FIITJEE (JEE-Advanced)

BATCHES – Two Year CRP(2426) Batches

PHYSICS, CHEMISTRY & MATHEMATICS

QP Code: 100687

Common Test – 1

Time Allotted: 3 Hours **Maximum Marks: 198**

- 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 (01-06) –** 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-A (07-12) –** Contains Six (06) 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.

(ii) **Part-B (01-06)** contains Six (06) 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 :_____

SECTION-1 : PHYSICS

PART – A

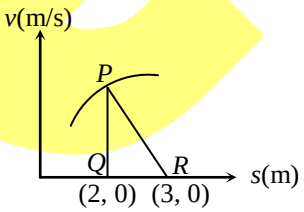
(Single Correct Choice Type)

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

1. There are 'n' non zero vectors of same kind with different magnitudes. If the resultant of these vectors is a non-zero vector, then 'n' must be equal to
(A) 2 (B) 3
(C) 4 (D) none of these

2. Rectilinear motion under constant acceleration the displacement in n^{th} second $\vec{S}_{n^{th}} = \vec{u} + \frac{\vec{a}}{2}(2n-1)$ where $\vec{u}$ is initial velocity and $\vec{a}$ is acceleration then choose the correct option regarding this equation
(A) Dimension of each term is the dimension of displacement.
(B) Dimension of each term is the dimension of velocity.
(C) Dimension of each term is the dimension of acceleration.
(D) none of these

3. Velocity versus displacement curve of a particle moving in straight line is shown in the figure. From a point *P*, a line is drawn perpendicular to displacement axis and line *PR* is drawn normal to the curve at *P*. The magnitude of tangential acceleration of the particle at point *P* is



(A) 1 m/s^2 (B) 2 m/s^2
(C) 3 m/s^2 (D) 2.5 m/s^2

4. 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) $\frac{7}{3}\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$

5. A particle is projected with speed u at an angle θ (< 60°) with the horizontal. The time taken by it, so that its velocity makes an angle 60° with the initial velocity.
(A) $\frac{\sqrt{3}}{2}\frac{u}{g}\frac{1}{\sin(\theta + 60^o)}$ (B) $\frac{\sqrt{3}}{2}\frac{u}{g}\frac{1}{\sin(\theta + 30^o)}$
(C) $\frac{\sqrt{3}}{2}\frac{u}{g}\frac{1}{\sin(\theta - 30^o)}$ (D) $\frac{\sqrt{3}}{2}\frac{u}{g}\frac{1}{\left|\sin(\theta - 60^o)\right|}$

Space For Rough Work

6. 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) $2\beta^2 V^3$

(Multi Correct Choice Type)

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

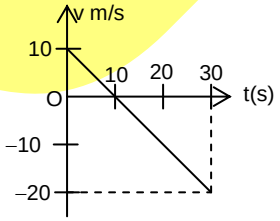
7. The magnitude of component of a vector may be
(A) greater than the magnitude of that vector.
(B) equal to the magnitude of that vector.
(C) smaller then the magnitude of that vector.
(D) zero

8. If $\vec{a} = 2\hat{i} + 3\hat{j}$ and $\vec{b} = 2\hat{i} - \hat{k}$, then

(A) $\vec{a}.\vec{b} = 4$ (B) $\vec{a}\times\vec{b} = -3\hat{i} + 2\hat{j} - 6\hat{k}$

(C) $\vec{a}.\vec{b} = 1$ (D) $\vec{a}\times\vec{b} = 4\hat{k}$

9. 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.

10. 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.

11. A particle moves along positive branch of the curve, $y = \frac{x}{2}$, where $x = \frac{t^3}{3}$, x and y are measured in metres and t in seconds, then

(A) The velocity of particle at $t = 1$s is $\hat{i} + \frac{1}{2}\hat{j}$

(B) The velocity of particle at t =1s is $\frac{1}{2}\hat{i} + \hat{j}$

(C) The acceleration of particle at t =1s is $2\hat{i} + \hat{j}$

(D) The acceleration of particle at t = 2 s is $\hat{i} + 2\hat{j}$

Space For Rough Work

12. A projectile have the same range R for two angles of projections. If T_1 and T_2 be the times of flight in the two cases, then

(A) $T_1T_2 \propto R$ (B) $T_1T_2 \propto R^2$ (C) $\frac{T_1}{T_2} = \tan\theta$ (D) $\frac{T_1}{T_2} = \cot\theta$

Here θ is the angle of projection corresponding to T_1.

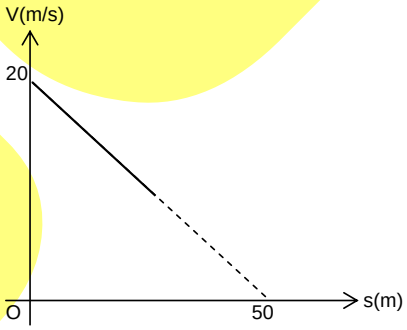
PART – B
(Numerical Type)

1. 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. 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 $\left|\vec{C}\right| = \left|\vec{A}\times\vec{B}\right|$.

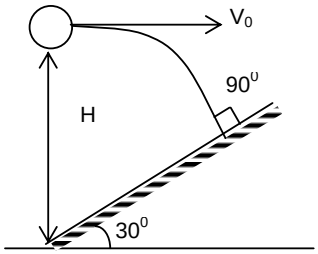
3. A man is going up in an air balloon going up with an acceleration 2 m/s^2. When he reaches to a ht. 100 m from ground, he drops a ball. The time taken by the ball to reach the ground is $x\left(1+\sqrt{6}\right)$. Value of x is

4. Referring to v–s diagram, if magnitude of acceleration of the particle when its velocity becomes half of the initial velocity is a, then find the value of a/5.



5. 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.

6. In the given figure, the angle of inclination of the inclined plane is 30^0. Find the horizontal velocity V_0 (in m/s) so that the particle hits the inclined plane perpendicularly. Given, H = 4m, g = 10 m/s^2



Space For Rough Work

SECTION-2 : CHEMISTRY

PART – A

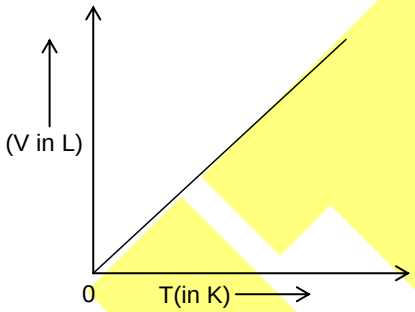
(Single Correct Choice Type)

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

1. The mass of one mole molecules of CO_2 gas is
   (A) $(44 \times 6.023 \times 10^{23})$ g
   (B) 44 g
   (C) $\left(\frac{44}{6.023 \times 10^{23}}\right)$g
   (D) $\frac{1}{44}$g

2. Which compound contains nitrogen in +5 oxidation state?
   (A) HNO_2
   (B) H_2NO_2
   (C) HNO_3
   (D) NH_2OH

3. A closed container of volume 800 mL contains an ideal gas at 400 K and the pressure produced by the gas is 0.4 atm. The gas was completely transferred into another container of volume 1200 mL at the same temperature and the container was closed. How much pressure will be produced in the larger container?
   (A) $\frac{2}{15}$atm
   (B) $\frac{1}{15}$atm
   (C) $\frac{4}{15}$atm
   (D) $\frac{6}{15}$atm

4. 

   The correct statement for above graph is
   (A) at 0^oC the volume of all gases become zero
   (B) volume of a gas is directly proportional to temperature at constant pressure
   (C) volume of gas is inversely proportional to temperature at constant pressure
   (D) the graph represents Boyle' law

5. 0.1 mole of NaOH is present in 600 mL solution. How much water should be added to it so that the concentration of the resultant solution becomes 0.1 M? (M = Molarity of solution)
   (A) 1000 mL
   (B) 400 mL
   (C) 1600 mL
   (D) 300 mL

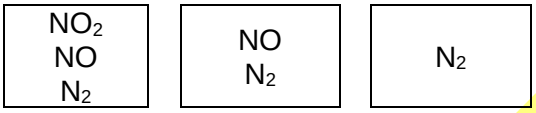
Space For Rough Work

6. Which of the following gas under the specified conditions, will **not follow** the ideal gas equation, PV = nRT?
(A) One mole of helium gas occupying 22.4 litre volume at 1 atm and 0°C.
(B) 22.4 litre of dioxygen gas weighing 36 gram at 273 K and 1 atm pressure.
(C) 0.1 mole of CO_2 occupying 2.24 litre at 760 mm of Hg pressure and 273 K temperature.
(D) 2 gram of dihydrogen exert 1 atm pressure in a container of volume 22.4 litre at 0°C.

(Multi Correct Choice Type)

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

7. $Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$
Choose correct statements for above reaction.
(A) Zn is oxidized
(B) Cu^{2+} is reduced
(C) the oxidation number of sulphur is +6
(D) the oxidation number of oxygen in $CuSO_4$ is +1

8. 

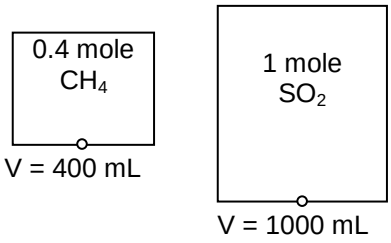
All the container have identical volume. Mole of same species in different containers are same/constant. The pressure of the gases in the container I, II and III respectively are 15 atm, 13 atm and 5 atm at constant temperature.
Choose the correct statement(s).
(A) the partial pressure of N_2 in container-II is 5 atm
(B) the partial pressure of NO is 8 atm
(C) the partial pressure of NO_2 is 2 atm
(D) the mole fraction of NO i.e. X_{NO} in the container-II is $\frac{8}{13}$

9. The equivalent mass and the molecular mass of H_2SO_4 in which reaction(s) is(are) identical?
(A) $H_2SO_4 + NaOH \longrightarrow NaHSO_4 + H_2O$
(B) $2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$
(C) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$
(D) $Na_2CO_3 + H_2SO_4 \longrightarrow NaHSO_4 + NaHCO_3$

10. Which change(s) is(are) neither oxidation nor reduction?
(A) $SO_3 + O^{2-} \longrightarrow SO_4^{2-}$
(B) $NO_2^- + O \longrightarrow NO_3^-$
(C) $2CrO_4^{2-} + 2H^+ \longrightarrow Cr_2O_7^{2-} + H_2O$
(D) $CO_2 + O^{2-} \longrightarrow CO_3^{2-}$

Space For Rough Work

11.



At constant temperature, the gases in the closed containers effuses through the orifice of identical sizes. Choose correct statement(s).

[R = 0.082 ℓ atm mol^{-1} K^{-1}]

(A) Both gases produce identical pressure in the two containers

(B) The ratio of relative rates of effusion of the gases, i.e., $\frac{r_{CH_4}}{r_{SO_2}}$ is 2 : 1

(C) At constant temperature and pressure the rate of effusion of the two gases becomes identical.

(D) The pressure of the gas in the smaller container at 1000 K is equal to 0.082 atm

12. $MnO_4^- + Fe^{2+} + H^+ \longrightarrow Mn^{2+} + Fe^{3+} + H_2O$

Balance the equation, then choose the correct statement(s) from the following.

(A) the ratio of the stoichiometric coefficients of MnO_4^- and Fe^{2+} in the balanced equation is 1 : 5.

(B) 200 mL of 0.5 N acidified MnO_4^- solution can oxidize 0.1 mole of Fe^{2+} to Fe^{3+} ion.

(C) the stoichiometric coefficient of H_2O is 4

(D) the n-factor of MnO_4^- is 5

Space For Rough Work

PART – B

(Numerical Type)

1. How much mass of oxygen in gram is present in 1.8 gram of H_2O?

2. If x number of compounds from the given list contain sulphur in +4 oxidation state, the value of $\frac{x}{2}$ is

   SO_2, SF_4, SO_3, SF_6, H_2SO_3, H_2SO_4, Na_2SO_3, $NaHSO_3$, H_2S, $KHSO_4$

3. $C + O_2 \longrightarrow CO_2$

   If the equivalent mass of the reactant carbon in above reaction is y g equ^{-1}, then the value of y/2 is

4. For a real gas
   b = The excluded volume of one molecule of the gas and
   V_m = the volume of one molecule of the gas
   If $\frac{b}{V_m} = x$, what is the value of $\frac{x}{2.5}$?

5. The root mean square velocity(V_{rms}) of an ideal gas nitric oxide(NO) at 800 K is 'x' ms^{-1}, what is the value of $\left(\frac{x}{125}\right)$? [R = 8 JK^{-1} mol^{-1}](Atomic mass of N = 14, O = 16)

6. $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

   How many moles of Cl_2 will be formed if 1.2 mole of MnO_2 and 1.2 mole of HCl undergo complete reaction?

Space For Rough Work

SECTION-3 : MATHEMATICS

PART – A

(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.**

1. If $\log_{30}(3)=\alpha$ and $\log_{30}(5)=\beta$, then $\log_{30}(8)$ is equal to

   (A) $3(1+\alpha-\beta)$ (B) $3(1+\alpha+\beta)$

   (C) $3(\alpha+\beta)$ (D) $3(1-\alpha-\beta)$

2. If $|x+1|+|x-2|>3$ then x is

   (A) $(-\infty,-1)\cup(2,\infty)$ (B) $(2,\infty)$

   (C) $(-1,2)$ (D) none of these

3. $\int\frac{3x^2}{(x^3+3)^3}dx$ is given by

   (A) $\log|x^3+3|+c$ (B) $-\frac{1}{2(x^3+3)}+c$

   (C) $-\frac{1}{2(x^3+3)^2}+c$ (D) none of these

4. If $\cos\alpha=-\frac{3}{5}$ and $\sin\beta=-\frac{5}{13}$ and α lies in the third quadrant and B lies in the fourth quadrant then $\cot(\alpha-\beta)$ is equal to

   (A) $\frac{16}{63}$ (B) $\frac{33}{56}$

   (C) $\frac{63}{16}$ (D) 0

5. The value of $\sqrt{3}\,\text{cosec}\,20^o-\sec 20^o$ is

   (A) 4 (B) 2

   (C) $\sqrt{3}$ (D) 0

Space For Rough Work

6. If $y = \ln\left(\sqrt{x} + \sin^2 x\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{1}{\sqrt{x} + \sin^2 x}$

(B) $\frac{1}{\sqrt{x} + \sin^2 x}\left(\frac{1}{2\sqrt{x}} + \sin 2x\right)$

(C) $\frac{1}{\sqrt{x} + \sin^2 x}\left(\sin x + \cos^2 x\right)$

(D) $\frac{x + \cos x}{2\left(\sqrt{x} + \sin^2 x\right)}$

(Multi Correct Choice Type)

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

7. The value of x satisfying the equation $\left(\log_2 2x\right)\left(\log_2^2 x + \log_2\left(\frac{2}{x}\right)\right) = 2$, is

(A) a prime number

(B) a composite number

(C) an even number

(D) an odd number

8. Suppose ABCD (in order) is a quadrilateral inscribed in a circle. Which of the following are always true?

(A) $\sec B = \sec D$

(B) $\cot A + \cot C = 0$

(C) $\operatorname{cosec} A = \operatorname{cosec} C$

(D) $\tan B + \tan D = 0$

9. If $\cos\left(A - B\right) = \frac{3}{5}$ and $\tan A \tan B = 2$, then

(A) $\cos A \cos B = \frac{1}{5}$

(B) $\sin A \sin B = -\frac{2}{5}$

(C) $\cos\left(A + B\right) = -\frac{1}{5}$

(D) $\cos\left(A + B\right) = \frac{1}{5}$

10. Which of the following is **INCORRECT**?

(A) If $\frac{d}{dx}\left(\frac{1 + x^2 + x^4}{1 + x + x^2}\right) = ax + b$, then $a + b = 3$

(B) If $y = e^{\tan x}$, then $\left.\frac{dy}{dx}\right|_{x=0} = 0$

(C) $\lim\limits_{x \to 1} \frac{x - 1}{2x^2 - 7x + 5} = 0$

(D) $\lim\limits_{h \to 0} \frac{\sqrt{x + h} - \sqrt{x}}{h} = \frac{1}{\sqrt{x}}$

Space For Rough Work

11. If $\cos\alpha = \frac{3}{5}$ and $\cos\beta = \frac{5}{13}$ then

(A) $\cos(\alpha+\beta) = \frac{33}{65}$ (B) $\sin(\alpha+\beta) = \frac{56}{65}$

(C) $\sin^2\left(\frac{\alpha-\beta}{2}\right) = \frac{1}{65}$ (D) $\cos(\alpha-\beta) = \frac{63}{65}$

12. Let $f_n(\theta) = \tan\frac{\theta}{2}(1+\sec\theta)(1+\sec 2\theta)(1+\sec 4\theta)....(1+\sec 2^n\theta)$ then

(A) $f_2\left(\frac{\pi}{16}\right) = 1$ (B) $f_3\left(\frac{\pi}{32}\right) = 1$

(C) $f_4\left(\frac{\pi}{64}\right) = 1$ (D) $f_5\left(\frac{\pi}{128}\right) = 1$

PART – B
(Numerical Type)

1. If a, b, c are positive real numbers such that $a^{\log_3 7} = 27$, $b^{\log_7 11} = 49$ and $c^{\log_{11} 25} = \sqrt{11}$. Find the value of $a^{(\log_3 7)^2} + b^{(\log_7 11)^2} + c^{(\log_{11} 25)^2}$

2. If $(x+1) = 2\log_2(2^x+3) - 2\left(\log_4(1980 - 2^{-x})\right)$ then the sum of the roots of the equation is $\log_2 k$ then $\frac{k}{2}$ is

3. If $x = \sin\frac{2\pi}{7} + \sin\frac{4\pi}{7} + \sin\frac{8\pi}{7}$ and $y = \cos\frac{2\pi}{7} + \cos\frac{4\pi}{7} + \cos\frac{8\pi}{7}$ then $x^2 + y^2$ is

4. If the value of tan 100º + 4 sin 100º is α, then find the value of α^2

5. If $y = 3e^{2x} + 2e^{3x}$, then $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y =$

6. $\lim_{x\to 0} \frac{\sqrt{x^2+1}-1}{\sqrt{x^2+16}-4} =$

Space For Rough Work

QP Code: 100687

ANSWERS

SECTION-1 : PHYSICS

PART – A

1.	A	2.	D	3.	A	4.	D
5.	B	6.	A	7.	ABCD	8.	AB
9.	AD	10.	BD	11.	AC	12.	AC

PART – B

1.	2	2.	1.5	3.	2	4.	0.80
5.	8	6.	4.00				

SECTION – 2 : CHEMISTRY

PART – A

1.	B	2.	C	3.	C	4.	B
5.	B	6.	B	7.	ABC	8.	ABCD
9.	AD	10.	ACD	11.	ABD	12.	ABCD

PART – B

1.	1.6	2.	2.5	3.	1.5	4.	1.6
5.	6.4	6.	0.3				

SECTION – 3 : MATHEMATICS

PART – A

1.	D	2.	A	3.	C	4.	A
5.	A	6.	B	7.	AC	8.	BC
9.	AC	10.	ABCD	11.	BCD	12.	ABCD

PART – B

1.	469	2.	5.50	3.	2	4.	3
5.	0	6.	4				