FIITJEE – JEE (Main)

BATCHES –NWCM822O1S_PT5

Physics, Chemistry & Mathematics

QP Code:

Time Allotted: 3 Hours **Maximum Marks: 300**

- Please read the instructions carefully. You are allotted 5 minutes specifically for this purpose.
- You are not allowed to leave the Examination Hall before the end of the test.

Important Instructions

Caution: Question Paper CODE as given above MUST be correctly marked in the answer OMR sheet before attempting the paper. Wrong CODE or no CODE will give wrong results.

A. General Instructions

1. Attempt ALL the questions. Answers have to be marked on the OMR sheets.
2. This question paper contains **Three Sections.**
3. **Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
4. Each **Section** is further divided into **Two Parts**: **Part-A & B** in the OMR.
5. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
6. No candidate is allowed to carry any textual material, printed or written, bits of papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices ext. except the Admit Card inside the examination hall / room.

B. Filling of OMR Sheet:

1. Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
2. On the OMR sheet, darken the appropriate bubble with ***Blue/Black Ball Point Pen*** for each character of your Enrolment No. and write in ink your Name, Test Centre and other details at the designated places.
3. OMR sheet contains alphabets, numerals & special characters for marking answers.
4. **Do not fold or make any stray marks on the Answer Sheet.**

C. Marking Scheme for All Two Parts:

(i) **Part-A (01-20) –** Contains Twenty (20) multiple choice objective questions which have four (4) options each and only one correct option. Each question carries **+4 marks** which will be awarded for every correct answer and **-1 mark** will be deducted for every incorrect answer.

(ii) **Part-B (01-05)** contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

Name of the Candidate :_____

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

Enrolment Number :_____

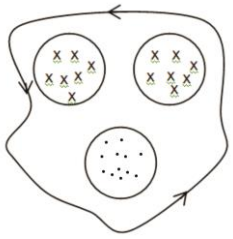
SECTION – I : PHYSICS

(PART – A)

Single Correct Questions

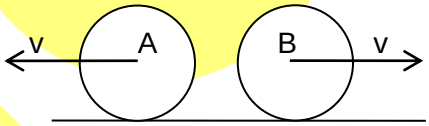
This section contains 20 Single Correct Questions out of which only one option is correct

1. Figure shows three regions of magnetic field each of area A and in each region magnitude of magnetic field decreases at a constant rate α. If $\vec{E}$ is induced electric field then value of line integral $\oint \vec{E}.d\vec{r}$ along the given loop is equal to



(A) αA (B) $-\alpha A$ (C) $3\alpha A$ (D) $-3\alpha A$

2. Two identical conducting rings A and B of radius R are in pure rolling over a horizontal conducting plane with same speed v but in opposite direction. A constant magnetic field B is present pointing inside the plane of paper. Then the potential difference between the highest points of the two rings is

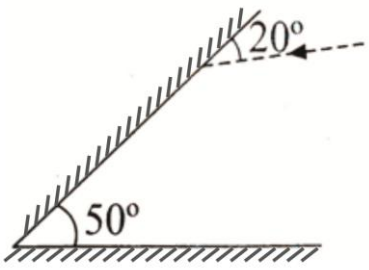


(A) zero (B) $2BvR$
(C) BvR (D) $4BvR$

3. The percentage errors in the measurement of mass and speed are 2% and 3 % respectively. Then how much will be the maximum error in the estimate of the kinetic energy ?

(a) 11% (b) 8 %
(c) 5 % (d) 1%

4. The deviation suffered by ray after three successive reflections in situation is :



(a) 200^0 clockwise (b) 200^0 anticlockwise
(c) 220^0 anticlockwise (d) 220^0 clockwise

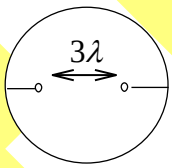
5. Unit vector along a ray of light that is incident on a plane mirror is $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ and unit vector along the normal to the mirror at the point incidence is $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$.unit vector along the reflected ray can be expressed as :

(a) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$ (b) $\frac{1}{\sqrt{3}}\left(-\hat{i}-\hat{j}-\hat{k}\right)$

(c) $\frac{1}{\sqrt{3}}\left(-\hat{i}-\hat{j}+\hat{k}\right)$ (d) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}-\hat{k}\right)$

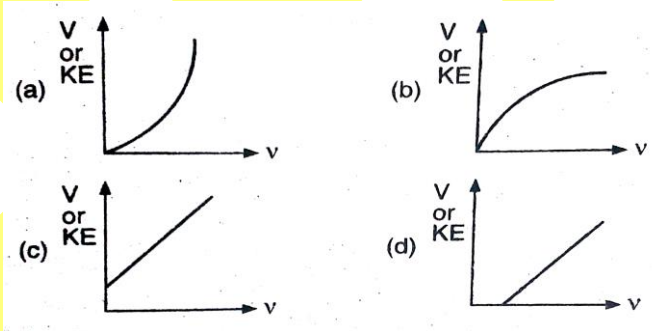
6. An object is moved at constant speed from infinity to the focus of a concave mirror , then
(a) image will move at constant speed from focus to infinity
(b) image will move slower in the beginning and faster later on, away from the mirror
(c) image will move faster in the beginning and slower later on , away from the mirror
(d) image will move away from the mirror in the beginning and towards the mirror later on but with a constant speed

7. If two coherent sources are placed at a distance 3λ from each other symmetric to the centre of the circle shown in the figure, then number of bright fringes shown on the screen placed along the circumference is :



(a) 16 (b) 12
(c) 8 (d) 4

8. For a photoelectric cell , the graph showing the variation of cut-off voltage or maximum KE of ejected photoelectrons with frequency of incident light is :



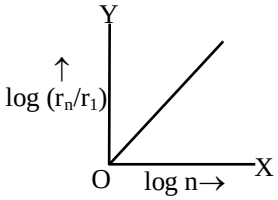
9. Monochromatic light of frequency f_1 is incident on a photocell and the stopping potential is found to be V_1. What is the new stopping potential of the cell if it is radiated by monochromatic light of frequency f_2 ?

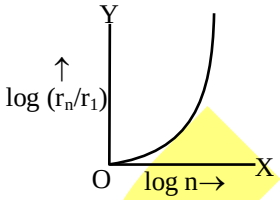
(a) $V_1-\frac{h}{e}(f_2-f_1)$ (b) $V_1+\frac{h}{e}(f_1+f_2)$

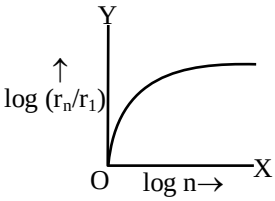
(c) $V_1-\frac{h}{e}(f_1+f_2)$ (d) $V_1+\frac{h}{e}(f_2-f_1)$

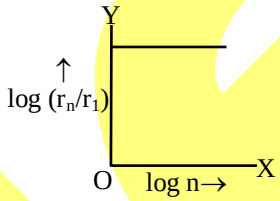
10. A spherical surface of curvature R separates air (μ=1.5). The centre of curvature is in the glass. A point object P placed in air is found to have a real image Q in the glass. The line PQ cuts the surface at a point O and PO = OQ. The distance PO is equal to
(A) 2R (B) 5R (C) 3R (D) 1.5R

11. In hydrogen atom, the radius of n^{th} Bohr orbit is r_n. The graph between log (r_n/r_1) and log n will be -

(A)


(B)


(C)


(D)


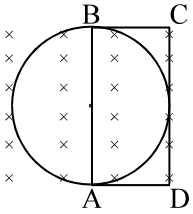
12. In a young's double slit experiment, slits are illuminated by a monochromatic source of wavelength $6000\,\overset{0}{A}$ and fringes are obtained. If screen is moved by a distance of 5 cm towards slits, change in fringe width is 3 x 10^{-5} m. Then separation between the slits will be
(A) 1 mm (B) 1.2 mm (C) 1.5 mm (D) 1.63 mm

13. The activity of a sample of radioactive material is R_1 at time t_1 and R_2 at time t_2 ($t_2 > t_1$). If mean life of the radioactive sample is T, then:
(A) $R_1t_1 = R_2t_2$ (B) $\frac{R_1 - R_2}{t_2 - t_1} = constant$ (C) $R_2 = R_1 \exp\left(\frac{t_1 - t_2}{T}\right)$ (D) $R_2 = R_1 \exp\left(\frac{t_1 + t_2}{T}\right)$

14. If w, x, y and z are mass, length, time and current respectively, then $\frac{x^2w}{y^3z}$ has dimensional formula same as
(A) electric potential (B) capacitance (C) electric field (D) permittivity

15. An inductance L, a capacitance C and a resistance R may be connected to an AC source of angular frequency ω, in three different combinations of RC, RL and RLC in series. Assume that $\omega L = \frac{1}{\omega C}$.
The power drawn by the three combinations are P_1, P_2, P_3 respectively. Then,
(A) $P_1 > P_2 > P_3$ (B) $P_1 = P_2 < P_3$ (C) $P_1 = P_2 > P_3$ (D) $P_1 = P_2 = P_3$

16. There exists a uniform but time varying magnetic field B = a + bt normal to plane of paper in a cylindrical region as shown. A rectangular conducting loop is placed as shown. Induced emf in branches AB and BC are



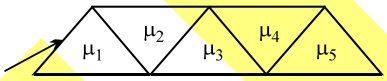
(A) $\pi R^2 b/2$, 0
(B) $2R^2 b$, 0
(C) 0, $\pi R^2 b/8$
(D) 0, $\pi R^2 b/4$

17. Which device is used to detect nuclear radiation?
(A) cyclotron
(B) Geiger counter
(C) linear accelerator
(D) Van de Graaff generator

18. As the voltage across a forward biased p-n junction is raised from zero level, the diode resistance.
(A) increases linearly
(B) increases first slowly then exponentially
(C) decreases linearly
(D) decreases first slowly then exponentially

19. Two point sources P and Q are 24 cm apart. Where should a convex lens of focal length 9 cm be placed in between them so that the images of both sources are formed at the same place?
(A) 3 cm from P
(B) 15 cm from Q
(C) 9 cm from Q
(D) 18 cm from P

20. The diagram shows five isosceles right angled prisms. A light ray incident at 90° at the first face emerges at same angle with the normal from the last face. Which of the following relations will hold regarding the refractive indices?



(A) $\mu_1^2+\mu_3^2+\mu_5^2=\mu_2^2+\mu_4^2$
(B) $\mu_1^2+\mu_3^2+\mu_5^2=1+\mu_2^2+\mu_4^2$
(C) $\mu_1^2+\mu_3^2+\mu_5^2=2+\mu_2^2+\mu_4^2$
(D) none

(PART – B)

(Integer Type)

Part-C (01-05) contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. A compound microscope having objective lens of focal length 2 cm and eyepiece of focal length 2.5 cm, is adjusted for clear vision, for which the angular magnification is found to be 110. The tube length must be about (in cm)

2. When two deutrons ($_1H^2$) fuse to from a helium nucleus $_2He^4$, 23.6 MeV energy is released. Find the binding energy of helium if it is 1.1 MeV for each nucleon of deuterium.(in MeV)

3. A glass plate of refractive index 1.2 is coated with a thin transparent layer of material with refractive index 1.5. Light of wavelength 600 nm is incident normally and constructive interference is obtained for reflected light. Minimum possible value of thickness of coating in 10^{-7} m is _____

4. When an excited hydrogen type atom makes transition from its exited state we get photon of maximum energy 52.22 ev and minimum energy 1.22 ev. Find its state of excitation i.e. n in $E = \frac{-13.6z^2}{n^2}$.

5. The activity of a radioactive sample is 1.6 curie, and its half-life is 2.5 days. Its activity after 10 days will be x/10 curie, then x is _____

SECTION – II : CHEMISTRY

(PART – A)

Single Correct Questions

This section contains 20 Single Correct Questions out of which only one option is correct

1. In the manufacture of iron from haematite, limestone is added to act as :
(A) flux (B) slag (C) a reducing agent (D) an oxidising agent

1	A

2. White phosphorus become paramagnetic in:
(A) solid state (B) vapour state (C) solution state (D) its hydride

2	B

3. Which of the following is the strongest oxidizing agent?
(A) O_2^{2-} (B) O^{2-} (C) O_2^{+} (D) O_2^{-}

3	C

4. Which of the following electronic transition provides colour to halogens?
(A) $\pi_u \longrightarrow \sigma_u$ (B) $\pi_g \longrightarrow \sigma_g$
(C) $\sigma_g \longrightarrow \sigma_u$ (D) $\pi_g \longrightarrow \sigma_u$

4	D

5. $Cl_2 + ClF_3 \longrightarrow$ Products
The product of above reaction is
(A) ClF (B) ClF_4 (C) ClF_5 (D) ClF_7

5	A

6. Anhydrous ferric chloride is prepared by :
(A) heating hydrated ferric chloride at a high temperature in stream of air
(B) heating metallic iron in a stream of dry chlorine gas.
(C) reaction of ferric oxide with HCl
(D) reaction of metallic iron with HCl.

6	B

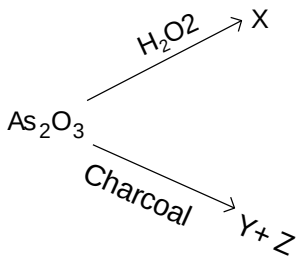
7. Which pair of compound is expected to show similar colour in aqueous solution ?
(A) $FeCl_2$, $CuCl_2$ (B) $VOCl_2$, $CuCl_2$
(C) $VOCl_2$, $FeCl_2$ (D) $FeCl_2$, $MnCl_2$

7 B

8. Which of the following substances on combination produces the strongest acid?
(A) HF + BF_3 (B) HF + SbF_5
(C) HF + SCl_4 (D) HF + KHF_2

8	B

9.



If Z is an oxide of carbon then X and Y are respectively

(A) As_2O_5 and As (B) As_2O_5 and As_2C_3

(C) H_3AsO_3 and As (D) H_3AsO_3 and AsC_2

9	A

10. The geometry of $Ni(CO)_4$ and $Ni(PH_3)_2Cl_2$ are :

(A) both square planer

(B) tetrahedral and square planer respectively

(C) both tetrahedral

(D) square planer and tetrahedral respectively

10	B

11. What kind of isomerism is exhibited by octachedral $[Co(NH_3)_4Br_2]Cl$?

(A) geometrical and ionization (B) geometrical and optical

(C) optical and ionization (D) geometrical only

11	A

12. The reagents NH_4Cl and aqueous NH_3 will precipitate

(A) Ca^{2+} (B) Al^{3+} (C) Mg^{2+} (D) Zn^{2+}

12	B

13. $CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + HF$

In above reaction, the impurity associated with CaF_2 decreases the yield of HF. The impurity may be

(A) NaCl (B) Cu

(C) Na_3AsO_3 (D) SiO_2

13	D

14. What will be the hybridisation of Xe in XeF_2

(A) sp^2 (B) sp^3d (C) sp^3 (D) sp^3d^2

14	B

15. In NaCl crystal, the centres of two nearest like charged ions are present at a distance of

(A) $\frac{a}{2}$ (B) $\frac{\sqrt{2}\,a}{2}$

(C) $\frac{\sqrt{3}\,a}{2}$ (D) $\frac{2a}{\sqrt{2}}$

15	B

16. Sodium metal crystallizes in bcc arrangement with the interfacial separation between the atoms at the edge is 53.6 pm. The density of this crystal is
(A) 2.46 g/cc (B) 1.19 g/cc
(C) 2.07 g/cc (D) 1.01 g/cc

16	B

17. A negatively charged sol will require minimum amount of which electrolyte for its coagulation :
(A) $NaNO_3$ (B) $Mg(NO_3)_2$ (C) $Al(NO_3)_3$ (D) $Th(NO_3)_4$

17	D

18. PCl_5 is an oxidative and substitutive agent. The side products obtained in the above type reactions respectively are
(A) PCl_3 and $POCl_3$ (B) $POCl_3$ and PCl_3 (C) PCl_3 and P_4O_{10} (D) P_4O_{10} and PCl_3

18	A

19. Which of the following 0.1M aqueous solution will have lowest freezing point?
[Assume complete dissociation of salts]
(A) K_2SO_4 (B) NaCl (C) NH_2CONH_2 (D) $C_6H_{12}O_6$

19	A

20. Which of the following pairs of compounds are heated together in the presence of concentrated sulphuric acid to prepare phenolphthalein?
(A) phthalic anhydride and resorcinol (B) phenol and formaldehyde
(C) phthalic anhydride and phenol (D) phenol and naphthalene

20	C

(PART – B)

(Integer Type)

Part-C (01-05) contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. The total number of lone pair of electron on Xe atom in XeF_4 is :

1	2

2. The packing efficiency of a simple cubic crystal with an interstitial atom exactly fitting at the body centre is

2	0.73 (range 0.72 to 0.74)

3. How many element(s) is/are present in Salvarsan?

3	5

4. 1 mole of Al is deposited by X coulomb of electricity passing through aluminium nitrate solution. The number of moles of silver deposited by X coulomb of electricity from silver nitrate solution is-

4	3

5. How many electron(s) is/are present in the t_2g orbital of Ni^{2+}, whether it forms complex with strong field or weak field ligands?

5	6

SECTION – I : MATHEMATICS

(PART – A)

Single Correct Questions

This section contains 20 Single Correct Questions out of which only one option is correct

1. The function $f(\theta) = \frac{d}{d\theta}\int_0^{\theta} \frac{dx}{1-\cos\theta\cos x}$ satisfies the differential equation

(A) $\frac{df}{d\theta} + 2f(\theta)\cot\theta = 0$ (B) $\frac{df}{d\theta} - 2f(\theta)\cot\theta = 0$

(C) $\frac{df}{d\theta} + 2f(\theta) = 0$ (D) $\frac{df}{d\theta} - 2f(\theta) = 0$

2. The equation of the curve, passing through (2,5) and having the area of triangle formed by the x-axis, the ordinate of a point on the curve and the tangent at the point 5 sq units, is

(A) $xy = 10$ (B) $x^2 = 10y$

(C) $y^2 = 10x$ (D) $xy^{1/2} = 10$

3. If $y = e^{4x} + 2e^{-x}$ satisfies the relation $\frac{d^3y}{dx^3} + A\frac{dy}{dx} + By = 0$, then value of A and B respectively are

(A) –13, 14 (B) –13, –12

(C) –13, 12 (D) 12, –13

4. Solution of equation $\frac{dy}{dx} = \frac{y\frac{d(\phi(x))}{dx} - y^2}{\phi(x)}$ is

(A) $y = \frac{\phi(x)+c}{x}$ (B) $y = \frac{\phi(x)}{x}+c$

(C) $y = \frac{\phi(x)}{x+c}$ (D) $y = \phi(x)+x+c$

5. Let $f(x) = \min\left\{(x+1), \sqrt{(1-x)}\right\}$, then area bounded by f(x) and x-axis is:

(A) $\frac{1}{6}$ (B) $\frac{5}{6}$

(C) $\frac{7}{6}$ (D) $\frac{11}{6}$

6. Three numbers are selected from the set {1, 2, 3, …, 23, 24} without replacement. The probability that the numbers form an A.P. is equal to

(A) $\frac{11}{23}$ (B) $\frac{12}{23}$

(C) $\frac{3}{46}$ (D) none of these

7. Vectors $\vec{a}$ and $\vec{b}$ make an angle $\theta = \frac{2\pi}{3}$. If $|\vec{a}| = 1$, $|\vec{b}| = 2$ then $\left|(a+3\vec{b})\times(3\vec{a}-\vec{b})\right|^2 =$

(A) 225 (B) 250

(C) 275 (D) 300

8. $|\vec{a}|=3,\ |\vec{b}|=4,\ |\vec{c}|=5$ such that each is $\perp$ to sum of other two, then $|\vec{a}+\vec{b}+\vec{c}|$ =

(A) $5\sqrt{2}$ (B) $\frac{5}{\sqrt{2}}$

(C) $10\sqrt{2}$ (D) $5\sqrt{3}$

9. If $A=\begin{bmatrix}2 & -3\\ -4 & 1\end{bmatrix}$, then adj. $(3A^2+12A)$ is equal to:

(A) $\begin{bmatrix}72 & -84\\ -63 & 51\end{bmatrix}$ (B) $\begin{bmatrix}51 & 84\\ 63 & 72\end{bmatrix}$

(C) $\begin{bmatrix}51 & 63\\ 84 & 72\end{bmatrix}$ (D) $\begin{bmatrix}72 & -63\\ -84 & 51\end{bmatrix}$

10. Consider a matrix $A=\begin{bmatrix}3 & 1\\ -6 & -2\end{bmatrix}$, then $(I+A)^{99}$ equals (where I is a unit matrix or order 2)

(A) $I+2^{98}A$ (B) $I+2^{99}A$

(C) $I+(2^{99}+1)A$ (D) $I+(2^{99}-1)A$

11. IF the plane $2x-3y+6z-11=0$ makes an angle $\sin^{-1}(k)$ with x-axis, then k is equal to

(A) $\sqrt{3}/2$ (B) 2/7

(C) $\sqrt{2}/3$ (D) 1

12. The shortest distance between the two straight lines $\frac{x-4/3}{2}=\frac{y+6/5}{3}=\frac{z-3/2}{4}$ and $\frac{5y+6}{8}=\frac{2z-3}{9}=\frac{3x-4}{5}$ is

(A) $\sqrt{29}$ (B) 3

(C) 0 (D) $6\sqrt{10}$

13. The equation of the plane passing through the line of interection of the planes $x+y+z=1$ and $2x+3y-z+4=0$ and parallel to x-axis is

(A) $y-3z-6=0$ (B) $y-3z+6=0$

(C) $y-z-1=0$ (D) $y-z+1=0$

14. If $A=\begin{bmatrix}1 & a\\ 0 & 1\end{bmatrix}$ then $\lim_{n\to\infty}\frac{1}{n}A^n$ is

(A) $\begin{bmatrix}0 & a\\ 0 & 0\end{bmatrix}$ (B) $\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

(C) $\begin{bmatrix}0 & 1\\ 0 & 0\end{bmatrix}$ (D) None of these

15. If $A=\begin{bmatrix}0 & 1 & -1\\ 2 & 1 & 3\\ 3 & 2 & 1\end{bmatrix}$, then $(A(\text{adj}\,A).A^{-1})A$ is equal to

(A) $2\begin{bmatrix}3 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 3\end{bmatrix}$ (B) $\begin{bmatrix}-6 & 0 & 0\\ 0 & -6 & 0\\ 0 & 0 & -6\end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1/6 & -1/6 \\ 2/6 & 1/6 & 3/6 \\ 3/6 & 2/6 & 1/6 \end{bmatrix}$ (D) None of these

16. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}$, $\vec{b}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}-\hat{k}$ be three vectors. A vector $\vec{v}$ in the plane of $\vec{a}$ and $\vec{b}$, whose projection on $\vec{c}$ is $\frac{1}{\sqrt{3}}$, is given by

(A) $\hat{i}-3\hat{j}+3\hat{k}$ (B) $-3\hat{i}-3\hat{j}-\hat{k}$

(C) $3\hat{i}-\hat{j}+3\hat{k}$ (D) $\hat{i}+3\hat{j}-3\hat{k}$

17. Equation of the plane containing the straight line $\frac{x}{2}=\frac{y}{3}=\frac{z}{4}$ and perpendicular to the plane containing the straight lines $\frac{x}{3}=\frac{y}{4}=\frac{z}{2}$ and $\frac{x}{4}=\frac{y}{2}=\frac{z}{3}$ is

(A) $x+2y-2z=0$ (B) $3x+2y-2z=0$

(C) $x-2y+z=0$ (D) $5x+2y-4z=0$

18. If $\vec{a}$ and $\vec{b}$ are vectors such that $\left|\vec{a}+\vec{b}\right|=\sqrt{29}$ and $\vec{a}\times\left(2\hat{i}+3\hat{j}+4\hat{k}\right)=\left(2\hat{i}+3\hat{j}+4\hat{k}\right)\times\vec{b}$, then a possible value of $\left(\vec{a}+\vec{b}\right).\left(-7\hat{i}+2\hat{j}+3\hat{k}\right)$ is

(A) 0 (B) 3

(C) 4 (D) 8

19. The equation $ax+by+c=0$ represents a plane perpendicular to the

(A) XY plane (B) YZ plane

(C) ZX plane (D) None of these

20. For two events A and B if $P(A)=P\left(\frac{A}{B}\right)=\frac{1}{4}$ and $P\left(\frac{B}{A}\right)=\frac{1}{2}$, then

(A) A and B are independent (B) $P\left(\frac{A'}{B}\right)=\frac{3}{4}$

(C) $P\left(\frac{B'}{A'}\right)=\frac{1}{2}$ (D) All of these

(PART – B)

(NUMERICAL BASED)

Part-C (01-05) contains five (05) Numerical based questions, the answer of which maybe positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30) and each question carries **+4 marks** for correct answer and **there will be no negative marking.**

1. For any 2×2 matrix, if $A.(\text{adj}\,A)=\begin{bmatrix}10 & 0\\ 0 & 10\end{bmatrix}$. Then $|A|$, is

2. Two distinct numbers are selected at random from the first twelve natural numbers. The probability that the sum will be divisible by 3 is

3. Given $2x-y-2z=2$, $x-2y+z=-4$, $x+y+\lambda z=4$ then the value of λ such that the given system of equation has NO solution, is

4. India plays two matches each with West Indies and Australia. In any match, the probability of India getting point 0, 1 and 2 are 0.45, 0.05 and 0.50 respectively. Assuming that the outcomes are independent, the probability of India getting atleast 7 points, is

5. The area of the region $\left[(x,y): x^2 \le y \le |x|\right]$ is

FIITJEE COMMON TEST

BATCHES: Two Year CRP (1921) AB-LOT

PHASE TEST–5

JEE-MAIN LEVEL

ANSWER KEY

Paper Code
SET–A

ANSWER KEYS [SET – A]

	PHYSICS	C.CODE		CHEMISTRY	C.CODE		MATHEMATICS	C.CODE
1	B		1			1	A	
2	D		2			2	A	
3	B		3			3	B	
4	D		4			4	C	
5	C		5			5	C	
6	B		6			6	C	
7	B		7			7	D	
8	D		8			8	A	
9	D		9			9	C	
10	B		10			10	D	
11	A		11			11	B	
12	A		12			12	C	
13	C		13			13	B	
14	A		14			14	A	
15	B		15			15	A	
16	C		16			16	C	
17	B		17			17	C	
18	D		18			18	C	
19	D		19			19	A	
20	C		20			20	D	
	PART – B			PART – B			PART - B	
1	24.3		1			1	10	
2	28		2			2	0.33	
3	1		3			3	-3	
4	5		4			4	0.0875	
5	1		5			5	0.33	

HINT OR SOLUTIONS
PHYSICS

1. B

Sol. $\oint \vec{E}.d\vec{r} = -\left(\frac{dB}{dt}\right)A$ and take the sign of flux according to right hand curl rule.

2. D

Sol. Considering rotation of diameter about lowest point

$$\varepsilon = \frac{B\omega(2r)^2}{2} = 2Bvr \text{ in (A)}$$

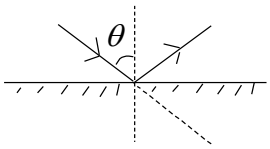
$$\varepsilon = -2Bvr \text{ in (B)}$$

3. (B)

$$\frac{\Delta K}{K}\times 100 = \left|\frac{\Delta M}{M} + 2\frac{\Delta V}{V}\right|\times 100\%$$

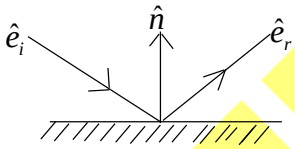
4. (D)

In reflection



deviation = (180 -2θ)

5. (C)



$$\hat{e}_r = \hat{e}_{\hat{i}} - 2(\hat{e}_{\hat{i}}.\hat{n})\hat{n}$$

$$(\hat{e}_{\hat{i}}.\hat{n}) = \frac{2}{\sqrt{3}.\sqrt{2}}$$

$$\hat{e}_r = \frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k}) - 2\left(\frac{2}{\sqrt{3}.\sqrt{2}}\right).\frac{1}{\sqrt{2}}(\hat{i}+\hat{j})$$

$$= \frac{1}{\sqrt{3}}(-\hat{i}-\hat{j}+\hat{k})$$

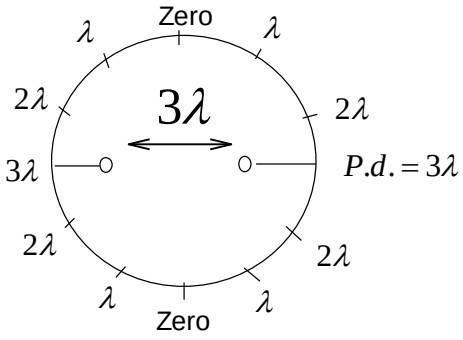
6 (B)

$\frac{1}{v}+\frac{1}{u}+\frac{1}{f}$ **for spherical mirror, differentiation with respect to time, we will get**

$$\frac{dv}{dt} = -\left(\frac{v^2}{u^2}\right)\frac{du}{dt}$$

Image speed **object speed**

7. (B)



Total no of maxima = 12

8. (D)

9. (D)

Maximum kinetic energy

$$\frac{1}{2}m\upsilon^2_{max} = eV_s$$

According ts Einstein's photoeletric equation

$$hf = eV_s + \phi$$

$$eV_s = hf - \phi$$

As per question

$$ev_1 = hf_1 = \phi$$

$$ev_2 = hf_2 - \phi$$

$$e(v_1 - v_2) = h(f_1 - f_2)$$

$$ev_2 = hf_2 - hf_1 + ev_1$$

$$v_2 = \frac{h}{e}(f_2 - f_1) + v_1$$

10. (B)

$$\text{As}\ \frac{\mu 2}{v} - \frac{\mu 1}{u} = \frac{\mu - 1}{R}$$

$$\text{or}\ \frac{1.5}{x} - \frac{1}{x} = \frac{1.5-1}{R} \Rightarrow x = \frac{2.5R}{0.5} = 5R$$

11. A

12. (A)

$$\beta = \frac{\lambda D}{d} \quad \text{and} \quad \beta' = \frac{\lambda D'}{d}$$

$$\therefore \beta - \beta' = \frac{\lambda(D - D')}{d}$$

$$\text{or}\ d = \frac{\lambda(D - D')}{(\beta - \beta')}$$

$$= \frac{6000x10^{-10}x5x10^{-2}}{3x10^{-5}}m = 10^{-3}m = 1mm$$

13. (C)

If R_0 be the initial activity of the sample, then $R_1 = R_0e^{-\lambda t_1}$ and $R_2 = R_0e^{-\lambda t_2}$

Where $l = \frac{1}{T}$ $\left(\because \text{Mean life} = T = \frac{1}{\lambda}\right)$

$\Rightarrow \quad \frac{R_2}{R_1} = \frac{e^{-\lambda t_2}}{e^{-\lambda t_1}} = e^{\lambda(t_1 - t_2)}$

$\Rightarrow \quad R_2 = R_1 \exp\left(\frac{t_1 - t_2}{T}\right)$

14. (A)

$$\left[\frac{x^2 w}{y^3 z}\right] = \frac{ML^2}{T^3 A}$$

$\Rightarrow \quad \left[\frac{x^3 w}{y^3 z}\right] = \frac{ML^2T^{-2}}{AT} = \frac{[\text{Work}]}{[\text{Charge}]}$

$\Rightarrow \quad \left[\frac{y^3 w}{y^3 z}\right] = \frac{[\text{Work}]}{[\text{Charge}]} = [\text{Potential}]$

Part – B

1. 24.3 cm
2. 28
3. 1

$2\mu t = \frac{\lambda}{2}$

$t = \frac{\lambda}{4\mu} = \frac{600 \times 10^{-9}}{4 \times 1.5} = 100 \times 10^{-9}$

4. 5

$\frac{E_1}{n^2} - E_1 = 52.22n \text{ eV}$

And $\frac{E_1}{n^2} - \frac{E_1}{(n-1)^2} = 1.22n \text{ eV}$

Solving we get n = 5

5. 1

$n\left(\frac{10}{2.5}\right) = 4$

$\frac{A}{A_0} = \left(\frac{1}{2}\right)^n \Rightarrow A = 1.6\left(\frac{1}{2}\right)^4$

A = 0.1 Curie.

CHEMISTRY

MATHEMATICS

14. **A**

Sol. Given, $A=\begin{bmatrix}1 & a\\ 0 & 1\end{bmatrix}$

Now, $A^n=\begin{bmatrix}1 & na\\ 0 & 1\end{bmatrix}$

$$\frac{1}{n}A^n=\frac{1}{n}\begin{bmatrix}1 & na\\ 0 & 1\end{bmatrix}=\begin{bmatrix}\frac{1}{n} & a\\ 0 & \frac{1}{n}\end{bmatrix}$$

Hence, $\lim\limits_{n\to\infty}\frac{1}{n}A^n=\begin{bmatrix}\lim\limits_{n\to\infty}\frac{1}{n} & a\\ 0 & \lim\limits_{n\to\infty}\frac{1}{n}\end{bmatrix}=\begin{bmatrix}0 & a\\ 0 & 0\end{bmatrix}$

15. **A**

Sol. We have, $A=\begin{bmatrix}0 & 1 & -1\\ 2 & 1 & 3\\ 3 & 2 & 1\end{bmatrix}$

$$\Rightarrow \quad |A|=0(1-6)+1(9-2)-1(4-3)$$
$$=0+7-1=6$$

Now, $\left(A.(\text{adj}\,A).A^{-1}\right)A=\left(|A|.I.A^{-1}\right)A$

$$=|A|I$$
$$=6\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$$

19. **A**

Sol. The equation of XY – plane is z = 0 i.e.

$0.x+0.y+z=0$

Clearly, the given plane is perpendicular to this plane.

20. **D**

Sol. $\because \quad P(A)=P\left(\frac{A}{B}\right)=\frac{P(A\cap B)}{P(B)}$

$\Rightarrow \quad P(A\cap B)=P(A).P(B)$

$\Rightarrow$ A and B are independent events.

$\Rightarrow$ A' and B' are independent events

$\Rightarrow$ A' and B are independent events

$\Rightarrow \quad P\left(\frac{A'}{B}\right)=P(A')=1-P(A)$

$=1-\frac{1}{4}=\frac{3}{4}$ and $P\left(\frac{B'}{A'}\right)=P(B')=1-P(B)=1-P\left(\frac{B}{A}\right)$

$=1-\frac{1}{2}=\frac{1}{2}$

(Numerical Based)

1. Sol. Given, $A.(\text{adj}\,A)=\begin{bmatrix}10 & 0\\ 0 & 10\end{bmatrix}$

$\Rightarrow \quad |A(\text{adj}\,A)| = 100$

$\Rightarrow \quad ||A|I| = 100$

$\Rightarrow \quad \begin{vmatrix} |A| & 0 \\ 0 & |A| \end{vmatrix} = 100$

$\Rightarrow \quad |A|^2 = 100$

$\therefore \quad |A| = 10$

2. 0.33

3. -3

4. 0.0875

Sol. Clearly, matches played by India are four and maximum point in any match are 2.

$\therefore$ Maximum point in four matches can be 8 only

Required probability = Probability of India getting 7 points

+ Probability of India getting 8 points

Note that, 7 points can be get in 4 matches, if India get 1 point in one of the 4 matches and 2 points in each of rest 3 matches and 8 points can be get only if India get 2 point in each of the 4 matches.

From equation (i), we have

Required probability $= {}^4C_1(0.05)(0.5)^3 + {}^4C_4(0.5)^4$

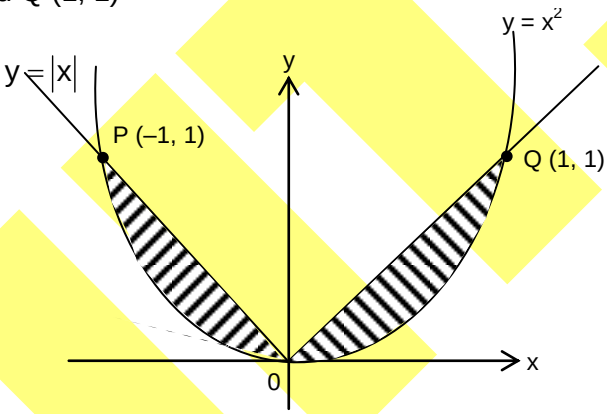
$= 4(0.05)(0.5)^3 + (0.5)^4$

$= 0.0250 + 0.0625$

$= 0.0875$

5. 0.33

Sol. The required points of intersection in the interval $\left[(x,y): x^2 \le y \le |x|\right]$ are O (0, 0), P (–1, 1) and Q (1, 1)



$\therefore$ Area $= 2\int_0^1 (x - x^2)\,dx = 2\left[\frac{x^2}{2} - \frac{x^3}{3}\right]_0^1$

$= 2\left(\frac{1}{2} - \frac{1}{3}\right) = \frac{1}{3}$ sq. units