

**FIITJEE COMMON TEST****PHYSICS, CHEMISTRY & MATHEMATICS****CODE:****Time Allotted: 3 Hours****Maximum Marks: 192**

- 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 Section.
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 & Part-B**
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 – 8)** contains 8 multiple choice questions which have only one correct answer. Each question carries **+3 marks** for correct answer and **- 1 mark** for wrong answer.

**PART – A (09 – 12)** contains 4 Multiple Choice Questions which have **One or More Correct** answer.

For each question in the group **Q. 9 – 12** of **PART – A** you will be awarded

*Full Marks: +4* If only the bubble(s) corresponding to all the correct option(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 6 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 :** \_\_\_\_\_

BATCHES – NWCM82201S, NWCM2022X1R, NWCM2022Y1R, NWCM2022A1R, NWCM2022A2R, NWCM2022A1W, NWCM2022A2W, NWCM2022A3W, NWCM2022A4W, NWCM2022X1W, NWCM2022Y1W, NWCM2022Z1W, NWCM2022XA1W, NWCM2022XA2W, PANINI2022-XI-1, PANINI2022-XI-2, & PANINI2022-G-1

## Section – I (Physics)

## PART – A

## (Single Correct Choice Type)

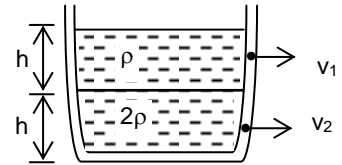
This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

1. A tank has a small hole made at its bottom. The time needed to empty the tank from level  $h_1$  to  $h_2$  will be proportional to

(A)  $h_1 + h_2$                       (B)  $\sqrt{h_1} + \sqrt{h_2}$                       (C)  $h_1 - h_2$                       (D)  $\sqrt{h_1} - \sqrt{h_2}$

1. **D**

2. Equal volumes of two immiscible liquids of densities  $\rho$  and  $2\rho$  are filled in a vessel as shown in figure. Two small holes are punched at depth  $h/2$  and  $3h/2$  from the surface of lighter liquid. If  $v_1$  and  $v_2$  are the velocities of efflux at these two holes, then  $v_1/v_2$  is



(A)  $\frac{1}{2\sqrt{2}}$                       (B)  $\frac{1}{2}$                       (C)  $\frac{1}{4}$                       (D)  $\frac{1}{\sqrt{2}}$

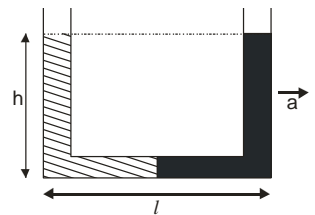
2. **D**

3. A ball of mass  $m$  and radius  $r$  is released in viscous liquid. The value of its terminal velocity is proportional to

(A)  $(1/r)$  only                      (B)  $m/r$                       (C)  $(m/r)^{1/2}$                       (D)  $m$  only

3. **B**

4. A U-tube of base length  $\ell$  filled with same volume of two liquids of densities  $\rho$  and  $2\rho$  is moving with an acceleration  $a$  on the horizontal plane. If the height difference between the two surfaces (open to atmosphere) becomes zero, then the height  $h$  is given by



(A)  $\frac{a}{2g}\ell$                       (B)  $\frac{3a}{2g}\ell$

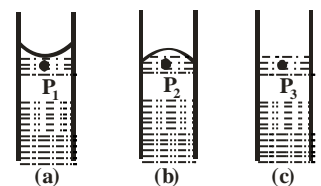
(C)  $\frac{a}{g}\ell$                       (D)  $\frac{2a}{3g}\ell$

4. **B**

5. Compare the pressure at the point P in the three tubes shown in the figure :

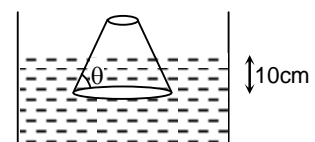
(A)  $P_2 > P_1 > P_3$                       (B)  $P_3 > P_1 > P_2$

(C)  $P_1 > P_3 > P_2$                       (D)  $P_2 > P_3 > P_1$



5. **D**

6. A conical flask of mass  $10\text{ kg}$  and base area  $10^3\text{ cm}^2$  is floating in liquid of specific gravity  $1.2$  as shown in the figure. The force that liquid exerts on curved surface of conical flask is ( $g = 10\text{ m/s}^2$ ). Neglect atmospheric pressure.



(A)  $20\text{ N}$  in downward direction

(B)  $40\text{ N}$  in downward direction

(C)  $20\text{ N}$  in upward direction

(D)  $40\text{ N}$  in upwards direction

6. **A**

7. An ice is floating in water in a tank. As the ice melts, the level of water in the tank will

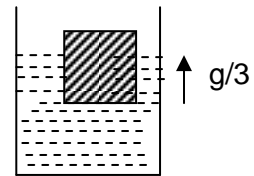
(A) rise                      (B) fall

(C) first rise then fall

(D) remain unchanged

7. **D**

8. A cubical block is floating in a liquid with half of its volume immersed in the liquid. When the whole system accelerates upwards with a net acceleration of  $g/3$ . The fraction of volume immersed in the liquid will be
- (A)  $1/2$  (B)  $> 1/2$   
(C)  $< 1/2$  (D) data insufficient

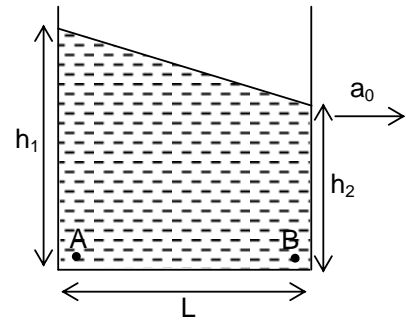


8. **A**

**(Multi Correct Choice Type)**

This section contains 4 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

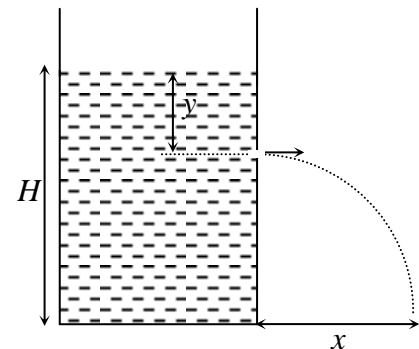
9. Figure shows an accelerating container containing liquid of density  $\rho$ . Let  $P_A$  &  $P_B$  be pressures at point A and B respectively at same horizontal level which are separately by distance  $L$ . Then:



- (A)  $P_A = P_B$   
(B)  $P_A < P_B$   
(C)  $P_A > P_B$   
(D)  $P_A = P_B + \rho g(h_1 - h_2) + \rho(a_0)L$

9. **C**

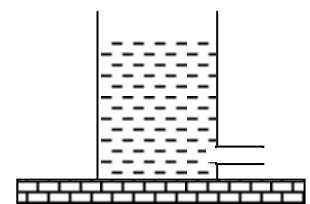
10. A tank, which is open at the top, contains a liquid up to a height  $H$ . A small hole is made in the side of the tank at a distance  $y$  below the liquid surface. The liquid emerging from the hole lands at a distance  $x$  from the tank
- (A) if  $y$  is increased from zero to  $H$ ,  $x$  will first increase and then decrease.  
(B)  $x$  is maximum for  $y = H/2$   
(C) the maximum value of  $x$  is  $H$ .  
(D) the maximum value of  $x$  will depend on the density of the liquid.



10. **ABC**

11. A liquid of density  $\rho$  comes out with a velocity  $v$  from a horizontal tube of area of cross-section  $A$ . The reaction force exerted by the liquid on the tube is  $F$ .

- (A)  $F \propto v$  (B)  $F \propto v^2$   
(C)  $F \propto A$  (D)  $F \propto \rho$

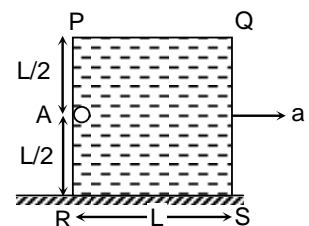


11. **BCD**

12. A small solid ball of density  $\rho$  is held inside at point A a cubical container of side  $L$ , filled with an ideal liquid of density  $4\rho$  as shown in the figure. Now, if the container starts moving with constant acceleration  $a$  horizontally and the ball is released from point A simultaneously, then

- (A) For ball to hit the top of container at end Q,  $a = 3g$   
(B) For ball to hit the top of container at end Q,  $a = 2g$

- (C) Ball hits the top of container at end Q after a time  $t = \sqrt{\frac{L}{3g}}$



(D) Ball hits the top of container at end Q after a time  $t = \sqrt{\frac{2L}{3g}}$

12. **BC**

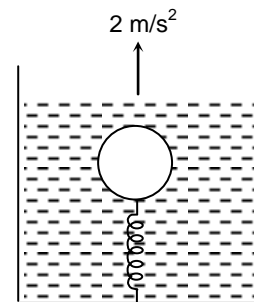
**PART – B**  
**(Numerical Based)**

This section contains 06 Numerical based questions, the answer of which may be positive or negative numbers or decimals (e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30)

1. A ball of mass  $m$  and density  $\rho$  is immersed in a liquid of density  $3\rho$  at a depth  $h$  and released. If the height will the ball jump up above the surface of liquid is  $H$  then find the value of  $H/h$  (neglect the resistance of water and air).

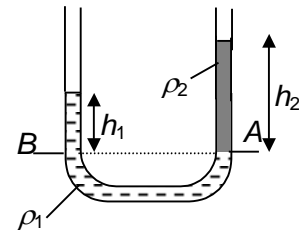
1. **2**

2. A ball of mass 10 kg and density  $1 \text{ gm/cm}^3$  is attached to the base of a container having a liquid of density  $1.1 \text{ gm/cm}^3$ , with the help of a spring as shown in the figure. The container is going up with an acceleration  $2 \text{ m/s}^2$ . If the spring constant of the spring is  $800 \text{ N/m}$ , then find the elongation (in cm) in the spring



2. **1.50**

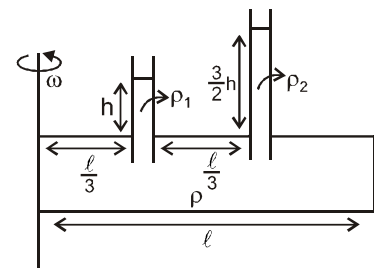
3. Two immiscible liquids are placed on a U-tube having densities  $\rho_1$  and  $\rho_2$ . Find the ratio of  $\frac{h_1\rho_1}{h_2\rho_2}$  :



3. **1**

4. The manometers inserted in a rotating liquid tube have different liquid columns of heights  $h$  and  $\frac{3h}{2}$  find the value of

$$\frac{\rho_1}{\rho_2} \times 10$$



4. **3.75**

5. A container, where bottom has round holes with diameter  $0.1 \text{ mm}$  is filled with water. The maximum height in cm upto which water can be filled without leakage is found to be  $x$  centimetre. [Surface Tension =  $75 \times 10^{-3} \text{ N/m}$  and  $g = 10 \text{ m/s}^2$ ]. Find value of  $x$ .

5. **30**

6. Two soap bubbles of radii  $2 \text{ mm}$  and  $4 \text{ mm}$  are brought in contact. If the surface tension of liquid is  $7 \times 10^{-2} \text{ Nm}^{-1}$ . Then the radius of the common surface is  $n \times 10^{-3} \text{ m}$  find  $n$ .

6. **4**

*space for rough work*

## Section – II (Chemistry)

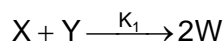
## PART – A

(Single Correct Choice Type)

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONLY ONE is correct.

1. The rate law for a reaction:  $2A + B \longrightarrow \text{Products}$  is  $\text{rate} = k[A]^n[B]^m$  on doubling the concentration of A and halving the concentration of B, the ratio of the new rate to the earlier rate of reaction will be
- (A)  $\frac{1}{2}^{m+n}$  (B)  $(m+n)$   
 (C)  $n-m$  (D)  $2^{n-m}$
1. D

2. A complex reaction  $2X + Y \longrightarrow Z$  takes place in 2 steps



If  $K_1 \ll K_2$ , then the order of the reaction will be

- (A) 1 (B) 2  
 (C) 3 (D) 0

2. B

3. The time taken in 75% completion of a zero order reaction is 10 hr. In what time the reaction will be 90% completed?

- (A) 12.0 hr (B) 16.6 hr  
 (C) 10.0 hr (D) 20.0 hr

3. A

4. As per collision theory, rate constant is given by

$$k = P.A.e^{-E_a/RT}$$

Which factor should register a decrease for the reaction to proceed more rapidly?

- (A) T (B) A  
 (C)  $E_a$  (D) P

4. C

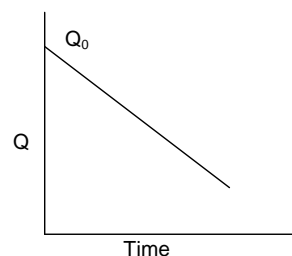
5. A positron is emitted from  ${}_{11}^{23}\text{Na}$ . The ratio of the atomic mass and atomic number of the resulting nuclide is

- (A)  $\frac{22}{10}$  (B)  $\frac{22}{11}$   
 (C)  $\frac{23}{10}$  (D)  $\frac{23}{12}$

5. C

6. In the reaction  $P + Q \longrightarrow R + S$

The time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the figure. The overall order of the reaction



- (A) 2 (B) 3  
 (C) 0 (D) 1

6. D

7. Match the compounds in List-I with its proper use in list –II and choose the correct answer:

List-I		List-II	
(1)	Borax	(a)	Mordant
(2)	Orthoboric acid	(b)	Qualitative analysis
(3)	Anhydrous $\text{AlCl}_3$	(c)	Friedal Craft Reaction
(4)	Alum	(d)	Enamels and glazer for potter and tiles

	a	b	c	d
(A)	1	2	3	4
(B)	4	3	2	1
(C)	4	1	3	2
(D)	3	4	2	1

7. C

8. Producer gas is the mixture of

(A) CO and  $\text{N}_2$  (B) CO and  $\text{H}_2$   
 (C)  $\text{N}_2$  and  $\text{NH}_3$  (D) CO,  $\text{H}_2$  and  $\text{N}_2$

8. A

**(Multi Correct Choice Type)**

This section contains 4 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

9. Which of the following carbides on treatment with water give methane?

(A)  $\text{CaC}_2$  (B)  $\text{Be}_2\text{C}$   
 (C)  $\text{Al}_4\text{C}_3$  (D)  $\text{Mg}_2\text{C}_3$

9. BC

10. Initial concentration of reactant for nth order reaction is  $C_0$ . Which of the following relation is/are not correct about  $t_{1/2}$  of the reaction?

(A)  $\ln t_{1/2} = \text{Constant} - (n - 1) \ln C_0$  (B)  $\ln t_{1/2} = \ln n + \text{Constant} - \ln C_0$   
 (C)  $t_{1/2} \cdot \ln = \text{Constant} + \ln C_0$  (D)  $t_{1/2} = n \ln C_0$

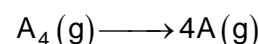
10. BCD

11. For a reversible reaction  $\text{A} \rightleftharpoons \text{B}$ ;  $\Delta H = -2 \text{ kcal}$ , the pre-exponential factors are same for the forward and backward reactions. If the activation energy of backward reaction is 8 kcal/mol, then which of the following statement is correct about the reaction?

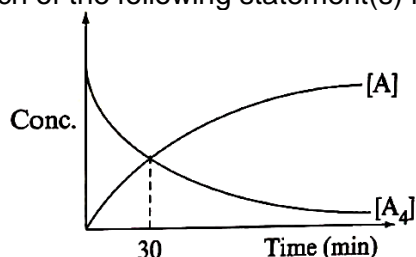
(A) The activation energy of forward reaction is 6 kcal/mol  
 (B) At 500 K, the fraction of 'A' molecules crossing the energy barrier for forward reaction is  $e^{-6}$   
 (C) At 500 K, the fraction of 'B' molecules crossing the energy barrier for backward reaction is  $e^{-8}$   
 (D) Equilibrium constant for the reaction is  $e^{-2}$  at 500 K

11. ABC

12. Consider the following first-order decomposition reaction.



Which of the following statement(s) is/are correct regarding the reaction? ( $\log 2 = 0.3$ )



(A) at 30 min, only 20% reaction is complete  
 (B)  $t_{1/2}$  of reaction is 90 min  
 (C) rate of reaction decreases linearly with time

12. (D) the time for intersection of two curves is independent of initial concentration of  $A_4$   
ABD

**PART – B**  
**(Numerical Based)**

This section contains 06 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)

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1. What is the value of 'x' in the following silicate mineral  $Be_3Al_2Si_xO_{18}$   
1. 6
2. Borax is represented as  $Na_2[B_4O_5(OH)_4] \cdot 8H_2O$ . How many tetrahedral boron atoms are present in the structure of borax?  
2. 2
3. In the presence of excess thiocyanate ion ( $SCN^-$ ) the following reaction is first order in chromium(III) ion, the rate constant is  $9.0 \times 10^{-5} s^{-1}$ .  
 $Cr^{+3}(aq) + SCN^-(aq) \longrightarrow Cr(SCN)^{+2}(aq)$   
If 80% of the reaction is required to obtain a noticeable colour from formation of  $Cr(SCN)^{+2}$  ion, then how many hours are required? ( $\ln 5 = 1.62$ )  
3. 5
4. If 0.01% of a substance undergoing decomposition is consumed in 1 minute when the concentration is 0.02 M and in 0.25 minutes when the concentration is 0.04 M. The order of reaction is  
4. 3
5. The rate constant for a reaction is  $1.5 \times 10^{-2} mol^{-1} Ls^{-1}$ . The order of reaction is  
5. 2
6.  ${}_{90}^{234}Th$  decays to give  ${}_{82}^{206}Pb$  as the final product, if no. of  $\alpha$ -particles and  $\beta$ -particles emitted are m and n respectively (m – n) is  
6. 1

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*space for rough work*

**Section – III (Mathematics)****PART – A****(Single Correct Choice Type)**

This section contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

1. The line  $2x + \sqrt{6}y = 2$ , is a tangent to the curve  $x^2 - 2y^2 = 4$ . The point of contact is  
 (A)  $(4 - \sqrt{6})$  (B)  $(7, -2\sqrt{6})$   
 (C) (2, 3) (D)  $(\sqrt{6}, 1)$
1. **A**
2. S and T are the foci of an ellipse and B is an end of the minor axis. If STB is an equilateral triangle, the eccentricity of the ellipse is  
 (A) 1/4 (B) 1/3  
 (C) 1/2 (D) 2/3
2. **C**
3. A circle is drawn on the major axis of the ellipse  $9x^2 + 16y^2 = 144$  as diameter. The equation of the circle is  
 (A)  $x^2 + y^2 = 4$  (B)  $x^2 + y^2 = 3$   
 (C)  $x^2 + y^2 = 16$  (D)  $x^2 + y^2 = 9$
3. **C**
4. An ellipse passes through the point (4, -1) and its axes are along the axes of co – ordinates. If the line  $x + 4y - 10 = 0$  is a tangent to it then its equation is  
 (A)  $\frac{x^2}{100} + \frac{y^2}{5} = 1$  (B)  $\frac{x^2}{80} + \frac{y^2}{5/4} = 1$   
 (C)  $\frac{x^2}{20} + \frac{y^2}{5} = 2$  (D) none of these
4. **B**
5. The equation of the tangent to the hyperbola  $4y^2 = x^2 - 1$  at the point (1, 0) is  
 (A)  $x = 1$  (B)  $y = 1$   
 (C)  $y = 4$  (D)  $x = 4$
5. **A**
6. Let  $e_1$  and  $e_2$  be the eccentricities of a hyperbola and its conjugate hyperbola. If  $e_1$  and  $e_2$  are the roots of  $x^2 - ax + 2 = 0$ , then the value of a is  
 (A) 8 (B) 4  
 (C)  $2\sqrt{2}$  (D) 2
6. **C**
7. The distance between the directrices of the ellipse  $9x^2 + 4y^2 = 36$  is  
 (A)  $\frac{9}{\sqrt{5}}$  units (B)  $\frac{24}{\sqrt{5}}$  units  
 (C)  $\frac{18}{\sqrt{5}}$  units (D) none of these
7. **C**



8. The equation of hyperbola confocal (having same foci) with the ellipse  $\frac{x^2}{25} + \frac{y^2}{9} = 1$  and having eccentricity 2 is
- (A)  $\frac{x^2}{4} + \frac{y^2}{12} = 1$  (B)  $\frac{x^2}{4} - \frac{y^2}{12} = 1$
- (C)  $\frac{x^2}{12} + \frac{y^2}{4} = 1$  (D)  $\frac{x^2}{12} - \frac{y^2}{4} = 1$

8. B

**(Multi Correct Choice Type)**

This section contains 4 **multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONE OR MORE** may be correct.

9. Let  $F_1, F_2$  be the foci of the ellipse and PT and PN be the tangent and the normal respectively to the ellipse at the point P, then
- (A) PN bisects the angle  $\angle F_1PF_2$  (B) PT bisects  $\angle F_1PF_2$
- (C) PT bisects angle  $(180^\circ - \angle F_1PF_2)$  (D)  $PF_1 + PF_2 = \ell$  (major axis)
9. ACD
10. A tangent to hyperbola  $3x^2 - y^2 = 3$  is parallel to the line  $y = 2x + 4$ . Its equation may be
- (A)  $y = 2x + 3$  (B)  $y = 2x + 1$
- (C)  $y = 2x - 1$  (D)  $y = 2x + 2$
10. BC

11. The equation  $\frac{x^2}{16-\lambda} + \frac{y^2}{8-\lambda} = 1$ , ( $\lambda \neq 8, 16$ ) represents
- (A) an ellipse if  $0 < \lambda < 8$  (B) a hyperbola if  $8 < \lambda < 16$
- (C) a rectangular hyperbola if  $\lambda = 12$  (D) no real curve if  $\lambda > 16$

11. ABCD

12. The focal distances of a point  $P(a \cos \theta, b \sin \theta)$  on the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  with eccentricity  $e$  are
- (A)  $a + a e \cos \theta$  (B)  $a + e \cos \theta$
- (C)  $a - a e \cos \theta$  (D)  $a - e \cos \theta$
12. AC

**PART – B**  
**(Numerical Based)**

This section contains 06 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)

1. If the foci of  $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$  and  $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$  coincide then  $b^2$  is equal to
1. 7
2. If the line  $y = x + k$  touches the ellipse  $9x^2 + 16y^2 = 144$  then  $|k|$  is equal to
2. 5

3. If the eccentricity of a hyperbola whose conjugate axis is half the distance between its foci is  $e$ , then  $\sqrt{3}e$  is equal to
3. 2
4. The sum of focal distances of any point on the ellipse  $x^2 + 4y^2 + 8y - 2x + 1 = 0$  is
4. 4
5. The maximum distance of any normal of the ellipse  $9x^2 + 16y^2 = 144$  from its centre is
5. 1
6. The area of quadrilateral formed by the foci of  $\frac{x^2}{4} - \frac{y^2}{3} = 1$  and its conjugate is  $2A$  square units. The value of  $A$  is
6. 7

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*space for rough work*