FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS
BATCHES: NWCMPB223A1-A2 & NWCMPD223A1
PHASE TEST – I
Q.P. CODE: 100104

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

- 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

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 to **Two decimal places** (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 :_____

Physics

PART – A

Straight Objective Type

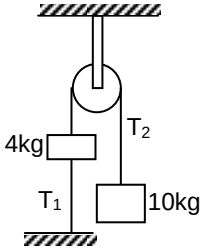
This part contains **20 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. Two forces, each of magnitude. F have a resultant of the same magnitude F. The angle between the two forces is
(A) 45^0 (B) 120^0 (C) 150^0 (D) 60^0

2. A projectile is projected from horizontal plane with velocity u at an angle θ with horizontal. Find out radius of curvature of particle motion when its velocity makes angle $\frac{\theta}{2}$ with horizontal, (u = 15 m/s, $\theta = 60^0$)
(A) $5\sqrt{3}$ m (B) $\frac{5}{\sqrt{3}}$m (C) $\frac{45}{8}$ m (D) none of these

3. If $\vec{R}_1 = \vec{A} + \vec{B}$ and $\vec{R}_2 = \vec{A} - \vec{B}$, then $\frac{\vec{R}_1 + \vec{R}_2}{\left|\vec{R}_1 + \vec{R}_2\right|}$ will be along
(A) $\vec{A}$ (B) $\vec{B}$ (C) $\vec{A} + \vec{B}$ (D) $\vec{A} - \vec{B}$

4. Two bodies of masses 4 kg and 10 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is also attached to another string whose other end is attached to the horizontal surface. The tension in this string T_1 is equal to
(A) 40 N (B) 44.3 N
(C) 100 N (D) 60 N

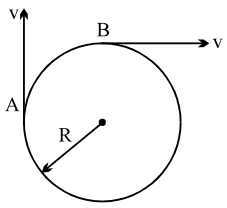


5. A particle of mass m slides down from the vertex of hemisphere with initial tangential velocity 7 m/s. AT what height from horizontal will the particle leave the sphere. (Radius of sphere R = 10 m and g = 10 m/s^2)
(A) $h = \frac{20}{3}$ (B) $h = \frac{30}{4}$ (C) $h = \frac{83}{10}$ (D) $h = \frac{57}{10}$

6. Consider a uniform square plate of side 'a' and mass 'm'. The moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is
(A) $\sqrt{\frac{5}{6}}\,ma^2$ (B) $\sqrt{\frac{1}{12}}\,ma^2$ (C) $\sqrt{\frac{7}{12}}\,ma^2$ (D) $\sqrt{\frac{2}{3}}\,ma^2$

Space For Rough Work

7. Two points of a rigid body are moving as shown. The angular velocity of the body is:



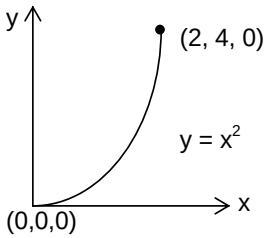
(A) $\frac{\upsilon}{2R}$ (B) $\frac{\upsilon}{R}$

(C) $\frac{2\upsilon}{R}$ (D) $\frac{2\upsilon}{3R}$

8. A ball is allowed to fall from a height of 10 m. If there is 40% loss of energy due to impact, then after one impact ball will go upto

(A) 10 m (B) 8 m (C) 4 m (D) 6 m

9. By applying a force $\vec{F} = (3xy - 5z)\hat{j} + 4z\hat{k}$ a particle is moved along the path $y = x^2$ from point (0, 0, 0) to (2, 4, 0). The work done by the force F on the particle is



(A) $\frac{280}{5}$ unit (B) $\frac{140}{5}$ unit

(C) $\frac{232}{5}$ unit (D) $\frac{192}{5}$ unit

10. When work done by force of gravity is negative

(A) PE increases (B) KE remain constant

(C) PE remains constant (D) PE decreases

11. In projectile motion power of the gravitational force

(A) is constant throughout (B) is –ve through out

(C) varies with time (D) is positive for complete path

12. A spring of force constant k is cut into two pieces such that one piece is double the length of the other. Then the long piece will have a force constant of

(A) $\frac{2}{3}k$ (B) $\frac{3}{2}k$ (C) 3k (D) 6k

13. Three particles of masses 2kg each are placed such that one lies on negative x axis, 2nd one lies on negative y axis an the third one lies on positive z axis at distances of 2m, 3m and 1m respectively from the origin. Then the square of the distance of centre of mass of the system from the origin is

(A) 1.55 m^2 (B) $\sqrt{1.55}$ m^2 (C) 1.55 m^2 (D) 1.25 m^2

Space For Rough Work

14. A person walking at the rate of 3km/hour, the rain appears to fall vertically when he increase his to speed 6 km/hr it appears to meet him at angle of 45^0 with vertical. The speed of rain is

(A) $3\sqrt{2}$ km/hr (B) $\frac{3}{\sqrt{2}}$ km/hr

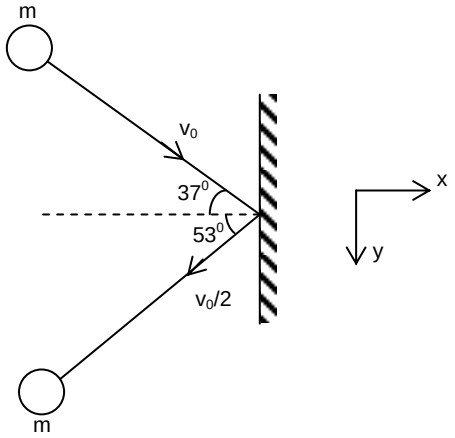
(C) $6\sqrt{2}$ km/hr (D) $2\sqrt{3}$ km/hr

15. When a spring is stretched by a distance x, it exerts a force, given by $F = -5x + 16x^3$ N. The work done, when the spring is stretched from 0.1M to 0.2M is

(A) 8.1×10^{-2}J (B) 12.2×10^{-2}J

(C) 8.1×10^{-1}J (D) 12.2×10^{-1}J

16. A ball of mass m moving with velocity v_0 collides with a wall as shown. After impact it rebounds with a velocity $v_0/2$. The component of impulse acting on the ball. Along the wall is



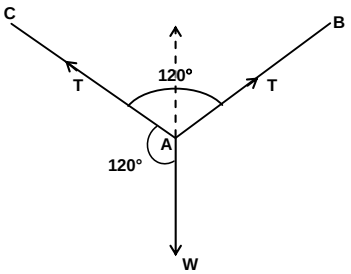
(A) $\frac{mv_0}{2}\hat{j}$

(B) $-\frac{mv_0}{2}\hat{j}$

(C) $-\frac{mv_0}{5}\hat{j}$

(D) none of these

17. A weight W is attached to two weightless strings AB and AC as shown in figure. The tension in each string will be



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

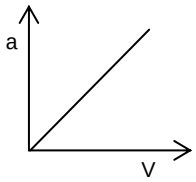
(C) $\frac{3W}{2}$ (D) W

18. Power applied to a particle varies with time as $P = 3t^2 - 2t + 1$ watt, where t is in second. Find the change in its kinetic energy between t = 2 sec and t = 4 sec

(A) 32 J (B) 46 J (C) 61 J (D) 100 J

Space For Rough Work

19. The acceleration-velocity graph of a particle moving in a straight line is as shown in figure. Then slope of velocity-displacement graph



(A) increases linearly (B) decreases linearly
(C) is constant (D) increases parabolically

20. A body of mass 1kg is thrown upwards with a velocity 20m/s. It momentarily comes to rest after attaining a height of 18m. How much energy is lost due to air friction. ($g = 10\ m/s^2$)
(A) 10 J (B) 20 J
(C) 30 J (D) 40 J

PART-B
Numerical Type

1. If $\vec{A}\cdot\vec{B} = \left|\vec{A}\times\vec{B}\right|$ and $\left|\vec{A}\right|$ & $\left|\vec{B}\right|$ are $2\sqrt{2}$ and 3 respectively, determine $\left|\vec{C}\right| = \left|\vec{A}\times\vec{B}\right|$.

2. Four point masses, each of value m, are placed at the corners of a square ABCD of side L. The moment of inertia through A and parallel to BD is $K(mL^2)$. Find K.

3. A car driver applies the brakes which retards the car at a rate of 8 m/s^2. If the initial velocity of the car is 10 m/s, the speed of the car after 5 s will be

4. A boat which has a speed of 5 km/h in still water crosses a rover of width 1 km along the shortest possible path in 15 min. The velocity of the river water in km/h is

5. A body is projected from the top of a tower with an initial velocity of 10 ms^{-1} horizontally (Assume g = 10 ms^{-2}). The distance of the body from the point of projection after two seconds is (in m):

Space For Rough Work

Chemistry

PART – A

Straight Objective Type

This part contains **20 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. $2H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$

If the rate of formation of water according to above reaction is 0.4 mol L^{-1} s^{-1}. What is the rate of the reaction in mol L^{-1} s^{-1} unit?

(A) 0.8 (B) 0.2
(C) 0.1 (D) 1.6

2. What is the hybridization of nitrogen in NF_3?

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

3. The half life of a first order reaction becomes 20 sec when the reaction starts with an initial concentration of 1M of the reactant. What will be the half – life if the reaction starts with 0.5 M concentration of the reactant?

(A) 10 sec (B) 20 sec
(C) 40 sec (D) 5 sec

4. What is the n-factor of N_2H_4 in the following reaction?

$N_2H_4 + 2O_2 \longrightarrow 2NO + 2H_2O$

(A) 10 (B) 6
(C) 8 (D) 4

5. The velocity with which maximum number of molecules of a sample of ideal gas, move, is represented by

(A) $\sqrt{\frac{2RT}{M}}$ (B) $\sqrt{\frac{3RT}{M}}$
(C) $\sqrt{\frac{4RT}{M}}$ (D) $\sqrt{\frac{8RT}{M}}$

6. Which of the following molecule experiences the lowest bond pair-bond pair repulsion?

(A) BF_3 (B) CH_4
(C) $BeCl_2$ (D) NCl_3

7. The relationship between ΔG^o and K_P is

(A) $\Delta G^o = -RT\ell nK_P$ (B) $\Delta G^o = -RT\ell n\sqrt{K_p}$
(C) $\Delta G^o = -2.303RT\ell nK_P$ (D) $\Delta G^o = -2.303RT\ell n\sqrt{K_p}$

Space For Rough Work

8. Which of the following gas will effuse at maximum rate under identical conditions?
(A) O_2 (B) N_2
(C) F_2 (D) Cl_2

9. How many sigma covalent bonds are present in CO_3^{2-} ion?
(A) 2 (B) 3
(C) 4 (D) 1

10. For which of the following reaction $K_P > K_C$ at 1000 K?
(A) $2CO(g) + O_2(g) \rightleftharpoons 2CO_2(g)$ (B) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$
(C) $C(s) + O_2(g) \rightleftharpoons CO_2(g)$ (D) $C(s) + 2S(s) \rightleftharpoons CS_2(\ell)$

11. If the average kinetic energy of N_2 gas is x J at a certain temperature, what will be the average kinetic energy of N gas in J at the same temperature ?
(A) 2x (B) $\frac{x}{2}$
(C) 4x (D) x

12. $HCN(aq) \rightleftharpoons CN^-(aq) + H^+(aq)$
The ionization constant K_a of HCN in the above reaction if 10^{-10}. What will be the value of p^{K_a} of the acid?
(A) 4 (B) 10
(C) –10 (D) –4

13. Which of the following has the highest value of dipole moment?
(A) BCl_3 (B) NCl_3
(C) CCl_4 (D) PCl_5

14. Which of the following reaction will proceed towards the forward direction by increasing pressure?
(A) $H_2(g) + Cl_2(g) \rightleftharpoons 2HCl(g)$ (B) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(C) $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$ (D) $N_2O_4(s) \rightleftharpoons 2NO_2(g)$

15. $(NH_4)_2SO_4(s) \rightleftharpoons 2NH_3(g) + H_2SO_4(\ell)$
What will be the equilibrium partial pressure of NH_3 in terms of the equilibrium constant K_P?
(A) $\sqrt{K_P}$ (B) $(K_P)^2$
(C) $K_P/2$ (D) $2K_P$

Space For Rough Work

16. The rate of what type of reaction, does not depend on concentration of reactant?
(A) Zero order reaction (B) First order reaction
(C) Second order reaction (D) Third order reaction

17. Which of the following quantum number has different values for the unpaired electrons of phosphorus?
(A) Principal quantum number (B) Azimuthal quantum number
(C) Magnetic quantum number (D) Spin quantum number

18. A six gram impure sample of calcium is dissolved in 200ml of 1.5N HCl. After complete reaction the excess acid required 100ml of 1N NaOH for complete neutralization. The mass of pure calcium present in the sample in gram unit is:
(A) 2 (B) 3
(C) 4 (D) 5

19. Which of the following electron transition in hydrogen atom forms visible spectral lines?
(A) $n = 5 \rightarrow n = 3$ (B) $n = 4 \rightarrow n = 1$
(C) $n = 3 \rightarrow n = 2$ (D) $n = 3 \rightarrow n = 1$

20. How many maximum number of electrons of an atom will have the following set of quantum numbers?
$n = 4, \ell = 0, 1, 2, m = \pm 1, s = +½$
(A) 18 (B) 6
(C) 8 (D) 4

PART-B
Numerical Type

1. What is the azimuthal quantum number of the subshell which contains three orbitals?

2. How many times will the r.m.s velocity of a gas change if the temperature is increased four times of its initial value?

3. The half-life period of a reaction becomes twice if the initial concentration of the reactant is doubled. What is the order of the reaction?

4. How many litre of 2 M HCl is needed for complete reaction of a solution containing two moles each of NaOH, KOH and NaCl?

5. $2X(g) \rightleftharpoons 2Y(g) + Z(g)$
The reaction starts with 20 moles of X. The equilibrium moles of X is equal to the sum of equilibrium moles of Y and Z. How many moles of Z is present at equilibrium?

Space For Rough Work

Mathematics

PART – A

Straight Objective Type

This part contains **20 multiple choice questions.** Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

1. The domain of the function f given by $f(x)=\sqrt{x-1}$ is

(A) $(-\infty, \infty)$ (B) $(1,\infty)$

(C) $[1,\infty)$ (D) $(0, \infty)$

2. Let $f(x)=-2x^2+1$ and $g(x)=4x-3$, then $(gof)(-1)$ is equal to

(A) 9 (B) –9

(C) 7 (D) –7

3. If $y=f(x^2+2)$ and $f'(3)=5$, then $\frac{dy}{dx}$ at $x=1$ is

(A) 5 (B) 25

(C) 15 (D) 10

4. If the function f: A $\rightarrow$ [1, ∞) defined by f(x) = 1 + x^2 be one – one onto, then A equals

(A) [0, ∞) (B) (0, ∞)

(C) (-∞, ∞) (D) None of these

5. Let $f(x)=\begin{cases} cx^2+2x, & \text{if } x<2 \\ 2x+4, & \text{if } x\geq 2 \end{cases}$

If the function f is continuous on $(-\infty,\infty)$, then the value of c is equal to

(A) 4 (B) 2

(C) 3 (D) 1

6. If $x^2+y^2=t+\frac{1}{t}$ and $x^4+y^4=t^2+\frac{1}{t^2}$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{y}{x}$ (B) $-\frac{y}{x}$

(C) $\frac{x}{y}$ (D) $-\frac{x}{y}$

Space For Rough Work

7. Let $f(x) = x^3 + x^2$ and $g(x)$ be the inverse of $f(x)$, then the value of $g'(2) =$

(A) $\frac{1}{3}$ (B) $\frac{1}{4}$

(C) $\frac{1}{5}$ (D) $\frac{1}{6}$

8. The range of x for which $f(x) = x^3 - 9x^2 + 15x + 2$ decreasing.

(A) [3,5] (B) [2,5]

(C) [1,5] (D)None of these

9. Number 20 is divided into two parts such that the product of one part and the cube of the other part is maximum. The two parts are

(A) (10, 10) (B) (12, 8)

(C) (15, 5) (D) none of these

10. If $\int \left(\sin x + \frac{4}{x} - 2e^x\right)dx = a\cos x + b\ln x + ce^x + D$ than $a + b + c$ is

(A) 0 (B) 1

(C) 2 (D) None

11. Value of $\int_0^2 \frac{dx}{1+5x}$ is

(A) $\frac{1}{5}\log 2$ (B) $\frac{1}{5}\log 3$

(C) $\frac{1}{11}\log 7$ (D) $\frac{1}{5}\log 11$

12. The function f given by $f(x) = x^3e^x$ is increasing on the interval

(A) $(0, \infty)$ (B) $(3, \infty)$

(C) $(-3, \infty)$ (D) $(-3, 3)$

13. $\int 3x^2\left(x^3+1\right)^{10}dx =$

(A) $\frac{\left(x^3+1\right)^{11}}{11} + C$ (B) $\frac{\left(x^3+1\right)^{9}}{9} + C$

(C) $\frac{\left(x^3+1\right)^{11}}{33} + C$ (D) $\frac{\left(x^3+1\right)^{11}}{11} + x^3 + C$

Space For Rough Work

14. $\int_0^{\frac{\pi}{2}} \frac{1}{1+\cot^4 x}\,dx =$

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

(C) π (D) $\frac{\pi}{8}$

15. Range of $f(x) = \sin x + \cos x$ is

(A) $[-2, 2]$ (B) $[-1, 1]$

(C) $\left[-\sqrt{2}, \sqrt{2}\right]$ (D) None of these

16. If $y = \left(1+x^{1/4}\right)\left(1+x^{1/2}\right)\left(1-x^{1/4}\right)$ then $\frac{dy}{dx} =$

(A) 1 (B) –1

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

17. Equation of normal to the curve y = (x)(2 –x) at the point (2, 0) is

(A) x –2y = 2 (B) 2x + y = 4

(C) x –2y + 2 = 0 (D) none of these

18. $\int_0^{\pi} e^{\sin^4 x} \cos^5 x\,dx$ =

(A) 0 (B) 1

(C) – π/2 (D) π/2

19. $\int x \tan^{-1} x\,dx =$

(A) $\frac{1}{2}\left(x^2+1\right)\tan^{-1} x - x + c$ (B) $\frac{1}{2}\left(x^2+1\right)\tan^{-1} x - \frac{1}{2}x + c$

(C) $\left(x^2+1\right)\tan^{-1} x - x + c$ (D) None of these

Space For Rough Work

20. $\int \frac{\cos 2x - 1}{\cos 2x + 1} dx =$

(A) $\tan x - x + c$ (B) $x + \tan x + c$

(C) $x - \tan x + c$ (D) $-x - \cot x + c$

PART-B
Numerical Type

1. The local minimum of $f(x) = (x+2)^2 (x-4)$. is

2. $\int_{-2}^{2} |x| dx$ is equal to

3. The absolute maximum of $y = x^3 - 3x + 2$ in [0 , 2]

4. Let f be a real valued invertible function such that $f\left(\frac{3x-5}{x+2}\right) = 100x + 15,\ x \neq 2$ and the value of $f^{-1}(2015) =$

5. $\lim_{x \to 0} \frac{\sin(x^2 + 5x)}{x}$ is equal to

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: NWCMPB223A1-A2 & NWCMPD223A1_JEEM

PHASE TEST – I

PHYSICS, CHEMISTRY & MATHEMATICS

ANSWER KEY

Paper Code 100104

SECTION – I

(PHYSICS)

PART – A

1.	**B**	2.	**A**	3.	**A**	4.	**D**
5.	**C**	6.	**D**	7.	**B**	8.	**D**
9.	**D**	10.	**A**	11.	**C**	12.	**B**
13.	**A**	14.	**A**	15.	**A**	16.	**C**
17.	**D**	18.	**B**	19.	**C**	20.	**B**

PART – B

1.	**6**	2.	**3**	3.	**0**	4.	**3**
5.	**28.8**						

SECTION – II

(CHEMISTRY)

PART – A

1.	**B**	2.	**B**	3.	**B**	4.	**C**
5.	**A**	6.	**C**	7.	**A**	8.	**B**
9.	**B**	10.	**B**	11.	**D**	12.	**B**
13.	**B**	14.	**B**	15.	**A**	16.	**A**
17.	**C**	18.	**C**	19.	**C**	20.	**D**

PART – B

1.	**1**	2.	**2**	3.	**0**	4.	**2**
5.	**4**						

SECTION – III
(MATHEMATICS)

PART – A

1.	C	2.	D	3.	D	4.	A
5.	D	6.	B	7.	C	8.	C
9.	C	10.	B	11.	D	12.	C
13.	A	14.	B	15.	C	16.	B
17.	A	18.	A	19.	B	20.	C

PART – B

1.	– 32	2.	4	3.	4	4.	2.50
5.	5						