FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS
Set A

Time Allotted: 3 Hours **Maximum Marks: 360**

- Do not open this Test Booklet until you are asked to do so.
- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.

Important 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. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
3. The test is of **3 hours** duration.
4. The Test Booklet consists of **90** questions. The maximum marks are **360**.
5. There are ***three*** parts in the question paper A, B, C consisting of **Physics, Chemistry** and **Mathematics** having 30 questions in each part of equal weightage. Each question is allotted **4 (four)** marks for correct response.
6. *Candidates will be awarded marks as stated above in instruction No.5 for correct response of each question. ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.*
7. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 6 above.
8. Use ***Blue / Black Ball Point Pen only*** for writing particulars / marking responses on ***Side-1*** and ***Side-2*** of the Answer Sheet. ***Use of pencil is strictly prohibited.***
9. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. except the Admit Card inside the examination hall / room.
10. 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.***
11. **Do not fold or make any stray marks on the Answer Sheet.**

Name of the Candidate (in Capital Letters) :_____

Enrolment Number :_____

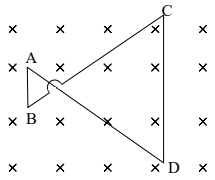
Batch :_____ **Date of Examination :** _____

PART – A (PHYSICS)

1. A resistance R and capacitance C are connected in series across a voltage $V = 100\sqrt{2}\sin(314t)$. The current is found to be $I = 5\sin\left(314t + \frac{\pi}{4}\right)$. The resistance R in the circuit is

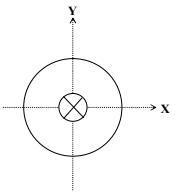
(A) 5Ω (B) 10Ω
(C) 15Ω (D) 20Ω

2. A conducting wire frame is placed in a magnetic field which is directed into the plane of the paper. The magnetic field is increasing at a constant rate. The directions of induced currents in wires AB and CD are



(A) B to A and D to C (B) A to B and C to D
(C) A to B and D to C (D) B to A and C to D

3. A circular loop is lying in X-Y plane with its centre at origin. A long straight wire passing through origin carries a current i in negative z-direction The induced current in the coil is :



(A) zero (B) Clockwise
(C) Anti-clockwise (D) Alternating

4. Two beams of light having intensities I and $4I$ interfere to produce a fringe pattern on a screen. The phase difference between the beams is $\pi/2$ at point A and π at point B. Then the difference between resultant intensities at A and B is :

(A) $2\ I$ (B) $4\ I$
(C) $5\ I$ (D) $7I$

5. The decay constant of a radioactive sample is λ. The half-life and mean-life of the sample are respectively given by:

(A) $1/\lambda$ and $(\ell n\ 2)/\lambda$ (B) $(\ell n\ 2)/\lambda$ and $1/\lambda$
(C) $\lambda(\ell n\ 2)$ and $1/\lambda$ (D) $\lambda/(\ell n\ 2)$ and $1/\lambda$

6. A plano-convex lens made of a material of refractive index 1.5 is silvered on the convex surface. The radius of curvature of the curved surface is, (silvered lens has focal length of 20 cm):

(A) 10 cm (B) 20 cm
(C) 30 cm (D) 60 cm

7. A ray of light incident on a solid, transparent sphere at an angle α is refracted at an angle β. The total deviation caused when the ray emerges from the other surface of the sphere is:

(A) $(\alpha - \beta)$ (B) $2(\alpha - \beta)$
(C) $\beta + \alpha$ (D) $2(\beta + \alpha)$

Space for rough work

8. A plate of thickness t made of a material of refractive index μ is placed in front of one of the slits in a double slit experiment. What should be the minimum thickness t which will make the intensity at the centre of the fringe pattern zero?

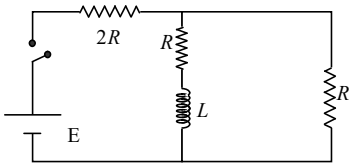
(A) $(\mu-1)\frac{\lambda}{2}$ (B) $(\mu-1)\lambda$

(C) $\frac{\lambda}{2(\mu-1)}$ (D) $\frac{\lambda}{(\mu-1)}$

9. Charging and discharging time constant of the circuit respectively

(A) $\frac{3L}{5R},\frac{2L}{R}$ (B) $\frac{L}{3R},\frac{L}{2R}$

(C) $\frac{L}{2R},\frac{L}{3R}$ (D) $\frac{3L}{5R},\frac{L}{2R}$



10. Two parallel rays are traveling in a medium of refractive index μ_1 = 4/3. One of the rays passes through a parallel glass slab of thickness t and refractive index μ_2 =3/2. The path difference between the two rays due to the glass slab (w.r.t. liquid)will be:

(A) 4t/3 (B) 3t/2

(C) t/8 (D) t/6

11. Two mirrors, one concave and the other convex, are placed 60 cm apart with their reflecting surfaces facing each other. An object is placed 30 cm from the pole of either of them on their axis. If the focal lengths of both the mirrors are 15cm, the position of the image formed by reflection, first at the convex and then at the concave mirror, is

(A) 19.09 cm from the pole of the convex mirror

(B) 19.09 cm from the pole of the concave mirror

(C) 11.09 cm from the pole of the concave mirror

(D) 11.09 cm from the pole of the convex mirror

12. The index of refraction of diamond is 2.0. Velocity of light in diamond in cm/sec. is approximately

(A) 6×10^{10} (B) 3×10^{10}

(C) 2×10^{10} (D) 1.5×10^{10}

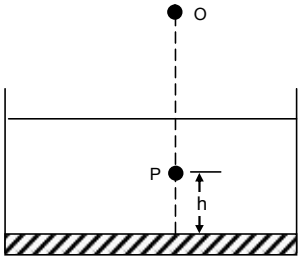
13. A converging lens is used to form an image on a screen. When the upper half of the lens is covered by an opaque screen

(A) half the image will disappear (B) complete image will disappear

(C) intensity of image will increase (D) intensity of image will decrease

Space for rough work

14. A plane mirror is placed at the bottom of a tank containing a liquid of refractive index μ. P is a small object at a height h above the mirror. An observer O – vertically above P, outside the liquid – sees P and its image in the mirror. The apparent distance between these two will be



(A) $2\mu h$ (B) $\frac{2h}{\mu}$

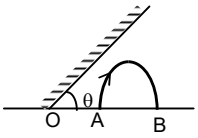
(C) $\frac{2h}{\mu-1}$ (D) $h\left(1+\frac{1}{\mu}\right)$

15. A concave mirror is placed on a horizontal table, with its axis directed vertically upwards. Let O be the pole of the mirror and C its centre of curvature. A point object is placed at C. It has a real image, also located at C. If the mirror is now filled with water, the image will be
(A) real and will remain at C
(B) real and located at a point between C and infinity
(C) virtual and located at a point between C and O.
(D) real and located at a point between C and O.

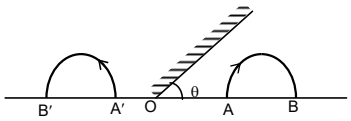
16. A concave mirror forms a real image three times larger than the object on a screen. Object and screen are moved until the image becomes twice the size of the object. If the shift of the object is 6 cm. The shift of screen
(A) 36 cm (B) 72 cm
(C) 18 cm (D) 9 cm

17 The critical angle for a prism and its surrounding interface is 36°. The maximum angle of prism for which any emergent ray is possible is
(A) 18° (B) 36°
(C) 72° (D) 144°

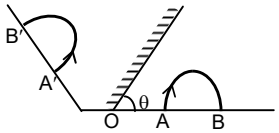
18. An object is projected from A and reaches B on the same horizontal surface. A plane mirror inclined at an angle θ to the horizontal is placed on the ground as shown in the figure. Which of the following best describes the path of the image?



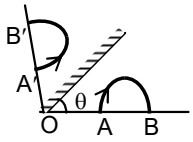
(A)



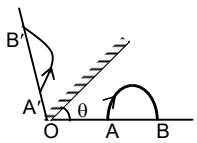
(B)



(C)



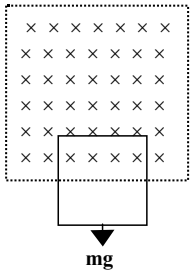
(D)



Space for rough work

19. The total number of images formed by two plane mirrors, inclined at an angle of 112.5°, and an object lying symmetrically is
(A) 3 (B) 4
(C) 2 (D) 3.2

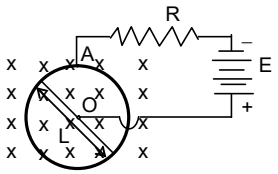
20. A horizontal magnetic field B is produced across a narrow gap between square iron pole-pieces as shown. A closed wire loop of side *l*, mass m and resistance R is allowed to fall with the top of the loop in the field. The terminal velocity attained by the loop is given by



(A) *gt* (B) $g\left(1-\frac{Btl}{m}\right)t$
(C) $\frac{mgR}{B^2l^2}$ (D) 0

21. A solenoid has 2000 turns wound over a length of 0.30m. Its central section is 1.2×10^{-3} m^2. Around its central section a coil of 300 turns is wound. If an initial current of 2A in the solenoid is reversed in 0.25 sec., the e.m.f. induced in the coil is equal to
(A) 6×10^{-4} volt (B) 4.8×10^{-2} volt
(C) 6×10^{-2} volt (D) 48 kV

22. A circular conducting loop of mass m is placed in a magnetic field B perpendicular to its plane and connected to a battery as shown in the fig. The circuit is completed by a massless conductor along the diameter, rigidly fixed to the loop. Point A slides over the loop. The loop is free to rotate about an axis passing through O and perpendicular to the plane of the loop. Then angular velocity of loop after long time will be (Assuming battery to be constant current source)



(A) $\frac{8E}{L^2B}$ (B) $\frac{2EBt}{mL}$
(C) $\frac{E}{L^2B}$ (D) None

23. From the following equations, pick out the possible nuclear fission reactions:
(A) ${}_8C^{13} + {}_1H^1 \longrightarrow {}_6C^{14} + 4.3$ MeV
(B) ${}_6C^{12} + {}_1H^1 \longrightarrow {}_7N^{14} + 2$ MeV
(C) ${}_7N^{14} + {}_1H^1 \longrightarrow {}_8O^{15} + 7.3$ MeV
(D) ${}_{92}U^{235} + {}_0n^1 \longrightarrow {}_{34}Xe^{140} + {}_{38}Sr^{94} + {}_0n^1 + {}_0n^1 + r + 200$ MeV

24. The mass no. of a nucleus is
(A) always less than its atomic number.
(B) always more than its atomic number.
(C) sometimes equal to its atomic number.
(D) sometimes more than and sometimes equal to its atomic number.

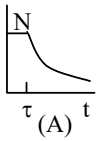
Space for rough work

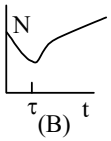
25. During a negative beta decay:
(A) an atomic electron is ejected.
(B) an electron which is already present within the nucleus is ejected.
(C) a neutron in the nucleus decays emitting electron.
(D) a part of binding energy of the nucleus is converted into an electron.

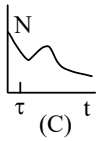
26. During a nuclear fusion reactions:
(A) a heavy nucleus breaks into two fragments by itself.
(B) a light nucleus bombarded by thermal neutrons breaks up.
(C) a heavy nucleus bombarded by thermal neutrons breaks up.
(D) two light nuclei combine to give a heavier nucleus and possibly other products.

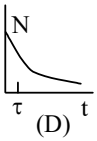
27. When the radioactive isotope $^{226}_{88}Ra$ decays in a series by emission of three α-particles and a β-particle, the isotope X which remain is
(A) $^{218}_{84}X$ (B) $^{214}_{83}X$
(C) $^{220}_{83}X$ (D) $^{223}_{87}X$

28. A radioactive sample consists of two distinct species having equal number of atoms initially. The mean life time of one species is τ and that of the other is 5τ. The decay products in both cases are stable. A plot is made of the total number of radioactive nuclei as a function of time. Which of the following figures best represents the form of this plot?

(A)


(B)


(C)


(D)


29. When a beam of X - Ray tube is operated at 40 Kv, then which the following wavelength will be absent from the continuous spectrum
(A) 0.35 A^0 (B) 1.5 A°
(C) 0.2 A^0 (D) 1.00 A^0

30. In terms of Bohr's radius a_0 the radius of the second orbit of hydrogen atom is
(A) 4 a_0 (B) 8 a_0
(C) $\sqrt{2}\ a_0$ (D) 2 a_0

Space for rough work

PART – B (CHEMISTRY)

1. The Henry's law constant for solubility of N_2 gas in water at 298 K is 1.0×10^5 atm. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at 298 K and 5 atm pressure is
(A) 4×10^{-4} (B) 4×10^{-5}
(C) 5×10^{-4} (D) 4×10^{-6}

2. A 5.25% solution of a substance is isotonic with 1.5% solution of urea (molar mass = 60 g/mol) in the same solvent. If density of both the solutions are assumed to be equal to 1 g cm^{-3}. The molar mass to substance will be
(A) 115 g/mol^{-1} (B) 105 g/mol
(C) 210 g/mol (D) 90 g/mol

3. 20g of binary electrolyte (mol. wt = 100) are dissolved in 500 g of water. The freezing point of solution is $-0.74°C$ $Kf = 1.86\,K$ $molality^{-1}$. The degree of ionisation of electrolyte is
(A) 50% (B) 75%
(C) 100% (D) 0

4. Given below are half cell reactions
$Mn^{2+} + 2e^- \rightarrow Mn \quad E° = -1.18\ V$
$2\left(Mn^{3+} + e^- \rightarrow Mn^{2+}\right) \quad E^\circ = +1.51\,V$
The $E°$ for $3Mn^{2+} \rightarrow Mn + 2Mn^{3+}$ will be
(A) $-2.69\ V$, the reaction will occur (B) $-0.33\,V$ the reaction will not occur
(C) $-0.33\,V$, the reaction will occur (D) $-2.69\,V$, the reaction will not occur

5. The difference of oxidation number of two types of S-atom in $Na_2S_4O_6$ is
(A) 4 (B) 5
(C) 6 (D) Zero

6. The total charge required to convert three mole of Mn_3O_4 to MnO_4^{2-} in alkaline medium
(A) 10 F (B) 20 F
(C) 30 F (D) 40 F

7. CsCl Crystallises in body centered cubic lattice. If 'a' is edge length. Then which of the following expression is correct?
(A) $r_{Cs^+} + r_{Cl^-} = \frac{30}{2}$ (B) $r_{Cs^+} + r_{Cl^-} = \frac{\sqrt{3}}{2}a$
(C) $r_{Cs^+} + r_{Cl^-} = \sqrt{3}a$ (D) $r_{Cs^+} + r_{Cl^-} = 3a$

Space for rough work

8. Atom C forms fcc A are present at alternate faces replacing C and B all present at alternate edges. The formula of the compound is

(A) ABC_3 (B) A_4BC

(C) AB_4C (D) A_4B_4C

9. The correct statement regarding defects in solids are

(A) Frankel defect is usually favoured by a very small difference in the sizes of cation and anion

(B) Frenkel defect is not a dislocation defect

(C) Trapping of an electron in the lattice leads to the formation of F-center

(D) Schottky defects have no effect on physical properties of solids.

10. Hydrolysis of one mole of peroxodisulphuric acid produces

(A) Two moles of sulphuric acid

(B) Two moles of peroxymono sulphuric acid

(C) One mole of sulphuric acid one mole of peroxymonosulphric acid and one mole of H_2O_2

(D) One mole of sulphuric acid and one mole of peroxymonosulphuric acid.

11. Calcium burns in nitrogen to produce a white powder which dissolves in sufficient water to produce gas A and an alkaline solution. The solution on exposure to air produces a thin solid layer of (B) on surface, A & B are respectively.

(A) NH_3, $CaCO_3$ (B) N_2, $CaCO_3$

(C) NH_3, $Ca(HCO_3)_2$ (D) NH_3, $(Ca(OH)_2$

12. The incorrect order is

(A) HF < HCl < HBr < HI : acidic strength

(B) HF > HCl > HBr > HI : Thermal stability

(C) HF > HCl > HBr > HI : Boiling point

(D) HF > HCl > HBr > HI : Bond dissociation enthalpy

13. $MF + XeF_4 \rightarrow A$ (M^+ = alkali metal cation)

The state of hybridisation of central atom in 'A' and shape of the species are

(A) sp^3d, TBP (B) sp^3d^3, distorted octahedral

(C) sp^3d^3 pentagonal planar (D) No compound formed at all

14. Atomicity of white or yellow phosphorus is 4 and it is represented as P_4 molecule. Calculate the value of expression $\frac{x.y}{z}$ regarding this molecule

X : Total number of vertex angles in P_4 molecule

Y : Total number of lone pairs in P_4 molecule

Z: Total number of P-P bonds in P_4 molecule

(A) 6 (B) 8

(C) 4 (D) 2

15. The correct order of acidity is:

(A) $CO_2 > H_2O_2 > H_2O$ (B) $H_2O < H_2O_2 < CO_2$

(C) $H_2O < H_2O_2 > CO_2$ (D) $H_2O_2 > CO_2 > H_2O$

Space for rough work

16. The order of reducing power of MH_3 is
(A) $NH_3 < PH_3 < SbH_3 < BiH_3$ (B) $PH_3 < AsH_3 < BiH_3 < SbH_3$
(C) $BiH_3 < SbH_3 < PH_3 < NH_3$ (D) $PH_3 < AsH_3 < BiH_3 < SbH_3$

17. When ammonia is added to cupric salts solution, the deep blue colour is observed it is due to formation of
(A) $[Cu(OH)_4]^{2-}$ (B) $[Cu(NH_3)_4]^{2+}$
(C) $[Cu(H_2O)_2(NH_3)_2]^{2+}$ (D) $[Cu(H_2O)_4]^{2+}$

18. Knowing that the chemistry of lanthanoids (Ln) is dominated by its +3 oxidation state. Which of the following statements is incorrect?
(A) Because of the large size of Ln(III) ions the bonding in its compounds is predominantly ionic in character
(B) The ionic sizes of Ln(III) decrease in general with increasing atomic number
(C) Ln (III) compounds are generally colourless
(D) Ln(III) hydroxides are mainly basic in nature.

19. The IUPAC name of the co-ordination compound $K_3\left[Fe(CN)_6\right]$ is
(A) Potassium hexacyanoferrate (II) (B) Potassium hexacyanoferrate (III)
(C) Potassium hexacyanoiron (II) (D) Tripotassium hexacyanoiron (II)

20. Which series of reactions correctly represents chemical reactions related to iron and its compounds
(A) $Fe \xrightarrow[dil\ H_2SO_4]{} FeSO_4 \xrightarrow[H_2SO_4.O_2]{} Fe_2(SO_4)_3 \xrightarrow[\Delta]{} Fe$
(B) $Fe \xrightarrow[O_2.\Delta]{} FeO \xrightarrow[dil.H_2SO_4]{} FeSO_4 \xrightarrow[\Delta]{} Fe$
(C) $Fe \xrightarrow[Cl_2.\Delta]{} FeCl_3 \xrightarrow[heat.air]{} FeCl_2 \xrightarrow[Zn]{} Fe$
(D) $Fe \xrightarrow[O_2.\Delta]{} Fe_3O_4 \xrightarrow[CO,600°C]{} FeO \xrightarrow[CO,700°C]{} Fe$

21. Upon treatment with ammonical H_2S, the metal ion that precipitates as sulphide is
(A) Fe(III) (B) Al(III)
(C) Mg(II) (D) Zn(II)

22. $[x] + H_2SO_4 \longrightarrow [Y]$ a colourless gas with irritating smell
$[y] + K_2Cr_2O_7 + H_2SO_4 \longrightarrow$ green solution, $[x]$ and $[y]$ is
(A) SO_3^{2-}, SO_2 (B) Cl^-, HCl
(C) S^{2-}, H_2S (D) CO_3^{2-}, CO_2

Space for rough work

23. A solution of a metal ion, when treated with KI gives a red precipitate which dissolves in an excess of KI to give a colourless solution. Moreover, the solution of the metal ion on treatment with a solution of cobalt (II) thiocyanate gives rise to a deep blue crystalline precipitate. The metal ion is
(A) Pb^{2+} (B) Hg^{2+}
(C) Cu^{2+} (D) CO^{2+}

24. Most common oxidation states of Ce are
(A) + 2, +3 (B) +2, + 4
(C) +3, + 4 (D) +3. + 5

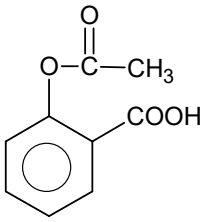
25. Which of the following will leave behind a metal on strong heating?
(A) $Mn(NO_3)_2$ (B) $AgNO_3$
(C) $Fe(NO_3)_3$ (D) $Cu(NO_3)_2$

26. The equation which is balanced and represents the correct product is
(A) $Li_2O + 2KCl \longrightarrow 2LiCl + K_2O$
(B) $[CoCl(NH_3)_5]^+ + 5H^+ \longrightarrow Co^{2+} + 5NH_4^+ + Cl^-$
(C) $[Mg(H_2O)_6]^{2+} + (EDTA)^{4-} \xrightarrow[Excess\ NaOH]{} [Mg(EDTA)]^{2+} + 6H_2O$
(D) $CuSO_4 + 4KCN \longrightarrow K_2[Cu(CN)_4] + K_2SO_4$

27. Which of the following facts about the complex is wrong $[Cr(NH_3)_6]Cl_3$
(A) The complex involves d^2sp^3 hybridisation and octahedral in shape
(B) The complex is paramagnetic
(C) The complex is outer orbital complex
(D) The complex gives white precipitate with $AgNO_3$ solution

28. In alumino thermic process aluminium is used as
(A) Oxidising agent (B) reducing agent
(C) dehydrating agent (D) complex forming agent

29. The slag obtained during smelting process in extraction of copper pyrite is mainly composed of
(A) Cu_2S (B) $FeSiO_3$
(C) $CuSiO_3$ (D) SiO_2

30. The compound  is used as
(A) antiseptic (B) Antibiotic
(C) Analgesic (D) pesticide

Space for rough work

PART – C (MATHEMATICS)

1. If $P=\begin{bmatrix}1 & \alpha & 3\\ 1 & 3 & 3\\ 2 & 4 & 4\end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A|=4$, then α is equal to

(A) 11 (B) 5
(C) 0 (D) 4

2. If $\frac{dy}{dx}=y+3$ and $y(0)=2$, then $y(\ln 2)$ is equal to

(A) 7 (B) 5
(C) 13 (D) – 2

3. The area of the region enclosed by the curve $y=x,\ x=e,\ y=\frac{1}{x}$ and positive x-axis is

(A) $\frac{1}{2}$ sq. units (B) 1 sq. units
(C) $\frac{3}{2}$ sq. units (D) $\frac{5}{2}$ sq. units

4. The area bounded between the parabolas $x^2=\frac{y}{4}$ and $x^2=9y$ and the straight line $y=2$ is

(A) $\frac{20\sqrt{2}}{3}$ (B) $10\sqrt{2}$
(C) $20\sqrt{2}$ (D) $\frac{10\sqrt{2}}{3}$

5. Let $A=\begin{pmatrix}1 & 0 & 0\\ 2 & 1 & 0\\ 3 & 2 & 1\end{pmatrix}$. If u_1 and u_2 are the column matrices such that $Au_1=\begin{pmatrix}1\\0\\0\end{pmatrix}$ and $Au_2=\begin{pmatrix}0\\1\\0\end{pmatrix}$, then u_1+u_2 is equal to:

(A) $\begin{pmatrix}-1\\-1\\0\end{pmatrix}$ (B) $\begin{pmatrix}1\\-1\\-1\end{pmatrix}$
(C) $\begin{pmatrix}-1\\1\\0\end{pmatrix}$ (D) $\begin{pmatrix}-1\\1\\-1\end{pmatrix}$

Space for rough work

6. Let P and Q be 3 × 3 matrices with $P \neq Q$. If $P^3 = Q^3$ and $P^2Q = Q^2P$, then determinant of $\left(P^2 + Q^2\right)$ is equal to

(A) 0
(B) – 1
(C) – 2
(D) 1

7. The number of values of k for which the linear equations

$$4x + ky + 2z = 0$$
$$kx + 4y + z = 0$$
$$2x + 2y + z = 0$$

have a non-zero solution is

(A) zero
(B) 3
(C) 2
(D) 1

8. If $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = k\left(a+b+c\right)\left(a^2+b^2+c^2-bc-ca-ab\right)$, then the value of k is equal to

(A) 1
(B) 2
(C) – 1
(D) – 2

9. The area of figure bounded by $y = e^x$, $y = e^{-x}$ and the straight line $x = 1$ is

(A) $\left(e + \frac{1}{e}\right)$ sq. units
(B) $\left(e - \frac{1}{e}\right)$ sq. units
(C) $\left(e + \frac{1}{e} - 2\right)$ sq. units
(D) $\left(e + \frac{1}{e} + 2\right)$ sq. units

10. If $A = \begin{pmatrix} 3 & 2 \\ 0 & 1 \end{pmatrix}$, then $\left(A^{-1}\right)^3$ is equal to

(A) $\frac{1}{27}\begin{pmatrix} 1 & -26 \\ 0 & 27 \end{pmatrix}$
(B) $\frac{1}{27}\begin{pmatrix} -1 & 26 \\ 0 & 27 \end{pmatrix}$
(C) $\frac{1}{27}\begin{pmatrix} 1 & -26 \\ 0 & -27 \end{pmatrix}$
(D) $\frac{1}{27}\begin{pmatrix} -1 & -26 \\ 0 & -27 \end{pmatrix}$

Space for rough work

11. If $a^{-1}+b^{-1}+c^{-1}=0$ such that $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}=\lambda$, then the value of λ is

(A) 0 (B) abc

(C) $-abc$ (D) None of these

12. Let $\vec{a},\vec{b},\vec{c}$ be three non-zero vectors which are pairwise non-collinear. If $\vec{a}+3\vec{b}$ is collinear with $\vec{c}$ and $\vec{b}+2\vec{c}$ is collinear with $\vec{a}$, then $\vec{a}+3\vec{b}+6\vec{c}$ is equal to

(A) $\vec{a}+\vec{c}$ (B) $\vec{a}$

(C) $\vec{c}$ (D) 0

13. If a,b,c are positive numbers and $\Delta=\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix}>0$, then abc:

(A) <8 (B) >-8

(C) <4 (D) >-4

14. The area bounded by the curve $|x|+|y|\geq 1$ and $x^2+y^2\leq 1$ is

(A) 2 sq. units (B) π sq. units

(C) $(\pi-2)$ sq. units (D) $(\pi+2)$ sq. units

15. If $\vec{a},\vec{b},\vec{c}$ are non-coplanar unit vectors such that $\vec{a}\times(\vec{b}\times\vec{c})=\frac{\vec{b}+\vec{c}}{\sqrt{2}}$, then the angle between $\vec{a}$ and $\vec{b}$ is

(A) $\frac{\pi}{4}$ (B) $\frac{\pi}{2}$

(C) π (D) $\frac{3\pi}{4}$

16. $(x^2+y^2)dy=xy\,dx$. If $y(x_0)=e,\ y(1)=1$, then value of x_0 is

(A) $\sqrt{3}e$ (B) $\sqrt{\left(e^2-\frac{1}{2}\right)}$

(C) $\sqrt{\left(\frac{e^2-1}{2}\right)}$ (D) $\sqrt{\left(\frac{e^2+1}{2}\right)}$

Space for rough work

17. The order of the differential equation whose general solution is given by

$$y=(c_1+c_2)\cos(x+c_3)-c_4e^{x+c_5},$$

where c_1, c_2, c_3, c_4, c_5 are arbitrary constants, is

(A) 5 (B) 4
(C) 3 (D) 2

18. If $xdy=y(dx+ydy), y>0$ and $y(1)=0,$ then $y(-3)$ is equal to

(A) 1 (B) 3
(C) 5 (D) –1

19. An equation of a plane parallel to the plane $x-2y+2z-5=0$ and at a unit distance from the origin is

(A) $x-2y+2z-1=0$ (B) $x-2y+2z+5=0$
(C) $x-2y+2z-3=0$ (D) $x-2y+2z+1=0$

20. If the lines $\frac{x-1}{2}=\frac{y+1}{3}=\frac{z-1}{4}$ and $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, then k is equal to

(A) $\frac{9}{2}$ (B) 0
(C) -1 (D) $\frac{2}{9}$

21. If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a}+\vec{b}+\vec{c}=0,$ then $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$ is equal to

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

22. If the angle between the line $x=\frac{y-1}{2}=\frac{z-3}{\lambda}$ and the plane $x+2y+3z=4$ is $\cos^{-1}\left(\sqrt{\left(\frac{5}{14}\right)}\right),$

then λ equal to

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

23. A multiple choice examination has 5 questions. Each question has three alternative answer of which exactly one is correct. The probability that a student will get 4 or more correct answers just by guessing is :

(A) $\frac{13}{3^5}$ (B) $\frac{11}{3^5}$
(C) $\frac{10}{3^5}$ (D) $\frac{17}{3^5}$

Space for rough work

24. The area enclosed within the curve $|x|+|y|=1$ is

(A) 1 (B) $2\sqrt{2}$

(C) $\sqrt{2}$ (D) 2

25. Let A, B, C be pairwise independent events with $P(C)>0$ and $P(A\cap B\cap C)=0,$ then $P\left(\frac{A^c\cap B^c}{C}\right)=$

(A) $P(A^c)-P(B)$ (B) $P(A)-P(B^c)$

(C) $P(A^c)+P(B^c)$ (D) $P(A^c)-P(B^c)$

26. If $\left[\vec{a}\times\vec{b}\ \ \vec{b}\times\vec{c}\ \ \vec{c}\times\vec{a}\right]=\lambda\left[\vec{a}\ \vec{b}\ \vec{c}\right]^2$, then λ is equal to

(A) 0 (B) 1

(C) 2 (D) 3

27. Suppose $n\geq 3$ persons are sitting in a row. Two of them are selected at random. The probability that they are not together is

(A) $1-\frac{2}{n}$ (B) $\frac{2}{n-1}$

(C) $1-\frac{1}{n}$ (D) None of these

28. If $a\neq 6, b, c$ satisfy $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix}=0,$ then $abc=$

(A) $a+b+c$ (B) 0

(C) b^3 (D) $ab+bc$

29. Three numbers are chosen at random without replacement from $\{1, 2, 3,....,8\}$. The probability that their minimum is $3,$ given that their maximum is $6,$ is

(A) $\frac{1}{4}$ (B) $\frac{2}{5}$

(C) $\frac{3}{8}$ (D) $\frac{1}{5}$

30. If the vector $p\hat{i}+\hat{j}+\hat{k}, \hat{i}+q\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+r\hat{k}, (p\neq q\neq r\neq 1)$ are coplanar, then the value of $pqr-(p+q+r)$ is

(A) -2 (B) 2

(C) 0 (D) -1

Space for rough work

FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS

PHASE – 5

Answer Key

PHYSICS

1.	**D**	2.	**A**	3.	A	4.	B
5.	B	6.	D	7.	B	8.	C
9.	D	10.	C	11.	B	12.	D
13.	D	14.	B	15.	D	16.	A
17.	C	18.	C	19.	B	20.	C
21.	B	22.	A	23.	D	24.	C
25.	D	26.	D	27.	B	28.	D
29.	C	30.	A				

CHEMISTRY

1.	A	2.	C	3.	D	4.	D
5.	B	6.	C	7.	B	8.	A
9.	C	10.	D	11.	A	12.	C
13.	C	14.	B	15.	B	16.	A
17.	B	18.	C	19	B	20.	D
21.	D	22.	A	23.	B	24.	A
25.	B	26.	B	27.	C	28.	B
29.	B	30.	C				

MATHEMATICS

1.	A	2.	A	3.	C	4.	A
5.	B	6.	A	7.	C	8.	C
9.	C	10.	A	11.	B	12.	D
13.	B	14.	C	15.	D	16.	A
17.	C	18.	B	19.	C	20.	A
21.	C	22	D	23.	B	24.	D
25.	A	26.	B	27.	A	28.	C
29.	D	30.	A				