

JEE EXPERT

STAYHOME#STAYSAFE CORONA KO STOP KARO NA AT LOCKDOWN, UNLOCK YOUR POTENTIAL PRACTICE TEST – 02

Time: 3 Hours

Maximum Marks: 240

INSTRUCTIONS

A. General Instructions

1. This booklet is your question paper. Answers have to be marked on the provided OMR sheets.
2. This question paper contains 23 questions. All questions are compulsory.
3. Rough spaces are provided for rough work inside the question paper. No additional sheets will be provided for rough work.
4. Blank Papers, clip boards, log tables, slide rule, calculator, cellular phones, pagers and electronic devices, in any form, are not allowed.
5. Write in your Name and the Enrolment No. in the space provided at the bottom of this page.

B. Filling of OMR Sheet

6. On the OMR sheet, write in ink your Name, Enrolment No., and Name of the centre and put your signature in the appropriate boxes.
7. Every question has four choices for its answers (A), (B), (C), (D)

C. Marking Scheme

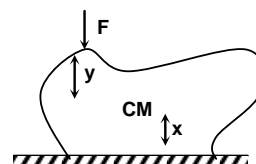
8. (i) Questions 1 to 7 have only one correct answer and carries **+3 marks** each for correct answer and **- 1 mark** for each wrong answer.
(ii) Questions 8 to 11 have one or more than one correct answer and carries **+4 marks** each for correct answer and **0 mark** for each wrong answer.
(iii) Questions 12 to 16 paragraph based multiple choice single correct and carries **+3 marks** each for correct answer and **- 1 mark** for each wrong answer.
(iv) Questions 1 to 7 are numerical based which has numerical value as answer and carries **+4 marks** each for correct answer and **0 mark** for each wrong answer.

PART - I: PHYSICS

SECTION – A Single Correct Answer Type

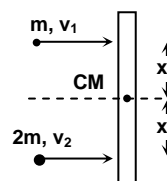
This section contains **7 multiple choice questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

1. A non-rigid body (like some object made of clay) is lying on a horizontal ground. A force F is applied at one of its point such that the point of application gets displaced by a distance y while due to this displacement, centre of mass of object gets displaced by x , then the work done by force F is (Assume both displacements x and y along the direction of F only).



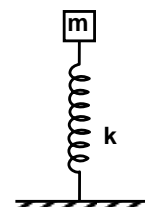
- (A) Fx (B) Fy
(C) Can't be determined (D) $F\left(\frac{x+y}{2}\right)$

2. The system shown is in a gravity free space. Both masses stop after collision with the rod. In which of the following cases does the rod translate only after collision? The situation given is just before collision. Thus, both the masses are very close to the rod at the instant shown and thus the collision can be assumed to be simultaneous.



- (A) $v_1 = 2 \text{ m/s}$, $v_2 = 1 \text{ m/s}$, $x_1 = 2 \text{ m}$, $x_2 = 3 \text{ m}$ (B) $v_1 = 2 \text{ m/s}$, $v_2 = 1 \text{ m/s}$, $x_1 = 1 \text{ m}$, $x_2 = 1 \text{ m}$
(C) $v_1 = 1 \text{ m/s}$, $v_2 = 1 \text{ m/s}$, $x_1 = 5 \text{ m}$, $x_2 = 2 \text{ m}$ (D) $v_1 = 1 \text{ m/s}$, $v_2 = 1 \text{ m/s}$, $x_1 = 1 \text{ m}$, $x_2 = 1 \text{ m}$

3. A block of mass m is attached to a spring of force constant k whose other end is fixed to a horizontal surface. Initially the spring is in its natural length and the block is released from rest. The average force acting on the surface by the spring till the instant when the block has zero acceleration for the first time is



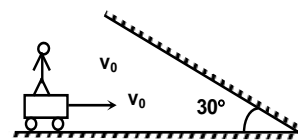
- (A) $\frac{mg}{\pi}$ (B) $\frac{2mg}{\pi}$
(C) $\frac{3mg}{\pi}$ (D) $\frac{4mg}{\pi}$

Space for rough work

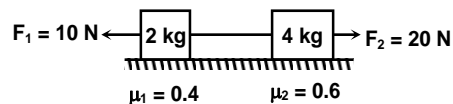
4. A car approaches an inclined wall (see in the figure) with speed v_0 on a horizontal road. When the horn of frequencies f_0 is sounded, the beat frequencies heard by the person on the car is (v = speed of sound)

(A) $\frac{v_0 f_0}{v - v_0}$
(C) $\frac{v_0 f_0}{2(v - v_0)}$

(B) $\frac{2v_0 f_0}{2v - v_0}$
(D) $\frac{2v_0 f_0}{v - v_0}$



5. Two blocks of masses 2 kg and 4 kg are connected through a massless inextensible string. The co-efficient of friction between 2 kg block and ground is 0.4 and the coefficient of friction between 4 kg block and ground is 0.6.

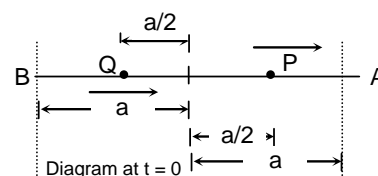


Two forces $F_1 = 10$ N and $F_2 = 20$ N are applied on the blocks as shown in the figure. Calculate the frictional force between 4 kg block and ground (Assume initially the tension in the string was just zero before forces F_1 and F_2 were applied)

(A) 24 N
(C) 18 N

(B) 8 N
(D) 10 N

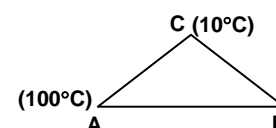
6. Two particle P and Q are executing simple harmonic motion along X-axis with their mean position at origin. They have same amplitude 'a' and frequency 'f' of oscillation. At the certain instant, they are found at a distance 'a/2' from the origin on opposite side but their velocities are found to be in the same direction. The phase difference between the oscillation of two particles, is



(A) $\pi/2$
(C) $4\pi/3$

(B) $\pi/4$
(D) $5\pi/3$

7. Three rods AB, BC and AC are made of same material. AC and BC are having length ℓ each and length of AB is 2ℓ . Cross-section area of all the three is same. If the temperature of end A and C is maintained at 100°C and 10°C respectively, then temperature of end B is



(A) 55°C
(C) 36.7°C

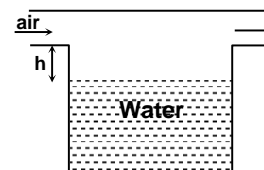
(B) 30°C
(D) 40°C

Space for rough work

Multiple Correct Answers 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.

8. The velocity of air through a thin horizontal tube in a spray device (see the figure) is v and density ρ . The density of water inside the pot is ρ_w . h is the depth of the top surface of the water from the tube. Then

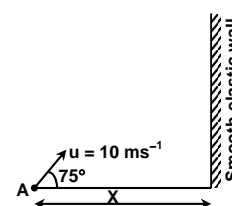


- (A) the maximum value of h for successful spray is $\frac{\rho v^2}{2\rho_w g}$
 (B) the maximum value of h for successful spray is $\frac{\rho v^2}{\rho_w g}$
 (C) the maximum value of h for successful spray is $\frac{\rho v^2}{2g}$
 (D) the work done by air raises the level of water.

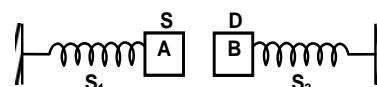
9. A particle is projected with a velocity of 10 m/s at an angle of 75° with the horizontal, then

- (A) The value of 'X' for the ball to return to its initial point of projection is 2.5m.
 (B) The value of 'X' for the ball to return to its initial point of projection is 5m.

- (C) The horizontal component of velocity is $\frac{5(\sqrt{3}-1)}{\sqrt{2}}$.
 (D) The horizontal component of velocity is $\frac{10(\sqrt{3}-1)}{\sqrt{2}}$



10. A source S is fixed on a block A which is attached to the free end of spring S_1 . The source emits sound of frequency 300 Hz. The detector D is fixed to block B which is attached to free end of spring S_2 . Both the blocks are simultaneously displaced towards each other through some distance and then left to vibrate. If the frequency of oscillation of each block is 2 Hz and amplitude of oscillation of each block is 1 m, then what can you state above the sound heard by detector D? (Neglect the effect of gravity, velocity of sound = 330 m/s.)



- (A) Its maximum frequency will be approximately 324 Hz.
 (B) Its minimum frequency will be approximately 278 Hz.
 (C) Its maximum frequency will be approximately 302 Hz.
 (D) Its minimum frequency will be approximately 298 Hz.

11. During an experiment, an ideal gas is found to obey a condition $VP^2 = \text{constant}$. The gas is initially at a temperature T , pressure P and volume V . The gas expands to volume $4V$.

- (A) The pressure of gas changes to $P/2$
 (B) The temperature of gas changes to $4T$
 (C) The graph of above process on the P-T diagram is parabola
 (D) The graph of above process on the P-T diagram is hyperbola.

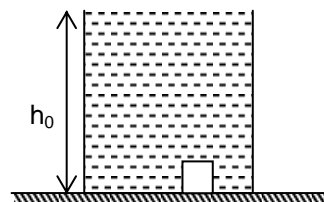
Space for rough work

Paragraph Type

This section contains **2 paragraphs**. Based upon the paragraphs **2 multiple choice questions** and **3 multiple choice questions** have to be answered. Each of these questions has 4 choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Questions 12 to 13

Figure shows a container having ideal liquid of variable density. The density of liquid varies as $\rho = \rho_0 \left(4 - \frac{3h}{h_0} \right)$ where h_0 is height of liquid in container, ρ_0 is constant and h is height from bottom. A solid block of small dimensions whose density $\frac{5}{2}\rho_0$ and mass m is released from bottom of tank.



12. The motion of the block
 (A) periodic but not SHM
 (B) SHM
 (C) oscillatory but not SHM
 (D) oscillatory but not periodic
13. After what time block reaches its initial position?
 (A) $2\pi\sqrt{\frac{5h_0}{6g}}$
 (B) $2\pi\sqrt{\frac{h_0}{g}}$
 (C) $\pi\sqrt{\frac{h_0}{3g}}$
 (D) $\pi\sqrt{\frac{5h_0}{6g}}$

Paragraph for Questions 14 to 16

We have two vessels of equal volume, one filled with hydrogen and the other with an equal mass of Helium. The common temperature is 27°C .

14. What is the relative number of molecules in the two vessels?
 (A) $\frac{n_{\text{H}}}{n_{\text{He}}} = \frac{2}{1}$
 (B) $\frac{n_{\text{H}}}{n_{\text{He}}} = \frac{3}{1}$
 (C) $\frac{n_{\text{H}}}{n_{\text{He}}} = \frac{5}{1}$
 (D) $\frac{n_{\text{H}}}{n_{\text{He}}} = \frac{4}{1}$
15. If pressure of Hydrogen vessel is 2 atm, what is the pressure of Helium?
 (A) 2 atm
 (B) 3 atm
 (C) 4 atm
 (D) 1 atm
16. If the temperature of Helium is kept at 27°C and that of hydrogen is changed, at what temperature will its pressure become equal to that of helium? The molecular weights of hydrogen and helium are 2 and 4 respectively.
 (A) -423°C
 (B) -323°C
 (C) -123°C
 (D) -523°C

Space for rough work

SECTION – C

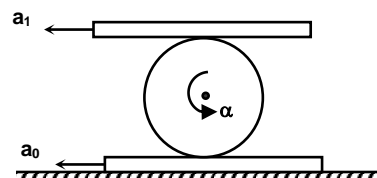
Integer Answer Type

This section contains **7 questions**. The answer to each question is a **single-digit integer**, ranging from 0 to 9. The correct digit below the question number in the ORS is to be bubbled.

17. Two plane progressive transverse waves having equations $y = 3\sin(kx + \omega t)$ and $y = 5\sin(kx - \omega t)$ are traveling in $-ve$ x axis and $+ve$ x axis respectively on a long string. The energy passing through the node of resulting wave per second is of the form $\left(\frac{A_0 \rho \omega^3 S}{k}\right)$, calculate the value of A_0 ? Density of string is ρ and cross-sectional area is S , angular frequency is ω and wave number is k .

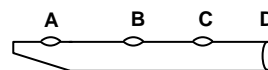
18. 600 J of heat is added to a monatomic gas in a process in which the gas performs a work of 150 J. The molar heat capacity for the process is KR . Then find K .

19. A system of two planks and a uniform solid sphere in motion as shown in figure. Radius of the sphere is R and there is no slipping at both contacts of planks with sphere. It is given that $R\alpha = 2a_0$, where α is angular acceleration of sphere and lower plank is having acceleration a_0 . It is given that magnitude of acceleration of upper block is $a_1 = ka_0$, where k is a $+ve$ constant. Find the value of $(k + 2)$. Sense of α is anticlockwise.

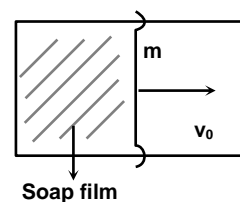


20. Two persons A and B having masses 50 kg and 60 kg respectively are sitting at the two extreme to a 4 m long platform of mass 40 kg kept on smooth ice. If they come to the middle of the boat then the boat moves on the ice during the process is 13Kcm. Find the value of K .

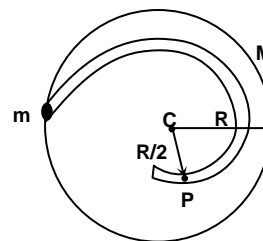
21. A simplified flute is shown in the figure. It is open at end D. There is also a large opening at A (near the mouth piece) and there are two holes at B and C [$AB = BD$ and $BC = CD$]. The distance $AD = 34$ cm. The speed of sound is 340 m/s. The frequency you expect to hear when you blow keeping hole C closed is $250K$. Find the value of K .



22. A soap film is created in a small wire frame as shown in the figure. The sliding wire of mass m is given a velocity v_0 to the right. Assuming the plane of the film to be horizontal, surface tension T , length of the wire L and v_0 is small enough so that the film does not break, the maximum displacement of the wire will be $\frac{mv_0^2}{KLT}$. Find the value of K .



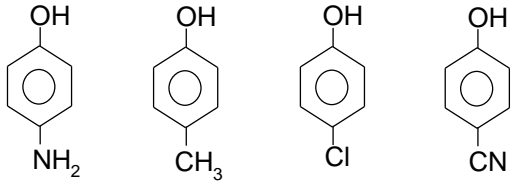
23. Mass of solid sphere is M and radius R , the particle is released from rest as shown in the figure, and surface of tunnel is frictionless. Then velocity of particle when it comes at point P is $\sqrt{\frac{KGM}{4R}}$. Find the value of K .



Space for rough work

PART - II: CHEMISTRY**SECTION – A**
Single Correct Answer Type

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

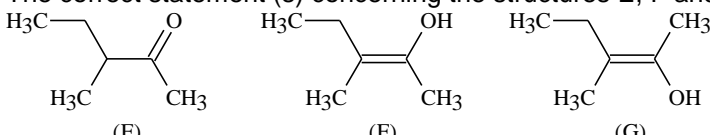
- If m = magnetic quantum number, ℓ = azimuthal quantum number, then relationship between ℓ and m is
 (A) $m = \ell + 2$ (B) $m = 2\ell^2 + 1$
 (C) $\ell = \frac{m-1}{2}$ (D) $\ell = 2m + 1$
- The correct hybridization of CO_2 , I_3^- , XeF_2 respectively is
 (A) all sp (B) sp , sp^2 , sp^3
 (C) sp , sp^3 , sp^3d (D) sp , sp^3d , sp^3d
- A hypothetical reaction $\text{A}_2 + \text{B}_2 \rightarrow 2\text{AB}$ proceeds via following proposed mechanism:
 $\text{A}_2 \xrightleftharpoons{K_1} 2\text{A}$ fast
 $\text{B}_2 \xrightleftharpoons{K_2} 2\text{B}$ fast
 $\text{A} + \text{B} \xrightarrow{K} \text{AB}$ slow
 The order of reaction with respect to A_2 and B_2 respectively.
 (A) 1 and 1 (B) 1 and 0
 (C) 1/2 and 1/2 (D) 1 and 2
- The correct order of increasing pK_a value of following compounds.

 (I) (II) (III) (IV)
 (A) $\text{IV} < \text{III} < \text{II} < \text{I}$ (B) $\text{III} < \text{IV} < \text{II} < \text{I}$
 (C) $\text{IV} < \text{II} < \text{III} < \text{I}$ (D) $\text{II} < \text{IV} < \text{I} < \text{III}$

Space for rough work

5. 20 ml of 0.001 M AgNO_3 solution is added to one litre of 0.002 M K_2CrO_4 solution.
 K_{sp} of $\text{Ag}_2\text{CrO}_4 = 2.4 \times 10^{-12}$
 Which of the following is/are true?
 (A) $[\text{Ag}^+] = 1.96 \times 10^{-5} \text{ M}$ (B) $[\text{CrO}_4^{2-}] = 6.24 \times 10^{-3} \text{ M}$
 (C) precipitation does not occur (D) all
6. Bleaching powder (CaOCl_2) reacts with iodide ion as:
 $\text{OCl}^- + \text{I}^- + \text{H}^+ \longrightarrow \text{I}_2 + \text{Cl}^- + \text{H}_2\text{O}$
 0.6 gm sample of bleaching powder requires 34 ml of 0.1 M $\text{Na}_2\text{S}_2\text{O}_3$ to titrate the liberated iodine.
 The % of Cl in the sample is
 (A) 40.2 (B) 20.0
 (C) 5.15 (D) 45.1
7. An alkene on reductive ozonolysis gives 2 molecules of $\text{CH}_2(\text{CHO})_2$. The compound is
 (A) 2, 4-hexadiene (B) 1, 3-cyclohexadiene
 (C) 1, 4-cyclohexadiene (D) 1-methyl-1,3-cyclopentadiene

Multiple Correct Answer(s) Type

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

8. For radial probability distribution curves, which of the following is/are correct?
 (A) The number of maxima in 2s orbital are two
 (B) The number of spherical or radial nodes is equal to $n - \ell - 1$
 (C) The number of angular nodes are ' ℓ '
 (D) $3d_z^2$ has two angular nodes
9. The correct statement (s) concerning the structures E, F and G is (are)

 (A) E, F and G are resonance structures (B) E, F and E, G are tautomers
 (C) F and G are geometrical isomers (D) F and G are diastereomers
10. Chose the incorrect statement(s):
 (A) pH of an acidic buffer decreases if more salt is added.
 (B) pH of a basic buffer decreases if more salt is added
 (C) In a unsaturated solution, ionic product is equal to its solubility product
 (D) Solubility product is independent of temperature

Space for rough work

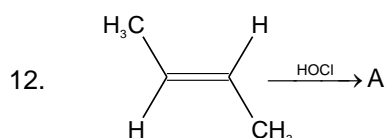
11. Arrhenius equation is represented as: $k = Ae^{-E_a/RT}$. Which of the following options is/are correct?
- (A) Graph plotted between k and $1/T$ is a straight line
 (B) Graph plotted between $\log k$ and $1/T$ is a straight line with a positive slope
 (C) Intercept of the graph between $\log k$ and $1/T = \log A$
 (D) Slope of the graph between $\log k$ and $1/T = -\frac{E_a}{2.303R}$

Paragraph Type

This section contains **5 multiple choice questions** relating to two paragraphs with **two questions and three questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.

Paragraph for Questions 12 and 13

The addition of bromine to cyclopentene provides evidence for bromonium ion intermediate in bromine addition. It follows ionic mechanism. When cyclopentene reacts with bromine in presence of CCl_4 anti addition occurs and gives trans isomer so addition of halogen to an alkene is a stereospecific reaction. cis alkene on addition with halogen gives racemic mixture and trans alkene on addition may give meso products.



In the first step of this reaction

- (A) attack of hydroxonium ion occurs
 (B) formation of cyclic chloronium ion occurs
 (C) attack of hydronium ion occurs
 (D) None
13. trans 2-butene on reacting with Br_2 in CCl_4 forms mainly
- (A) \pm 2,3 – dibromobutane
 (B) +2,3-dibromobutane
 (C) 1,2-dibromobutane
 (D) Meso 2,3-dibromobutane

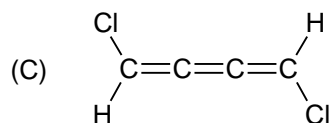
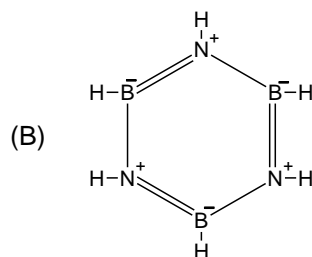
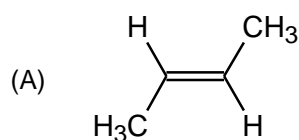
Paragraph for Questions 14 and 16

By the VSEPR theory the lone pairs occupy those positions in which the repulsion is minimum so structure should have maximum stability. The dipole moment of the compound is decided by shape and the electronegativity of the atoms involved in the bond formation

14. The increasing order of bond angle
- (A) $\text{H}_2\text{O} < \text{OF}_2 < \text{NH}_3$
 (B) $\text{OF}_2 < \text{H}_2\text{O} < \text{NH}_3$
 (C) $\text{NH}_3 < \text{H}_2\text{O} < \text{OF}_2$
 (D) none of these
15. Which of the following is a polar molecule?
- (A) PF_3Cl_2
 (B) PCl_3F_2
 (C) Inorganic benzene
 (D) All of these

Space for rough work

16. The dipole moment of the compound is zero in



- (D) All of these

SECTION – C Integer Answer Type

This section contains **7 questions**. The answer to each question is a **single digit integer**, ranging from 0 to 9 (both inclusive).

17. Sum of the bond orders of molecules/molecular ions CO, CN⁻, O₂.
18. If half life period of first order reaction is 0.5 min, then how much time in minute it will take for completion of 75% of the reaction.
19. A 4 : 1 molar mixture of the He and CH₄ is contained in a vessel at 20 bar pressure. Due to hole in the vessel the gas mixture leaked – out. If the composition (mole – ratio) of the mixture effusing-out initially is found to be x : 1, then what is x?
20. N₂O₄ is 66% dissociated into NO₂ at 340 K and 1 atm. Find the volume of 10 gm of N₂O₄ occupied under these conditions.
21. Calculate the order of the following reaction $aA + bB \longrightarrow \text{products}$
- | [A] | [B] | Rate (mole/Lt/sec) |
|-----|-----|--------------------|
| 0.1 | 0.1 | 1×10^{-4} |
| 0.2 | 0.2 | 8×10^{-4} |
| 0.1 | 0.2 | 2×10^{-4} |
22. What is the number of monochloro substituted derivatives formed from diphenyl methane?
23. The number of possible enantiomeric pairs that can be produced during monochlorination of 2-methyl butane is

Space for rough work

PART - III: MATHEMATICS**SECTION – A**
Straight Objective Type

*This section contains 7 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.*

1. Tangents PA and PB are drawn to circle $(x + 3)^2 + (y - 2)^2 = 1$ from point P lying on $y^2 = 4x$, then the locus of circumcentre of $\triangle PAB$ is
(A) $(y - 1)^2 = 2x + 3$ (B) $(y + 1)^2 = 2x + 3$
(C) $(y + 1)^2 = 2x - 3$ (D) none of these
2. If $4 \cos \theta = 3 \cos \alpha$, then the value of $\cot \left(\frac{\theta - \alpha}{2} \right) \cot \left(\frac{\theta + \alpha}{2} \right)$ is
(A) -7 (B) $\frac{1}{7}$
(C) 7 (D) $-\frac{1}{7}$
3. The sum of the series $\sum_{r=1}^{3n-1} \frac{(-1)^{r-1} r}{{}^{3n}C_r}$ is (where n is an even natural number)
(A) 0 (B) $\frac{3n}{3n+1}$
(C) $\frac{3n+1}{3n+2}$ (D) $\frac{3n}{3n+2}$

Space for rough work

4. The points on the axis of the parabola $3y^2 + 4y - 6x + 8 = 0$ from where 3 distinct normal can be drawn is given by
(A) $(h, -2/3)$ where $h > 19/9$ (B) $(-2/3, h)$ where $h > 29/18$
(C) $(h, 1/3)$ where $h > 29/18$ (D) none of these
5. Let $z = x + iy$ where x and y are real and $i = \sqrt{-1}$. The points (x, y) in the plane for which $\frac{z+i}{z-i}$ is purely imaginary lie on
(A) a straight line (B) a circle
(C) a parabola (D) none of these
6. If $x^2 + \frac{1}{x^2} = A$ and $x - \frac{1}{x} = B$, where $x \in \mathbb{R}$ and $B > 0$, then the minimum value of $\frac{A}{B}$ is
(A) 2 (B) $2\sqrt{2}$
(C) $\sqrt{2}$ (D) none of these
7. The centre of the circle obtained by reflecting the circle $x^2 + y^2 = m^2 + m + 1$ in the line $y = mx + m$, is
(A) $\left(-\frac{2m^2}{1+m^2}, -\frac{2m}{1+m^2}\right)$ (B) $\left(-\frac{2m^2}{1+m^2}, \frac{2m}{1+m^2}\right)$
(C) $\left(\frac{2m}{1+m^2}, \frac{2m^2}{1+m^2}\right)$ (D) $\left(\frac{2m}{1+m^2}, -\frac{2m^2}{1+m^2}\right)$

Space for rough work

Multiple Correct Answers Type

This section contains 4 multiple correct answer(s) type questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE** is/are correct.

8. Two sides of a rhombus OABC (lying entirely in first quadrant or third quadrant) of area equal to 2 sq. units are $y = \frac{x}{\sqrt{3}}$, $y = \sqrt{3}x$. Then possible co-ordinates of B is / are (O being origin)
- (A) $(1 + \sqrt{3}, 1 + \sqrt{3})$ (B) $(-1 - \sqrt{3}, -1 - \sqrt{3})$
(C) $(\sqrt{3} - 1, \sqrt{3} - 1)$ (D) none of these
9. If $16a^2 + 25b^2 - c^2 = 40ab$, then the family of lines $ax + by + c = 0$ is concurrent at the point(s)
- (A) (4, -5) (B) (-4, -5)
(C) (-4, 5) (D) none of these
10. If the tangent at the point P(θ) to the ellipse $16x^2 + 11y^2 = 256$ is also a tangent to the circle $x^2 + y^2 - 2x = 15$, then the value of θ is
- (A) $\frac{\pi}{2}$ (B) $\frac{5\pi}{3}$
(C) $\frac{\pi}{3}$ (D) $\frac{3\pi}{2}$
11. If a chord $2x + y + 6 = 0$ cuts the curve $x^2 - 4y^2 = 4$ at P and Q, then co-ordinates of the point R (α, β) which satisfy $\alpha^2 + \beta^2 - 1 \leq 0$ are given by
- (A) $\left(\frac{-2}{\sqrt{5}}, \frac{1}{\sqrt{5}}\right)$ if area of triangle PQR is minimum
(B) $\left(\frac{-2}{\sqrt{5}}, \frac{-1}{\sqrt{5}}\right)$ if area of triangle PQR is minimum
(C) $\left(\frac{2}{\sqrt{5}}, \frac{1}{\sqrt{5}}\right)$ if area of triangle PQR is maximum
(D) $\left(\frac{2}{\sqrt{5}}, \frac{-1}{\sqrt{5}}\right)$ if area of triangle PQR is maximum

Space for rough work

Comprehension Type

This section **2 paragraphs**. Based upon the first paragraph **2 multiple choice questions** and based upon the second paragraph **3 multiple choice questions** have to be answered. Each of these questions has four choices (A), (B), (C) and (D) out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 12 to 13

Read the following write up carefully:

Let A_1, A_2, \dots, A_m be m sets and $n(A_i)$ represents the cardinality of the set A_i (the number of elements in the set A_i), then according to the principle of exclusion and inclusion

$$n(A_1 \cup A_2 \cup \dots \cup A_m) = \sum_{i=1}^m n(A_i) - \sum_{i < j} n(A_i \cap A_j) + \sum_{i < j < k} n(A_i \cap A_j \cap A_k) - \dots + (-1)^{n+1} n(A_1 \cap A_2 \cap \dots \cap A_m)$$

In particular, if A, B, C are three sets, then

$$n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C).$$

Principle of exclusion and inclusion must be applied whenever there is a chance of repeated counting of some of the samples.

Now answer the following question:

12. A six letters word is formed using the letters of the word ALMIGHTY with or without repetition. The number of words that contain exactly three different letters is
(A) 15600 (B) 30240
(C) ${}^8P_6 - {}^8P_3$ (D) none of these
13. The number of natural numbers less than or equal to 2985984, which are neither perfect squares nor perfect cubes is [Note that $2985984 = 2^{12} \cdot 3^6$].
(A) 2984124 (B) 2984244
(C) 2959595 (D) none of these

Space for rough work

Paragraph for Question Nos. 14 to 16

Read the following write up carefully:

$a, b \in \mathbb{R}^+$, $b < 2a^2$ and $|z^2 - a^2| = |2az + b|$ then z lies on pair of intersecting circle.

Now answer the following question:

14. Distance between the centres of the circles is
(A) $2\sqrt{3}a$ (B) $2a$
(C) $4a$ (D) $2\sqrt{2}a$
15. Which of the following statement is correct?
(A) the two circles will have equal radius
(B) the circles are orthogonal
(C) the real axis is the radical axis of the two circles
(D) the circles intersect at an angle 60° with each other
16. If S is the area of the quadrilateral formed by centres of the circle and the points where circle intersect then S^2 is equal to
(A) $3a^2 - b^2$ (B) $5a^2 - 2b^2$
(C) $5ab$ (D) none of these

Space for rough work

SECTION – C

Integer Answer Type

This section contains **7 questions**. The answer to each of the questions is a single digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. For example, if the correct answers to question numbers X, Y, Z and W (say) are 6, 0, 9 and 2, respectively, then the correct darkening of bubbles will look like the following:

X	Y	Z	W
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

17. If $A \cos x = \cos(x + \lambda) + B$ is an identity in x , then the number of values of ordered triplet $(A, \cos \lambda, B)$ is _____
18. Twice of the value of $\cot(\cot^{-1}3 + \cot^{-1}7 + \cot^{-1}13 + \cot^{-1}21)$ is _____
19. Total number of ways of factorising the number of 676 in to two factors, that are prime to each other is equal to _____
20. If for $x < -1$, $\cos^{-1} \frac{x^2 - 1}{x^2 + 1} + \sin^{-1} \frac{2x}{1 + x^2} - \tan^{-1} \frac{2x}{x^2 - 1} = \frac{\pi}{3}$, then x^2 is equal to _____
21. Number of solution of $\sin^4 x - \cos^2 x \sin x + 2 \sin^2 x + \sin x = 0$ in $0 \leq x \leq 2\pi$ is _____
22. The number of solutions of the equation $\cos^{-1} x + \cos^{-1} \sqrt{1 - x^2} = \pi$ is _____
23. The number of solution of equation $\cos^{-1}(x^2) + \cos^{-1}(1 + x^2) = 0$ is/are _____

Space for rough work