICAO
B. DCGA
C. DGCA
D. Gol

ANS: (C)
16. Which airport was India's first civil airport?
A) Juhu airport
B) Kemegowda airport
C) Rajiv Gandhi International Airport
D) Delhi airport

ANS: (A)
17. Who is the flying girl of India?
A) Bhawana kanth
B) Avani Chaturvedi
C) Mohana Singh
D) Gunjan Saxena

ANS: (B)
18. Which country made the first missile?
A) America
B) Japan
C) Germany
D) China

ANS: (C)
19. Which is the smallest missile of India?
A) Prithvi
B) Agni
C) Agni V
D) Nag

ANS: (D)
20. Brahmos are which kind of missiles?
A) surface-to-surface missiles
B) Surface-to-air missiles
C) Both A and B
D) None of the above

ANS: (A)
21. The India's first privately build rocket Vikram-S is developed by?
A) DRDO
B) Skyroot Aerospace
C) ISRO
D) Both A and C

ANS: (B)
22. Space Aura Aerospace Technologies Pt. Ltd. Company is based in?
A) Chennai
B) Mumbai
C) Hyderabad
D) Bangalore

ANS: (B)
23. Lighter than air aircraft are categorized as?
A) Maximum gross take-off weight is lesser than 5670 kg
B) Maximum gross take-off weight is or lesser than 5670 kg
C) MTOM is more than 5670 kg
D) Only option B is correct

ANS: (B)
24. Drones use which kind of power supply?
A) No power supply
B) Small power supply but AC motor
C) AC and DC both power supply
D) DC power supply

ANS: (D)
25. Two seater plane is called as?
A) Rotorcraft
B) Monoplane
C) Biplane
D) Both B and C

ANS: (C)

## COURSES

- 

B.Tech Aerospace engineeringB.Tech Aeronotical engineering
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-
Aircraft Maintance Engineering (AME) + B.sc (Aeronautics)

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