FIITJEE Phase Test (JEE-Advanced)

PHYSICS, CHEMISTRY & MATHEMATICS

Pattern - CPT-1 | **QP Code:** | **Test - 1**

Time Allotted: 3 Hours **Maximum Marks: 183**

- 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.

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. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.

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 HB pencil 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.

C. Marking Scheme For All Two Parts.

(i) **Part-A (01-07) –** Contains seven (07) multiple choice questions which have **One or More** correct answer.
Full Marks: **+4** If only the bubble(s) corresponding to all the correct options(s) is (are) darkened.
Partial Marks: **+1** For darkening a bubble corresponding **to each correct option,** provided NO incorrect option is darkened.
Zero Marks: **0** If none of the bubbles is darkened.
***Negative Marks*: –1 In all other cases.**
For example, if **(A), (C) and (D)** are all the correct options for a question, darkening all these three will result in **+4 marks**; darkening only **(A) and (D)** will result in **+2 marks**; and darkening **(A) and (B)** will result in **–1** marks, as a wrong option is also darkened.

(i) **Part-A (08-13) –** Contains six (06) multiple choice questions which have ONLY ONE CORRECT answer Each question carries **+3 marks** for correct answer and **-1 marks** for wrong 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 **+3 marks** for correct answer and **there will be no negative marking.**

Name of the Candidate :_____

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

Enrolment Number :_____

BATCHES – 2022

SECTION-1 : PHYSICS

PART – A

(Multi Correct Choice Type)

This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. A rocket is fired vertically up from the ground with a resultant acceleration of 10 m/s^2 upward. The fuel is finished in 1 minute and it continuous to move up ($g = 10\ m/s^2$)
(A) the maximum height reached by rocket from ground is 18 km.
(B) the maximum height reached by rocket from ground is 36 km.
(C) the time from initial in which rocket again at ground is 240 s.
(D) the time from initial in which rocket again at ground is $(120+60\sqrt{2})$s.

1. **BD**

2. If $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 2\hat{i} - 3\hat{j} + \hat{k}$ then
(A) $\vec{A}.\vec{B} = -5$ (B) $\vec{A}.\vec{B} = 5$
(C) $\left|\vec{A} \times \vec{B}\right| = \sqrt{157}$ (D) $\left|\vec{A} \times \vec{B}\right| = -\sqrt{157}$

2. **AC**

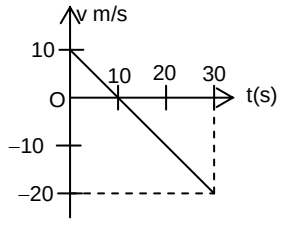
3. If $\vec{A} \times \vec{B} = \vec{C} + \vec{D}$, then select the correct alternative
(A) Component of $\vec{C}$ along $\vec{B}$ = component of $\vec{D}$ along $\vec{B}$
(B) Component of $\vec{C}$ along $\vec{B}$ = – component of $\vec{D}$ along $\vec{B}$
(C) Component of $\vec{C}$ along $\vec{A}$ = component of $\vec{D}$ along $\vec{A}$
(D) Component of $\vec{C}$ along $\vec{A}$ = – component of $\vec{D}$ along $\vec{A}$

3. **BD**

4. The magnitude of component of a vector may be
(A) greater than the magnitude of that vector.
(B) equal to the magnitude of that vector
(C) smaller then the magnitude of that vector
(D) zero

4. **ABCD**

5. The velocity-time graph for a particle moving on a straight line is shown in figure.
(A) the particle has constant acceleration
(B) the particle has never turned around
(C) the particle has zero displacement at t = 30 s.
(D) the average speed in the interval 0 to 10 s is the same as the average speed in the interval 10 s to 20 s.



5. **AD**

6. A man has to hold his umbrella at 30° with the vertical to keep himself dry. He, then runs at a speed of 10 m/s leaving umbrella behind and finds the raindrops to be hitting him vertically. Speed of the raindrop with respect to the earth is
(A) 10m/s (B) $20\sqrt{3}$ m/s (C) 20m/s (D) $10\sqrt{3}$ m/s

6. **C**

7. A bus starts from rest with an acceleration of 1 m/s^2. A car which is 48 m behind the bus is moving with a uniform velocity of 10 m/s. the time at which of passenger of car can jump into the bus.
(A) 6.4 s (B) 8 s
(C) 12 s (D) 12.4 s

7. **BC**

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. Given the $\bar{A}+\bar{B}=\bar{C}$ and that $\bar{C}$ is $\perp$ to $\bar{A}$. Further if $|\bar{A}|=|\bar{C}|$, then what is the angle between $\bar{A}$ and $\bar{B}$

(A) $\frac{\pi}{4}$ radian (B) $\frac{\pi}{2}$ radian (C) $\frac{3\pi}{4}$ radian (D) π radian

8. **C**

9. The resultant of $\bar{A}+\bar{B}$ is $\bar{R}_1$. On reversing the vector $\bar{B}$, the resultant becomes $\bar{R}_2$, what is the value of $R_1^2+R_2^2$
(A) $A^2 + B^2$ (B) $A^2 - B^2$ (C) $2(A^2 + B^2)$ (D) $2(A^2 - B^2)$

9. **C**

10. The relation between time t and distance x moved by a particle is $t=\alpha x^2+\beta x$ where α and β are constants. The retardation is (if v represents velocity)
(A) $2\alpha V^3$ (B) $2\beta V^3$ (C) $2\alpha\beta V^3$ (D) $2\beta^2 V^3$

10. **A**

11. If $\vec{A}=\hat{i}+2\hat{j}+2\hat{k}$ and $\vec{B}=3\hat{i}+6\hat{j}+2\hat{k}$, then the vector in the direction of $\vec{A}$ and having same magnitude as $|\vec{B}|$, is

(A) $\frac{7}{3}\left(\hat{i}+\hat{j}+2\hat{k}\right)$ (B) $7\left(\hat{i}+2\hat{j}+2\hat{k}\right)$
(C) $\frac{3}{7}\left(\hat{i}+2\hat{j}+2\hat{k}\right)$ (D) $\frac{7}{3}\left(\hat{i}+2\hat{j}+2\hat{k}\right)$

11. **D**

12. Average velocity of particle moving in a straight line, with constant acceleration a and initial velocity u in first t seconds
(A) $u+\frac{1}{2}at$ (B) u + at (C) $\frac{u+at}{2}$ (D) $\frac{u}{2}$

12. **A**

13. A body is moving in a circle at a uniform speed v. The magnitude of the change in velocity when the radius vector describes an angle 60° is
(A) v (B) $\frac{v}{2}$ (C) $\frac{\sqrt{3}}{2}v$ (D) $\frac{v}{3}$

13. **A**

PART – B
(Numerical based)

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

1. **1.5**

2. Two seconds after the projection, a projectile is moving in a direction at 30° to the horizontal. After one more second, it is moving horizontally. The magnitude of the initial velocity is $\left(gy\sqrt{3}\right)$. Find the value of y

2. **2**

3. In a car race, car A takes 4 seconds less than car B to reach the finish line and passes the finishing line with velocity v more than car B. Assume cars start from rest and travel with constant acceleration $a_A = 4\ m/s^2$ and $a_B = 1\ m/s^2$. Find the value of v in m/s.

3. **8**

4. If the sum of two unit vectors is a unit vector, find the magnitude of their difference.

4. **1.73**

5. A particle starts with initial velocity 10 m/s along positive x direction with an acceleration 5 m/s^2 along negative x direction. Find the displacement (in meters) of the particle in 5 seconds.

5. **–12.5**

SECTION-2 : CHEMISTRY

PART – A

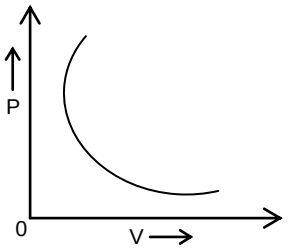
(Multi Correct Choice Type)

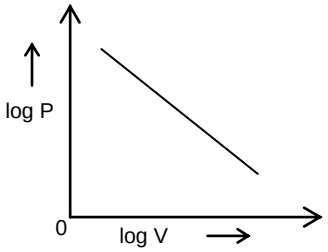
This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

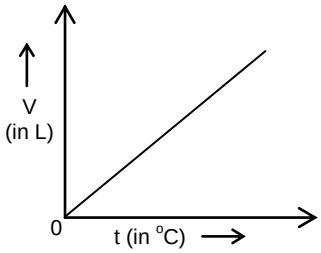
1. 200 mL of 0.4 M aqueous NaOH solution can be exactly neutralized by
   (A) 400 mL of 0.2 M HCl solution
   (B) 200 mL of 0.8 N H_2SO_4 solution[assume complete dissociation of H_2SO_4]
   (C) 200 mL of solution of strength 2.92 g/L of HCl
   (D) 400 mL of 0.2 M H_2SO_4 solution[assume complete dissociation of H_2SO_4]

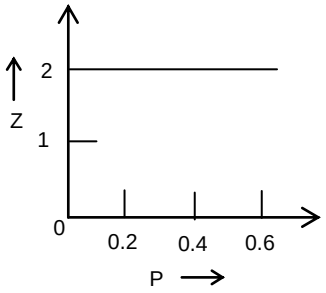
1. ABC

2. Which of the following curve(s) is/are followed by ideal gasses?

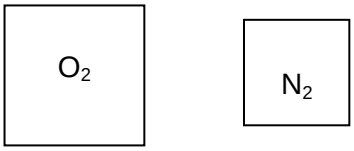
(A)


(B)


(C)


(D)


2. AB

3.


V = 6 L V = 4 L
P = 200 mm Hg P = 500 mm Hg

The containers as shown above contains the ideal gases O_2 and N_2 at constant temperature.
Choose the correct statements
(A) When the two containers are connected with each other through a volume les tube the resultant pressure becomes 320 mm Hg.
(B) The ratio of number of moles present in the larger container to the smaller container is 3 : 5
(C) When a dent of volume 2 L is produced in the larger container the pressure inside it becomes 300 mm of Hg.
(D) The RMS velocity of O_2 gas is higher than that of N_2 gas.

3. ABC

4. Which of the following statement(s) is/are correct for ideal gases?

(A) Kinetic energy of one mole of ideal gas is $K.E = \frac{3}{2}RT$

(B) The velocity possessed by maximum fraction of gas molecules is $C_{m.p} = \sqrt{\frac{2RT}{M}}$

(C) Kinetic energy of one molecule of an ideal gases is $K.E = \frac{3}{2}kT$

(D) The density of an ideal gas is $d\ \alpha\ \frac{P}{T}$

4. ABCD

5. 14 gram of an impure sample of $CaCO_3$ is treated with 800 mL of 0.5 M HCl solution. The reaction mixture is heated to complete the reaction and for evolution of CO_2 gas from the solution. 400 mL of 0.5 M NaOH is added then to neutralize the excess HCl.

$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 \uparrow + H_2O$

$NaOH + HCl \longrightarrow NaCl + H_2O$

Choose the correct statement(s)
(A) 10 g of pure $CaCO_3$ is present in the mixture
(B) 28.6 % of impurity is present in the mixture
(C) the normality of HCl solution that is used is 0.25 N
(D) After complete reaction, the mixture contains 0.01 mole of OH^- ions

5. AB

6. $MnO_4^- + C_2O_4^{2-} + H^+ \longrightarrow Mn^{2+} + CO_2 + H_2O$

Balance the equation and choose the correct statement(s)
(A) 2 moles of MnO_4^- can oxidize 5 moles of $C_2O_4^{2-}$
(B) The n-factor of $C_2O_4^{2-}$ ion is 2
(C) The stoichiometric coefficient of H^+ is 16 in the balanced equation
(D) The n-factor of MnO_4^- is 5

6. ABCD

7. Which of the following relationship(s) is/are followed by non-ideal gas at high pressure and low temperature?

(A) P(V - b) = nRT (B) Z > 1
(C) PV = nRT (D) b = 4 V_m

7. ABD

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. In which of the following reaction, the normality and molarity of HCl has different values?

(A) $Mg(OH)_2 + HCl \longrightarrow Mg(OH)Cl + H_2O$

(B) $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

(C) $Cl_2 + H_2O \longrightarrow HCl + HClO$

(D) $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$

8. B

9. What is the oxidation number of bromine in $BrCl_2^+$?
(A) +3 (B) +1
(C) -3 (D) +2

9. A

10. Under which of the following limit conditions the compressibility factor Z = 1?
(A) $P \to \infty$, $T \to \infty$, $V \to \infty$ (B) $P \to 0$, $T \to \infty$, $V \to \infty$
(C) $P \to 0$, $T \to 0$, $V \to \infty$ (D) $P \to \infty$, $T \to 0$, $V = 0$

10. B

11. The van der Waal's constant a and b for four gases are given below:

Gas	P	Q	R	S
'a' in cm^6 atm mol^{-1}	0.21	1.35	5.46	37.5
'b' in cm^6 mol^{-1}	16.7	38.6	30.5	238

Choose the correct statement
(A) Out of the four gases 'S' can be easily liquefied.
(B) Gas 'P' can produce maximum pressure as compared to other gases.
(C) Gas 'Q' shows maximum deviation from ideal behaviour.
(D) The molecular volume(v_m) of 'P' is 5.27 cm^3.

11. B

12. One mole of NH_4NO_3 contains
(A) 18 g of ammonium ion (B) 14 g of nitrogen
(C) 12.046 atom of oxygen (D) 4 g-molecule of hydrogen

12. A

13. Choose the correct statement regarding the significances of Z < 1 for a gas.
(A) Attractive forces are lower than repulsive forces
(B) Gas produces lower pressure than the ideal value(produced by ideal gases)
(C) The gas occupies 22.4 L volume at NTP
(D) The gas will behave like ideal gases when the pressure is increased

13. B

PART – B
(Numerical based)

1. 400 mL of HCl solution is treated with 10.6 g of Na_2CO_3 and 0.1 mole of NaOH upto phenolphthalein indicator. What is the molarity of HCl solution?

1. 0.5

2. What is the root mean square velocity of one mole of C_2H_6 gas in ms^{-1} unit?
(Given $\sqrt{RT}$ is 0.2)

2. 2

3. What is the oxidation number of nitrogen in NH_2OH?

3. -1

4. The degree of hardness of a sample of hard water is 2 ppm. How many moles of $CaCO_3$ is present in one litre of the sample?

4. 0.2

5. A mixture of 20 mL of a hydrocarbon and 80 mL of dioxygen is subjected to combustion. After combustion 40 mL of CO_2 and 40 mL of H_2O are formed. What volume of O_2 in mL is left unreacted?

5. 20

SECTION-3 : MATHEMATICS

PART – A

(Multi Correct Choice Type)

This section contains 7 **multiple choice questions.** Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

1. Which of the following when simplified, vanishes?

(A) $\frac{1}{\log_3 2}+\frac{2}{\log_9 4}-\frac{3}{\log_{27} 8}$

(B) $\log_2\left(\frac{2}{3}\right)+\log_4\left(\frac{9}{4}\right)$

(C) $-\log_8 \log_4 \log_2 16$

(D) $\log_{10}\cot 1^o+\log_{10}\cot 2^o+\log_{10}\cot 3^o+....+\log_{10}\cot 89^o$

1. ABCD

2. Coordinates of a point which is at 3 units distance from the point (1, –3) on the line $2x+3y+7=0$ is/are

(A) $\left(1+\frac{9}{\sqrt{13}}, 3-\frac{6}{\sqrt{13}}\right)$ (B) $\left(1-\frac{9}{\sqrt{13}}, -3+\frac{6}{\sqrt{13}}\right)$

(C) $\left(1+\frac{9}{\sqrt{13}}, -3-\frac{6}{\sqrt{13}}\right)$ (D) $\left(1-\frac{9}{\sqrt{13}}, 3-\frac{6}{\sqrt{13}}\right)$

2. BC

3. If the vertices P, Q, R of a triangle PQR are rational points, which of the following points of the triangle PQR is/are always rational point (s)?

(A) centroid (B) incentre

(C) circumcentre (D) orthocentre

3. ACD

4. Let P (x, y) be a point on the line $y=-3x$. If the point P and the point (4, 3) lie on the opposite sides of the line $3x-4y=8$, then:

(A) $x>\frac{8}{15}$ (B) $x<\frac{8}{15}$

(C) $y>-\frac{8}{5}$ (D) $y<-\frac{8}{5}$

4. AD

5. If the points (k, 2 – 2k), (–k + 1, 2k) and (–4 –k, 6 – 2k) are collinear, then they lie on the line:

(A) $2x+y-2=0$ (B) $4x+5y-7=0$

(C) $x-2y+3=0$ (D) $5x-4y-7=0$

5. AB

6. The equation (s) of the lines through the point (3, 2) which make angle 45^o with the line $x-2y=3$ is/are:

(A) $3x-y-7=0$ (B) $x+3y-9=0$

(C) $2x+3y=12$ (D) $3x-2y-5=0$

6. AB

7. Solution of inequation $\frac{x-1}{x^2-x-12}\le 0$ contains in the interval

(A) $(-\infty, 4]$ (B) $(-\infty,\infty)$

(C) $(-\infty, 10]$ (D) None of these

7. ABC

(Single Correct Choice Type)

This section contains **6 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct.**

8. If $A(\cos\alpha,\sin\alpha), B(\sin\alpha,-\cos\alpha), C(1,2)$ are the vertices of a ΔABC, then as α varies, the locus of its centroid is

(A) $x^2+y^2-2x-4y+3=0$ (B) $x^2+y^2-2x-4y+1=0$

(C) $3(x^2+y^2)-2x-4y+1=0$ (D) None of these

8. C

9. The area of triangle formed by the lines $x+y-3=0, x-3y+9=0$ and $3x-2y+1=0$ is

(A) $\frac{16}{7}$ sq. units (B) $\frac{10}{7}$ sq. units

(C) 4 sq. units (D) 9 sq. units

9. B

10. Three vertices of triangle ABC are A (–1, 11), B (–9, –8) and C (15, –2). The equation of angle bisector of angle A is

(A) $4x-y=7$ (B) $4x+y=7$

(C) $x+4y=7$ (D) $x-4y=7$

10. B

11. Solution set of in equality $\frac{(x-1)^2(x-2)^4(x-3)^6}{(x-4)^7}\le 0$ is

(A) $(-\infty, 4]$ (B) $(-\infty,4)$

(C) $(-\infty,1)\cup(1,2)\cup(2,3)\cup(3,4)$ (D) None of these

11. B

12. If $\frac{d}{dx}\left(\frac{x^4+x^2+1}{x^2+x+1}\right)=ax+b$ then (a, b) =

(A) (1, 2) (B) (1, –2)
(C) (2, –1) (D) None

12. C

13. $\int\frac{(\log x)^2}{x}dx=$

(A) $\frac{(\log x)^3}{3}+C$ (B) $(\log x)^3+C$
(C) $\frac{\log x}{x}+C$ (D) None

13. A

PART – B
(Numerical based)

1. If the straight line $3x+4y+5-k(x+y+3)=0$ is parallel to y axis, then the value of k is

1. 4

2. If $\lambda x^2-10xy+12y^2+5x-16y-3=0$ represents a pair of straight lines, then λ is equal to

2. 2

3. Number of solutions of $\log_4(x-1)=\log_2(x-3)$ is

3. 1

4. $\frac{1}{\log_{\sqrt{bc}}abc}+\frac{1}{\log_{\sqrt{ca}}abc}+\frac{1}{\log_{\sqrt{ab}}abc}$ has the value equal to

4. 1

5. The number of real roots of the equation $|x|^2-5|x|+6=0$ is:

5. 4