

**PHYSICS, CHEMISTRY & MATHEMATICS**

Pattern - CPT-1

QP Code: 100190

PAPER - 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.
- (ii) **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 to **Two Places** (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 : \_\_\_\_\_

## **SECTION-1 : PHYSICS**

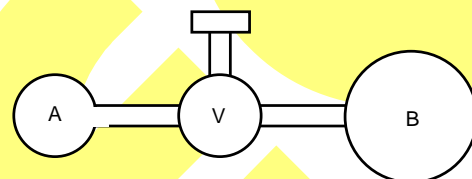
### **PART – A**

#### **(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.

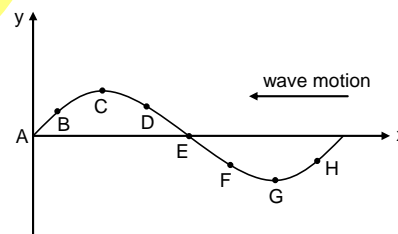
1. The  $(x, y)$  co-ordinates of the corners of a square plate are  $(0,0)$ ,  $(L,0)$ ,  $(L,L)$  and  $(0, L)$ . The edges of the plate are clamped and transverse standing waves are set up in it. If  $u(x, y)$  denotes the displacement of the plate at the point  $(x, y)$  at some instant of time, the possible expression(s) for  $u$  is (are) ( $a =$  positive constant)
- (A)  $a \cos(\pi x / 2L) \cos(\pi y / 2L)$                       (B)  $a \sin(\pi x / L) \sin(\pi y / L)$   
 (C)  $a \sin(\pi x / L) \sin(2\pi y / L)$                       (D)  $a \cos(2\pi x / L) \sin(\pi y / L)$

2. Two soap bubbles A and B are formed at the two open ends of a tube. The bubble A is smaller than bubble B. If valve  $v$  is opened and air can flow freely between the bubbles then
- (A) there is no change in the size of the bubbles.  
 (B) the two bubbles will become of equal size.  
 (C) A will become smaller and B will become larger.  
 (D) B will become smaller and A will become larger.



3. A vibrating string produces 2 beats per seconds when sounded with a tuning fork of frequency 256 Hz. increasing the tension in the string produces 3 beats per second. The initial frequency of the string may have been
- (A) 253 Hz    (B) 254 Hz  
 (C) 258 Hz    (D) 259 Hz

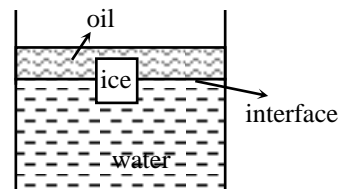
4. A transverse wave is travelling along a stretched string from right to left. The figure shown represents the shape of the string (snap shot) at a given instant. At this instant:
- (A) the particles at A, B and H have upward velocity.  
 (B) the particles at D, E and F have downward velocity.  
 (C) the particles at C, E and G have zero velocity.  
 (D) the particles at A and E have maximum velocity.



5. A closed organ pipe of length 28 cm closed at one end is found to be at resonance when a tuning fork of frequency 850 Hz is sounded near the open end. If velocity of sound in air is 340 m/s, then the
- (A) air in the pipe is vibrating in fundamental mode  
 (B) air in the pipe is vibrating in first overtone  
 (C) end correction of the pipe is 1 cm  
 (D) end correction of the pipe is 2 cm

*Space For Rough Work*

6. An ice cube is floating in water above which a layer of a lighter oil is poured. As the ice melts completely, the level of the upper most level of oil will
- (A) rise (B) fall  
(C) not change (D) data insufficient



7. Two bodies A and B have thermal emissivity of 0.01 and 0.81 respectively. The outer surface areas of the two bodies are equal. The two bodies emit total radiant power at the same rate. The wavelength  $\lambda_B$  corresponding to maximum spectral radiancy in the radiation from B to shifted from the wavelength corresponding to maximum spectral radiancy in the radiation from A by  $1 \mu\text{m}$ . If the temperature of A is 5802 K,
- (A) The temperature of B is 1934 K (B)  $\lambda_B = 1.5 \mu\text{m}$   
(C) The temperature of B is 1160 K (D) The temperature of B is 2901 K

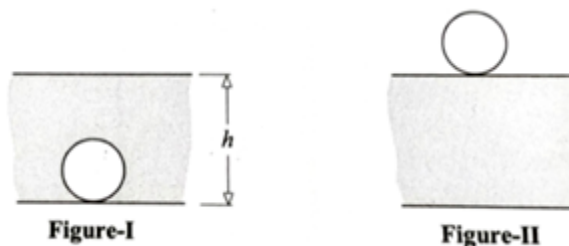
**(Single Correct Choice Type)**

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. The power of sound from a speaker is raised from 10 mW to 500 mW. What is the power increased in (decibel) dB as compared to initial original power is ( $\log_{10} 50 = 1.69$ )
- (A) 1.6 dB (B) 50 dB  
(C) 16.9 dB (D) 6.9 dB
9. A metal wire of length L area of cross section A and young's modulus Y is stretched by a variable force F such that F is always slightly greater than the elastic forces of resistance in the wire when the elongation of the wire is l.
- (A) the work done by F is  $\frac{YAl^2}{2L}$   
(B) the work done by F is  $\frac{YAl^2}{L}$   
(C) the elastic potential energy stored in the wire is  $\frac{2YAl^2}{L}$   
(D) the elastic potential energy stored in the wire is  $\frac{YAl^2}{L}$
10. A monoatomic gas expands at constant pressure on heating. The percentage of heat supplied that increases the internal energy of the gas and that is involved in the expansion is
- (A) 75%, 25% (B) 25%, 75%  
(C) 60%, 40% (D) 40%, 60%

*Space For Rough Work*

11. The volume of  $n$  moles of an ideal gas with degree of freedom  $f$  is varied according to the law  $V = \frac{a}{T}$  where  $a$  is a constant. The amount of heat received by the gas in this process if the gas temperature is increased by  $\Delta T$  is
- (A)  $n\left[\frac{f}{2}-1\right]R\Delta T$       (B)  $n\left[\frac{f}{2}+1\right]R\Delta T$       (C)  $n[f+2]R\Delta T$       (D)  $n\left[\frac{f}{2}+2\right]R\Delta T$
12. In figure-I is shown a sphere of mass  $m$  and radius  $r$  resting at the bottom of a large container filled with water. Depth of the container is  $h$ . Density of material of the sphere is the same as that of water. Now the whole sphere is slowly pulled out of water as shown in figure-II.



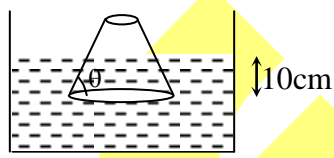
Work done by the agent pulling the sphere equals to

- (A)  $mgr$       (B)  $0.5 mgr$       (C)  $mg(0.5r + h)$       (D)  $mg(r + h)$
13. A Completely filled closed aquarium is kept on a weighing machine. It can be assumed that the density of the fish is greater than the density of the water. The total mass of the aquarium and its contents put together is  $M$ . If now all the fish start accelerating upwards with a acceleration  $A$ , then the correct option is
- (A) The weight recorded will be equal to  $Mg$ .  
 (B) The weight recorded will be less than  $Mg$ .  
 (C) The weight reading will be more than  $Mg$ .  
 (D) No conclusion can be drawn from the given information.

### PART – B (Numerical based)

1. If P-V diagram of a diatomic gas is plotted, it is a straight line passing through origin. The molar heat capacity of the gas in the process is  $x \text{ J K}^{-1} \text{ mol}^{-1}$ . Find the value of 'x'. (Given:  $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$ )
2. An organ pipe  $P_1$  closed at one end vibrating in its first overtone and another pipe  $P_2$  open at the both ends vibrating in its third overtone are in resonance with a given tuning fork. The ratio of the length of  $P_1$  to that of  $P_2$  is  $k$  then  $k = ?$

*Space For Rough Work*

3.  $n$ th harmonic of a closed organ pipe is equal to  $m$ th harmonic of an open pipe. First overtone frequency of the closed organ pipe is also equal to first overtone frequency of the open organ pipe. Find the value of  $\frac{n}{m}$ , if  $m = 6$ .
4. A conical flask of mass 10 kg and base area  $10^3 \text{ cm}^2$  is floating in liquid of specific gravity 1.2 as shown in the figure. Find the force (in N) that liquid exerts on curved surface of conical flask is ( $g = 10 \text{ m/s}^2$ )
- 
5. A string is stretched along the  $X$  axis. A disturbance given by the equation  $y(x,t) = 4 \sin\left(\frac{\pi x}{3}\right) \cos 10\pi t$ . Where  $X$  is in cm and  $t$  is in seconds. Distance between two adjacent nodes is  $n$  meter, then  $n = ?$

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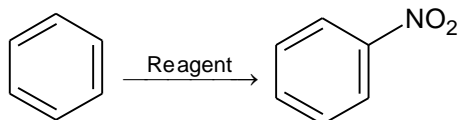
## SECTION-2 : CHEMISTRY

### 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.

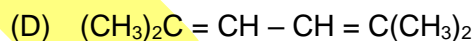
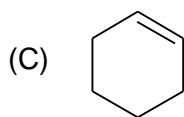
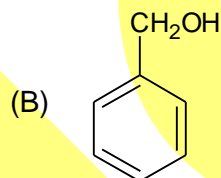
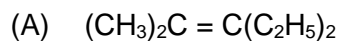


Which reagent(s) can be used for the above reaction?

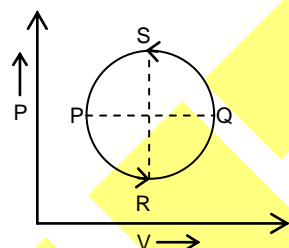
- (A) Conc.HNO<sub>3</sub>/Conc.H<sub>2</sub>SO<sub>4</sub>                      (B) NO<sub>2</sub>ClO<sub>4</sub>/Δ  
 (C) KNO<sub>2</sub>    (D) N<sub>2</sub>O<sub>5</sub>/Δ

2.

Which of the following compound(s), on hot acidified permanganate oxidation produces dicarboxylic acids?



3.

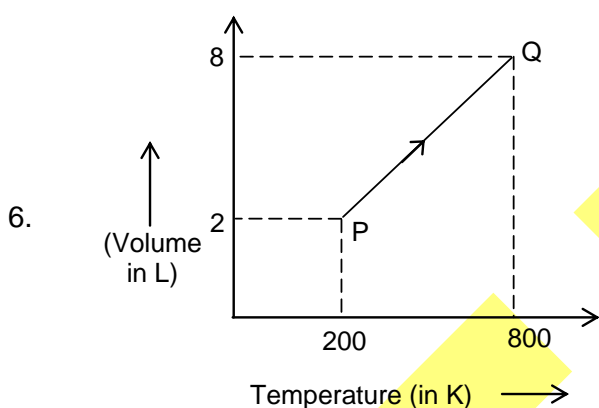
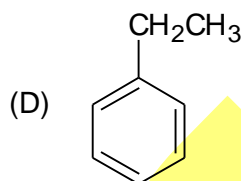
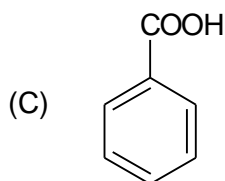
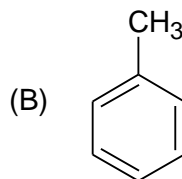
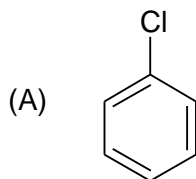


Choose correct statement

- (A) expansion of volume takes place along path
- (B) maximum PV-work can be done along path
- (C) total work done due to volume change along the circular path is positive
- (D) compression of volume takes place along the path

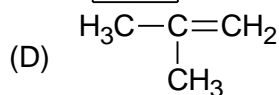
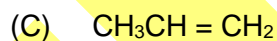
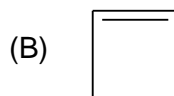
*Space For Rough Work*

4. Which of the following is/are intensive properties?  
 (A) Specific heat capacity (B) Heat capacity  
 (C) Molar heat capacity (D) Molarity
5. Which of the following compound(s) is/are more reactive than benzene towards  $\text{Cl}^+$  ion?



Choose correct statement(s) regarding above thermodynamic process?

- (A) It is an isobaric process  
 (B) It is an irreversible process  
 (C) The work done in the process is 600 R unit if one mole of gas is taken in the system  
 (D) It is accompanied with cooling of system
7. Which of the following compound(s) form(s) more than one monosubstituted product with N-bromosuccinamide(NBS) in presence of sunlight? (Consider rearrangement of reaction intermediates)

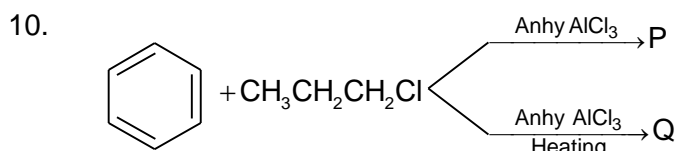


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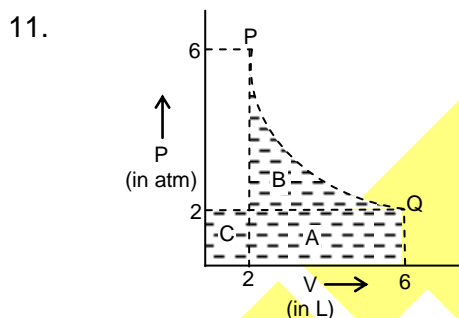
**(Single Correct Choice Type)**

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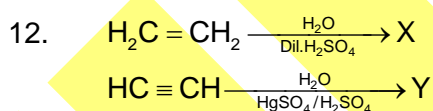
8. In which thermodynamic process, the amount of heat absorbed by the system, is completely utilized to increase the internal energy?  
 (A) Isothermal process (B) Adiabatic process  
 (C) Isobaric process (D) Isochoric process
9. Which of the following can form salt with  $\text{NaNH}_2$ ?  
 (A) Position isomer of  $\text{CH}_3\text{C}\equiv\text{CCH}_3$  (B) Functional isomer of  $\text{CH}_3\text{C}\equiv\text{CCH}_3$   
 (C) Ring-chain isomer of  $\text{CH}_3\text{C}\equiv\text{CCH}_3$  (D) None of these



- The correct statement between product(s) 'P' and 'Q' is  
 (A) both forms same number of monochloro products  
 (B) both can decolourise hot alkaline  $\text{KMnO}_4$  solution  
 (C) 'P' is aromatic and 'Q' is non-aromatic compound  
 (D) Both are formed through a common reaction intermediate



- The work done at 2 atm pressure is equal to the area(s) marked with  
 (A) A + C (B) A + B (C) only A (D) only B



- In above reaction, X and Y  
 (A) contain same functional group  
 (B) can react with each other to form a hydrocarbon containing four carbon atoms  
 (C) are produced in above reaction through same reaction intermediate  
 (D) when heated with conc.  $\text{H}_2\text{SO}_4$  'X' forms an alkene

Space For Rough Work



13. The entropy change of a reversible process can be expressed as

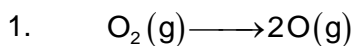
$$(A) \int ds = \int \frac{q_{\text{rev}}}{T}$$

$$(B) \int \Delta s = \int \frac{q_{\text{rev}}}{T}$$

$$(C) \Delta s = \frac{\Delta q_{\text{rev}}}{T}$$

$$(D) \int ds = \int \frac{\Delta q_{\text{rev}}}{T}$$

**PART – B**  
**(Numerical based)**

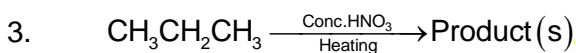


What is the change in heat capacity ( $\Delta C_P$ ) of the reaction at constant volume in  $\text{J mol}^{-1}$  unit? Heat capacity of monoatomic gas at constant volume =  $\frac{3R}{2}$

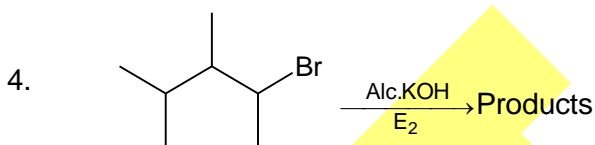
Heat capacity of diatomic gas at constant volume =  $\frac{5R}{2}$

[ $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$ ]

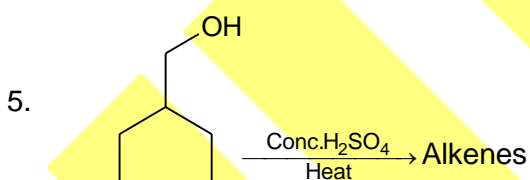
2. For a spontaneous process the value of  $\Delta G$  is  $-2.5 \text{ kJ mol}^{-1}$ . The enthalpy change when the process is carried out at  $400 \text{ K}$  is  $+2.5 \text{ kJ mol}^{-1}$ . What will be the entropy change of the process ( $\Delta S$ ) in  $\text{J K}^{-1} \text{ mol}^{-1}$  unit?



How many maximum number of nitro alkane(s) can be formed in the above reaction?



If the number of alkenes produced in the above reaction is  $X$ , then  $\frac{X}{2}$  is (Consider stereoisomers)



How many alkene(s) is/are formed in the above reaction?

*Space For Rough Work*

**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.

- Slope of the common tangent(s) to the parabola  $y^2 = 12x$  and the hyperbola  $8x^2 - y^2 = 8$ .  
 (A) 3 (B) - 3  
 (C) 2 (D) - 2
- Let  $n = 3^{100}$ , then for n:  
 (A) unit's digit is 1 (B) ten's digit is 0  
 (C) unit's digit is 7 (D) ten's digit is 2
- For the hyperbola  $9x^2 - 16y^2 - 18x + 32y - 151 = 0$   
 (A) one of the directrix is  $x = \frac{21}{5}$  (B) Length of latus rectum =  $\frac{9}{2}$   
 (C) Foci are (5, 1) and (-4, 1) (D) eccentricity is  $\frac{5}{4}$
- For the natural numbers m, n if  $(1-y)^m (1+y)^n = 1 + a_1 y + a_2 y^2 + \dots + a_{m+n} y^{m+n}$   
 and  $a_1 = a_2 = 10$ , then the value of is equal to:  
 (A)  $m = 35$  (B)  $n - m = 10$   
 (C)  $(m+n) = 100$  (D)  $(m+n) = 80$
- $\sin^4 x + \cos^4 x = a$  has a real solution for  
 (A)  $a \in \mathbb{R}$  (B)  $a = \frac{1}{2}$   
 (C)  $a = \frac{3}{2}$  (D)  $a = \frac{1}{4}$

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*Space For Rough Work*

6. A hyperbola having the transverse axis of length  $\sqrt{2}$  has the same foci as that of the ellipse  $3x^2 + 4y^2 = 12$ , then this hyperbola does not pass through which of the following points?
- (A)  $\left(1, -\frac{1}{\sqrt{2}}\right)$  (B)  $\left(\sqrt{\frac{3}{2}}, \frac{1}{\sqrt{2}}\right)$   
 (C)  $\left(-\sqrt{\frac{3}{2}}, 1\right)$  (D)  $\left(\frac{1}{\sqrt{2}}, 0\right)$
7. If  ${}^{100}C_6 + 4 \cdot {}^{100}C_7 + 6 \cdot {}^{100}C_8 + 4 \cdot {}^{100}C_9 + {}^{100}C_{10}$  has the value equal to  ${}^x C_y$ ; then the possible value (s) of  $x + y$  can be:
- (A) 112 (B) 114  
 (C) 196 (D) 198

**(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. The number of 6 digit numbers hat can be formed using the digits 0, 1, 2, 5, 7 and 9 which are divisible by 11 and no digits is repeated, is
- (A) 36 (B) 60  
 (C) 72 (D) 48
9. If the co-ordinates of two points A and B are  $(\sqrt{7}, 0)$  and  $(-\sqrt{7}, 0)$  respectively and P is any point on the conic  $9x^2 + 16y^2 = 144$ , then  $PA + PB$  is equal to:
- (A) 8 (B) 16  
 (C) 9 (D) 6
10. The sum of all numbers of the form  $\frac{12!}{a!b!c!}$  where  $a, b, c \in \mathbb{N}$  satisfy  $a + b + c = 12$  is  $3^{3k}$  where 'k' is
- (A) 10 (B) 8  
 (C) 6 (D) 4
11. If k is the number of irrational terms in the expression of  $(3^{1/2} + 5^{1/3})^{120}$ , then  $k - 4$  is divisible by
- (A) 23 (B) 24  
 (C) 25 (D) 26

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*Space For Rough Work*

12. Let  $e_1$  and  $e_2$  are the eccentricities of the ellipse  $9x^2 + 16y^2 = 144$  and the hyperbola  $9x^2 - 12y^2 = 108$  respectively and  $(e_1, e_2)$  is a point on the ellipse  $16x^2 + 8y^2 = M$  then M is equal to  
(A) 16 (B) 17  
(C) 21 (D) 20
13. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is:  
(A)  $\sqrt{3}$  (B)  $3\sqrt{2}$   
(C)  $\frac{3}{\sqrt{2}}$  (D)  $2\sqrt{3}$

**PART – B**  
**(Numerical based)**

1. If the point P on the curve,  $4x^2 + 5y^2 = 20$  is farthest from the point Q(0, -4) then  $PQ^2$  is equal to:
2. If the radius of circle which touches x – axis at origin and the curve  $y = \frac{1}{x}$  is 'r', then the value of  $3\sqrt{3}r^2$  is
3. Two vertical poles of heights, 20 m and 80m stand a apart on a horizontal plane. The height (in meters) of the point of intersection of the lines joining the top of each pole to the foot of the other, from his horizontal plane is:
4. If the third term in the binomial expansion of  $(1 + x^{\log_2 x})^5$  equals 2560, then a possible value of x is:
5. A group of students comprises of 5 boys and n girls. If the number of ways, in which a team of 3 students can randomly be selected from this group such that there is at least one boy and at least one girl in each team, is 1750, then n is equal to:

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*Space For Rough Work*

# FIITJEE INTERNAL TEST

BATCHES: Two Year CRP(2224) A-lot\_PAPER-1  
PHASE TEST – III

PHYSICS, CHEMISTRY & MATHEMATICS

## ANSWER KEY

Paper Code  
**100190**

### SECTION-1 : PHYSICS

#### PART – A

- |       |       |       |        |
|-------|-------|-------|--------|
| 1. BC | 2. BD | 3. BC | 4. ABD |
| 5. BD | 6. B  | 7. AB | 8. C   |
| 9. A  | 10. D | 11. A | 12. A  |
| 13. A |       |       |        |

#### PART – B

- |          |                               |         |
|----------|-------------------------------|---------|
| 1. 29.43 | 2. 0.37 (range: 0.36 to 0.38) | 3. 1.50 |
| 4. 20    | 5. 0.03                       |         |

### SECTION – 2 : CHEMISTRY

#### PART – A

- |        |        |        |        |
|--------|--------|--------|--------|
| 1. ABD | 2. BCD | 3. ABC | 4. ACD |
| 5. BD  | 6. ABC | 7. AB  | 8. D   |
| 9. A   | 10. B  | 11. C  | 12. D  |
| 13. A  |        |        |        |

#### PART – B

- |                              |                             |
|------------------------------|-----------------------------|
| 1. 4.15 (range 4.08 to 4.18) | 2. 12.5(Range 12.4 to 12.6) |
| 3. 4                         | 4. 5                        |
|                              | 5. 3                        |

### SECTION – 3 : MATHEMATICS

#### PART – A

- |       |        |        |        |
|-------|--------|--------|--------|
| 1. AB | 2. AB  | 3. ABD | 4. ACD |
| 5. BC | 6. ACD | 7. BD  | 8. B   |
| 9. A  | 10. D  | 11. B  | 12. C  |
| 13. B |        |        |        |

#### PART – B

- |       |      |       |         |
|-------|------|-------|---------|
| 1. 36 | 2. 4 | 3. 16 | 4. 0.25 |
| 5. 25 |      |       |         |