

FIITJEE - JEE (Main)

PHYSICS, CHEMISTRY & MATHEMATICS

BATCHES: Two Yr CRP224-E-Lot

PHASE TEST – II

Q.P. CODE: 100178

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

- Attempt ALL the questions. Answers have to be marked on the OMR sheets.
- This question paper contains **Three Sections**.
- Section-I** is Physics, **Section-II** is Chemistry and **Section-III** is Mathematics.
- Each **Section** is further divided into **Two Parts: Part-A & B** in the OMR.
- Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
- 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:

- Ensure matching of OMR sheet with the Question paper before you start marking your answers on OMR sheet.
- 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.
- OMR sheet contains alphabets, numerals & special characters for marking answers.
- Do not fold or make any stray marks on the Answer Sheet.**

C. Marking Scheme for All Two Parts:

- 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.
- Part-B (01-05)** contains five (05) Numerical based questions, the answer of which may be 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

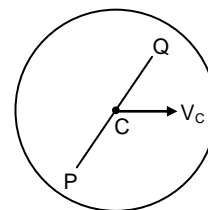
Straight Objective Type

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. A boy is standing at the centre of a boat which is free to move on water. If the masses of the boy and the boat are m_1 & m_2 respectively and the boy move a distance of 1m forward then the movement of the boat is in meters

(A) $\frac{m_1}{m_1 + m_2}$ (B) $\frac{m_2}{m_1 + m_2}$ (C) $\frac{m_1}{m_2}$ (D) None of these

2. A disc is rolling (without slipping) on a horizontal surface. C is the centre and Q and P are two points equidistant from C. Let V_P , V_Q and V_C be the velocity of P, Q and C respectively, then



(A) $V_Q > V_C > V_P$ (B) $V_Q < V_C < V_P$ (C) $V_Q = V_P, V_C = \frac{V_P}{2}$ (D) $V_Q < V_C > V_P$

3. What is the mass of the planet that has a satellite whose time period is T and orbital radius is r.

(A) $\frac{4\pi^2 r^3}{GT^2}$ (B) $\frac{4\pi^2 r^2}{GT^2}$ (C) $\frac{4\pi^2 r^3}{GT^3}$ (D) $\frac{4\pi^2 r}{GT^2}$

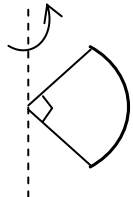
4. The escape velocity on earth is 11.2 km/s. What would be the escape velocity on a planet whose mass is 1000 times and radius is 10 times that of earth

(A) 112 km/s (B) 11.2 km/s (C) 1.12 km/s (D) 3.7 km/s

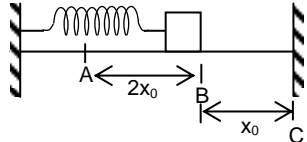
5. If a tunnel is dug along the diameter of the earth and a body is dropped into it, then the time taken by it to cross the tunnel once is (R = radius of earth)

(A) $2\pi\sqrt{\frac{R}{g}}$ (B) $\pi\sqrt{\frac{R}{g}}$ (C) $2\pi\sqrt{\frac{g}{R}}$ (D) $\pi\sqrt{\frac{g}{R}}$

Space For Rough Work

6. A particle of mass m moving along the x -axis has a potential energy $U(x) = a + bx^2$ where a and b are positive constants. It will execute simple harmonic motion with a frequency determined by the value of :
 (A) b alone (B) b and a alone (C) b and m alone (D) b, a and m alone
7. A solid spherical ball rolls on a table. Ratio of rotational KE to the total KE is
 (A) $2/7$ (B) $1/2$ (C) $1/5$ (D) $7/10$
8. Moment of inertia of a uniform circular disc about a diameter is I . Its moment of inertia about an axis \perp to its plane and passing through a point on its rim will be
 (A) $5I$ (B) $3I$
 (C) $6I$ (D) $4I$
9. There is a 90° bend in a pipe line in which water is flowing at speed v . The cross sectional area of pipe is A . The force exerted by pipe walls on water at bend is
 (A) $\sqrt{3}Av^2\rho$ (B) $\sqrt{2}Av^2\rho$
 (C) $Av^2\rho$ (D) $\sqrt{5}Av\rho$
10. One quarter section is cut from a uniform circular disc of radius R . This section has mass M . It is made to rotate about a line perpendicular to its plane and passing through the centre of the original disc. Its moment of inertia about the axis of rotation is
 (A) $\frac{1}{2}MR^2$ (B) $\frac{1}{4}MR^2$
 (C) $\frac{1}{8}MR^2$ (D) $\sqrt{2}MR^2$
- 
11. A shell of mass m moving with velocity v suddenly breaks into 2 pieces. The part having mass $m/4$ remains stationary. The velocity of other part will be
 (A) v (B) $2v$
 (C) $\frac{3}{4}v$ (D) $\frac{4}{3}v$
12. A particle executes simple harmonic motion with a frequency ' f '. The frequency with which its kinetic energy oscillates is
 (A) $f/2$ (B) f (C) $2f$ (D) $4f$

Space For Rough Work

13. The density of a newly discovered planet is twice that of earth. The acceleration due to gravity at the surface of the planet is equal to that at the surface of the earth. If the radius of Earth is R , the radius of planet would be
 (A) $\frac{R}{4}$ (B) $\frac{R}{2}$ (C) $2R$ (D) $4R$
14. A body is projected vertically upwards from the earth's surface to reach a height $7R$, where R is the Radius and M is mass of earth. The minimum velocity required to do so is
 (A) $\sqrt{\frac{7GM}{8R}}$ (B) $\sqrt{\frac{7GM}{4R}}$ (C) $\sqrt{\frac{8GM}{3R}}$ (D) $\sqrt{\frac{20GM}{11R}}$
15. One end of a spring of force constant k is fixed to a vertical wall and the other to a body of mass m resting on a smooth horizontal surface. There is another wall at a distance x_0 from body. The spring is then compressed by $2x_0$ and released. The time taken to strike the wall is
 (A) $\frac{\pi}{6} \sqrt{\frac{k}{m}}$ (B) $\sqrt{\frac{k}{m}}$
 (C) $\frac{2\pi}{3} \sqrt{\frac{m}{k}}$ (D) $\frac{\pi}{4} \sqrt{\frac{k}{m}}$
- 
16. The time taken by a particle executing SHM of period T to move from the mean position to half the maximum displacement is
 (A) $T/3$ (B) $T/4$ (C) $T/8$ (D) $T/12$
17. A uniform wire of cross-sectional area A and Young's modulus Y is stretched within the elastic limit. If S is the stress in the wire, the elastic energy density stored in the wire in terms of the given parameters is
 (A) $\frac{S}{2Y}$ (B) $\frac{2Y}{S^2}$ (C) $\frac{S^2}{2Y}$ (D) $\frac{S^2}{Y}$
18. A bullet hits and gets embedded in a solid block resting on a horizontal frictionless table. What is conserved?
 (A) momentum (B) kinetic energy
 (C) momentum and K.E. both (D) None of these

Space For Rough Work

19. The motion of a particle executing SHM is given by $x = 0.01 \sin \{100\pi (t+0.5)\}$ where x is in m and t in seconds. The time period is
(A) 0.01 sec (B) 0.02 sec
(C) 0.1 sec (D) 0.2 sec
20. The dimensions of impulse is
(A) ML^2T^{-2} (B) MLT^{-1}
(C) MLT^{-2} (D) ML^2T^{-1}

PART-B
Numerical Type

1. The maximum acceleration and maximum velocity of simple harmonically oscillating system are 8 m/sec^2 and 8 m/s respectively. What is the angular frequency?
2. A satellite is moving in a circular orbit around earth at a height R above earth surface (R being radius of earth) It's velocity should be increased to \sqrt{k} times its initial orbital speed value, so as to make it escape from earth gravitational pull and reach infinity. Find k
3. The M.I. of a body (initially at rest) about a given axis is 1.2 kgm^2 . In order to produce a rotational K.E. of 1500 J , an angular acceleration of 25 rad/s^2 must be applied about that axis for a period of T sec. Find the value of ' T '.
4. A wheel rotates about an axle. Due to the friction of axle it experience a retardation which is proportional to its angular velocity ω . It completes $n = 5$ revolutions when angular velocity falls to half of the initial value. How many more revolutions will it make before coming to rest
5. A tangential force F acts at the top of a thin spherical shell of mass m and radius R . If it rolls without slipping then acceleration is given by $a = \frac{xF}{5m}$. What is the value of ' x '.

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.

- In a reversible chemical reaction the equilibrium constant K_C has no unit. Then which of the following relation is correct?
(A) $K_P > K_C$ (B) $K_P = K_C$
(C) $K_P < K_C$ (D) Unpredictable
- $\text{HCN}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{CN}^-(\text{aq})$
Which of the following can decrease the degree of dissociation (α) of HCN in above reaction?
(A) Addition of water (B) Addition of NaCl
(C) Addition of HCl (D) Addition of KOH
- $3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$
What will be the equilibrium constant K_P of the reaction if the number of moles of H_2O and H_2 are same at equilibrium?
(A) Zero (B) One
(C) infinity (D) Unpredictable
- Which of the following aqueous solution will have the highest pH at 25°C ?
(A) Sugar (B) Common salt
(C) Vinegar (D) Lime water
- Which of the following reaction is not affected by changing pressure?
(A) $2\text{SO}_3(\text{g}) \rightleftharpoons 2\text{SO}_2(\text{g}) + \text{O}_2(\text{g})$ (B) $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$
(C) $\text{S}(\text{s}) + \text{O}_2(\text{g}) \rightleftharpoons \text{SO}_2(\text{g})$ (D) $\text{N}_2\text{O}_4(\text{s}) \rightleftharpoons 2\text{NO}_2(\text{g})$
- Which of the following two compounds form a buffer when mixed in 1 : 1 molar ratio?
(A) CH_3COOH and NaOH (B) KOH and HCN
(C) NH_4OH and CH_3COOH (D) NH_4OH and HCl

Space For Rough Work

7. $2\text{CO}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{CO}_2(\text{g})$
Which of the following can increase the yield of CO_2 in the above reaction?
(A) Decreasing pressure
(B) Adding a catalyst
(C) Decreasing the volume of reaction container
(D) Removing oxygen
8. What is the conjugate base of NH_4^+ ion?
(A) NH_3 (B) NH_5^{2+}
(C) NH_2^- (D) NH^{2-}
9. $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$ and $\text{CH}_3\text{COCH}_2\text{CH}_3$ are
(A) chain isomers (B) position isomers
(C) functional isomers (D) geometrical isomers
10. What is the value of K_b of CN^- ion if the value of K_a for HCN is 10^{-10} ?
(A) 10^{-10} (B) 10
(C) 4 (D) 10^{-4}
11. The functional isomer of ether is
(A) alcohol (B) aldehyde
(C) ketone (D) acid
12. $4\text{X}(\text{s}) \rightleftharpoons 2\text{Y}(\text{g}) + \text{Z}(\text{g})$
The equilibrium constant K_P of above reaction is 32 atm^3 . What is the equilibrium partial pressure of Z gas?
(A) 8 atm (B) 4 atm
(C) 10.3 atm (D) 2 atm
13. NH_4OH is a weaker base than NaOH because of the hydrogen bond between
(A) OH^- and H_2O (B) NH_4^+ and H_2O
(C) NH_4^+ and OH^- (D) H_2O and H_2O

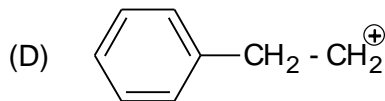
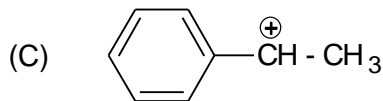
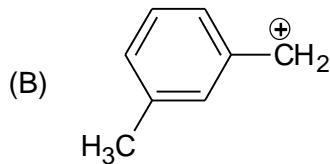
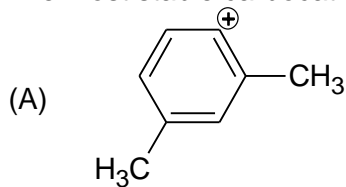
Space For Rough Work

14. C_2H_5 exerts the strongest +I effect in
(A) C_2H_5F (B) C_2H_5Cl
(C) C_2H_5Br (D) C_2H_5I
15. The unit of rate and rate constant of a reaction containing one reactant are equal so the half-life period of the reaction is
(A) directly proportional to initial concentration of reactant
(B) does not change with temperature
(C) independent of reactant concentration
(D) inversely proportional to the concentration of reactant
16. The rate of a chemical reaction is given as:
$$\text{Rate} = k \frac{[A]^2 [B]^{0.5}}{[C]}$$

The correct statement for the reaction is
(A) overall order of the reaction is 2.5
(B) rate of reaction does not depend on the concentration of C
(C) the unit of rate constant is $\text{mol}^{-0.5} \text{L}^{0.5} \text{s}^{-1}$
(D) the reaction is zero order with respect to 'C'
17. Which of the following happens for a reaction if the activation energy is zero?
(A) The half-life period will be maximum
(B) The rate constant will have maximum value
(C) Rate of the reaction will have the minimum value
(D) Number of molecules crossing the energy barrier is minimum
18. Cyclopropane is an isomer of
(A) C_3H_8 (B) C_3H_6
(C) C_3H_4 (D) C_3H_3
19. The stability of which reaction intermediate, follow the order: $1^\circ > 2^\circ > 3^\circ$?
(A) Carbocations (B) Carbanions
(C) Free radicals (D) All are correct

Space For Rough Work

20. The most stable carbocation out of the following is:



PART-B
Numerical Type

- $P(s) \rightleftharpoons Q(g) + R(g) + S(g)$
Initially only taking P, it was found that the equilibrium constant (K_P) of the reaction is 8 atm^3 at a particular temperature. What is the equilibrium pressure of the reaction in atm unit?
- What is the pH of 10^{-4} M solution of HCl?
- How many asymmetric carbon atom(s) is/are present 2, 3-dihydroxy butane?
- What is the pH of 10^{-3} M solution of CH_3COONa ?
[K_a of $\text{CH}_3\text{COOH} = 10^{-5}$]
- $\text{ClCH}_2\text{CH} = \text{CH} - \text{CH} = \text{CHCH}_2\text{Cl}$
How many geometrical isomer(s) is/are possible for the above compound?

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.

- If $a_1, a_2, a_3, \dots, a_n$ are in A.P and $a_1 + a_4 + a_7 + \dots + a_{16} = 114$, then $a_1 + a_6 + a_{11} + a_{16}$ is equal to
(A) 76 (B) 64
(C) 98 (D) 38
- The fourth term of an A.P is 4. Then the sum of the first 7 terms is
(A) 4 (B) 28
(C) 16 (D) 40
- If $A + iB = \frac{(1+i)(2-i)(3+4i)}{(1-2i)(4-3i)}$, then $A^2 + B^2$ is
(A) 0 (B) 1
(C) 2 (D) 4
- If 6 arithmetic means are inserted between 1 and $9/2$, then 4th arithmetic mean is
(A) 2 (B) 6
(C) 3 (D) 4
- If the 7th term of a H.P. is $\frac{1}{10}$ and the 12th term is $\frac{1}{25}$, then the 20th term is
(A) $\frac{1}{37}$ (B) $\frac{1}{41}$
(C) $\frac{1}{45}$ (D) $\frac{1}{49}$
- Number of values of 'p' for which the equation $(p^2 - 3p + 2)x^2 - (p^2 - 5p + 4)x + p - p^2 = 0$ possess more than two roots, is
(A) 0 (B) 1
(C) 2 (D) -1

Space For Rough Work

7. The set of values of p for which the roots of the equation $3x^2 + 2x + p(p - 1) = 0$ are of the opposite sign is
(A) $(-\infty, 0)$ (B) $(0, 1)$
(C) $(1, \infty)$ (D) $(0, \infty)$
8. If $2x^{\log_4 3} + 3^{\log_4 x} = 27$, then x is equal to
(A) 2 (B) 4
(C) 8 (D) 16
9. If the cube roots of unity are $1, \omega, \omega^2$ then the roots of the equation $(x - 2)^3 + 27 = 0$
(A) $-1, -1, -1$ (B) $-1, -\omega, -\omega^2$
(C) $-1, 2 + 2\omega, 2 + 3\omega^2$ (D) $-1, 2 - 3\omega, 2 - 3\omega^2$
10. If p, q and r are distinct roots of $x^3 - x^2 + x - 2 = 0$, then $p^3 + q^3 + r^3$ equals
(A) 2 (B) 4
(C) 8 (D) 16
11. The complex number $\left(\frac{1+2i}{1-i}\right)$ lies in
(A) Ist quadrant (B) IInd quadrant
(C) IIIrd quadrant (D) IVth quadrant
12. If ω is a non-real cube root of unity then the expression $(1 - \omega)(1 - \omega^2)(1 + \omega^4)(1 + \omega^8)$ is equal to
(A) 0 (B) 3
(C) 1 (D) 2
13. The principal argument of the complex number $-\sqrt{3} + i$ is
(A) $\pi/6$ (B) $\pi/2$
(C) $5\pi/6$ (D) none of these
14. The length of latus rectum of the parabola $25[(x - 1)^2 + (y - 4)^2] = (3x + 4y - 4)^2$ is
(A) $\frac{3}{5}$ (B) 3
(C) 6 (D) 15
15. A student score the following marks in five tests: 45, 54, 41, 57, 43. His score is not known for the sixth test. If the mean score is 48 in the six tests, then the marks in six tests is:
(A) 45 (B) 47
(C) 50 (D) 48

Space For Rough Work

16. Equation of the tangent at $(-4, -4)$ on $x^2 = -4y$ is
 (A) $2x - y + 4 = 0$ (B) $2x + y - 4 = 0$
 (C) $2x - y - 12 = 0$ (D) $2x + y + 4 = 0$
17. The line $y = mx + 1$ is a tangent to the parabola $y^2 = 4x$ is m is equal to
 (A) 1 (B) 2
 (C) 4 (D) 3
18. Given the quadratic equation $x^2 - 6x + k = 0$, ($k \in I$) has exactly one root between 1 and 2
 Find number of possible integral values of k :
 (A) 1 (B) 2
 (C) 3 (D) 4
19. If $\left| \frac{z + 2i}{z - i} \right| = 2$ is a circle, then centre of circle is:
 (A) $(0, 0)$ (B) $(0, 2)$
 (C) $(2, 0)$ (D) $(-2, 0)$
20. If $f(x) = bx^2 + cx + d$ with $f(x+1) - f(x) = 8x + 3$ then
 (A) $bc = -2$ (B) $bc = 2$
 (C) $bc = -4$ (D) $bc = 4$

PART-B
Numerical Type

1. The number of terms common to the two A.P.'s 3, 7, 11,.....407 and 2, 9, 16,709 is _____
2. The circle $|z + 3| = 1$ touches $|z - \sqrt{7}i| = r$. Then sum of possible values of r is
3. If the roots of $x^2 - bx + c = 0$ are the consecutive integers, the $b^2 - 4c =$
4. The latus rectum of a parabola whose focal chord PSQ is such that $SP = 3$ and $SQ = 2$ is given by
5. The solution set of the system of equations $\log_2 x + \log_2 y = \log_2 9 + 1$, $\log_{x+y}(27) = \frac{3}{2}$ is (p, q) then $pq =$

Space For Rough Work

FIITJEE INTERNAL TEST

BATCHES: Two Yr CRP224-E-Lot

PHYSICS, CHEMISTRY & MATHEMATICS

JEE MAIN-PHASE-II

ANSWER KEY

Paper Code
100178

SECTION – I

(PHYSICS)

PART – A

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

PART – B

1. 1	2. 2	3. 2	4. 5
5. 6			

SECTION – II

(CHEMISTRY)

PART – A

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

PART – B

1. 6	2. 4	3. 2	4. 8
5. 3			

SECTION – III (MATHEMATICS)

PART – A

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

PART – B

1. 14	2. 8	3. 1	4. 4.8
5. 18			