

2021-22



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CLASS XI (PCM)

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Time : 60 minutes

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- You must complete the paper within the time allotted.
- Do not open this question paper until you are permitted to.
- You are not allowed to use a calculator.
- Figures herein are not to scale. Hence, you cannot depend on the estimate of size or measurement. Use your knowledge of the subject.
- Rough work shall be carried out only in the space provided for the same throughout this booklet. No separate sheets are allowed for the same.
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PAPER CODE

UN446



UCN/QP-XI(PCM)/01



01 Let F_1 be the set of parallelograms, F_2 be the set of rectangles, F_3 be the set of rhombus and F_4 be the set of squares then $F_1 \cup F_2 \cup F_3 \cup F_4 =$ _____

- (A) F_1
- (B) F_2
- (C) F_3
- (D) F_4

02 If $f(x) = |x - 1| + |x - 2| + |x - 3|$, $2 < x < 3$, then f is

- (A) an onto function but not one-one
- (B) one-one function but not onto
- (C) a bijection
- (D) neither one-one nor onto

SPACE FOR ROUGH WORK

03 Find the domain of the function defined by

$$f(x) = \sqrt{4-x} + \frac{1}{\sqrt{x^2-1}}$$

- (A) $(-\infty, -1) \cup (1, 4]$ (B) $\mathbb{R} - \{1, -1\}$
(C) $(-\infty, 4]$ (D) $[-1, 1]$

04 If $\frac{1}{6} \sin\theta$, $\cos\theta$ and $\tan\theta$ are in geometric progression, then the solution set of θ is.

- (A) $2n\pi \pm \left(\frac{\pi}{6}\right)$ (B) $2n\pi \pm \left(\frac{\pi}{3}\right)$
(C) $n\pi + (-1)^n \left(\frac{\pi}{3}\right)$ (D) $n\pi + \left(\frac{\pi}{3}\right)$

SPACE FOR ROUGH WORK

05 $\tan 15^\circ + \cot 15^\circ =$ _____

(A) 3

(B) 4

(C) 6

(D) 8

06 If $\tan 20^\circ = \lambda$, then $\frac{\tan 160^\circ - \tan 110^\circ}{1 + (\tan 160^\circ)(\tan 110^\circ)} = ?$

(A) $\frac{1 + \lambda^2}{2\lambda}$

(B) $\frac{1 + \lambda^2}{\lambda}$

(C) $\frac{1 - \lambda^2}{\lambda}$

(D) $\frac{1 - \lambda^2}{2\lambda}$

SPACE FOR ROUGH WORK

07 The sum of first 'n' terms of $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \dots$ is

(A) $\frac{3n}{2(3n+2)}$

(B) $\frac{3n}{3n+2}$

(C) $\frac{n}{2(3n+2)}$

(D) $\frac{n}{3n+2}$

08 $\frac{(1+i)^{2016}}{(1-i)^{2014}}$ is equal to

(A) $-2i$

(B) $2i$

(C) 2

(D) -2

09 If $a + ib = \frac{x+i}{x-i}$ then $a^2 + b^2 = ?$

(A) 0

(B) 1

(C) 5

(D) $\frac{8}{5}$

SPACE FOR ROUGH WORK

10 Solve the following system of linear inequalities

$$\frac{4x}{3} - \frac{9}{4} < x + \frac{3}{4} \text{ and } \frac{7x-1}{3} - \frac{7x+2}{6} > x$$

- (A) (-4, 9) (B) (-9, 4)
(C) (-9, -4) (D) (4, 9)

11 There are 10 intermediate stations on a railway line between two particular stations. The number of ways that a train can be made to stop at 3 of these intermediate stations so that no two of these halting stations are consecutive is

- (A) 56 (B) 20
(C) 126 (D) 120

SPACE FOR ROUGH WORK

12 If P_m stands for ${}^m P_m$ then

$$1 + 1 \cdot P_1 + 2 \cdot P_2 + 3 P_3 + \dots + n P_n = ?$$

- (A) $(n-1)!$ (B) $n!$
(C) $(n+1)!$ (D) $(n+2)!$

13 The number of different ways of preparing a garland using 6 distinct white roses and 5 distinct red roses such that no two red roses come together is

- (A) 21,600 (B) 43,200
(C) 86,400 (D) 1,51,200

14 $x = \frac{1.3}{3.6} + \frac{1.3.5}{3.6.9} + \frac{1.3.5.7}{3.6.9.12} + \dots$ to infinite terms,
then $9x^2 + 24x =$

- (A) 31 (B) 11 (C) 41 (D) 21

SPACE FOR ROUGH WORK

15 Find the 5th term from end in the expansion of

$$\left(\frac{x^3}{2} - \frac{2}{x^2} \right)^6$$

(A) $\frac{60}{(x^2)}$

(B) $\frac{-3x^{13}}{8}$

(C) $\frac{15x^8}{4}$

(D) $-20x^3$

16 If x_1, x_2, x_3 as well as y_1, y_2, y_3 are in geometric progression with the same common ratio, then the points $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ are

(A) vertices of an equilateral triangle.

(B) vertices of a right angled triangle.

(C) vertices of a right angled isosceles triangle.

(D) collinear.

SPACE FOR ROUGH WORK

- 17 The coefficients of 5th, 6th and 7th terms in the expansion of $(1 + x)^n$ are in AP. Find the value of n .
- (A) 12 (B) 13
(C) 14 (D) 15
- 18 If the lines $x + 3y - 9 = 0$, $4x + by - 2 = 0$ and $2x - y - 4 = 0$ are concurrent, then the equation of the line passing through the point $(b, 0)$ and the point of concurrence with the given lines, is
- (A) $2x + y + 10 = 0$ (B) $4x - 7y + 20 = 0$
(C) $x - y + 5 = 0$ (D) $x - 4y + 5 = 0$
- 19 Find the coordinates of the orthocentre of the triangle, whose vertices are $(-1, 3)$, $(2, -1)$ and $(0, 0)$.
- (A) $(0, 0)$ (B) $(-3, 4)$
(C) $(-4, -3)$ (D) $(4, -3)$

SPACE FOR ROUGH WORK

- 20** The value of $k (> 0)$, such that the angle between the lines $4x - y + 7 = 0$ and $kx - 5y - 9 = 0$ is 45° , is
- (A) $-\frac{25}{3}$ (B) $\frac{5}{3}$ (C) 3 (D) 5
- 21** The number of normals drawn to the parabola $y^2 = 4x$ from the point $(1, 0)$ is
- (A) 0 (B) 1
(C) 2 (D) 3
- 22** ΔABC is formed by $A(1, 8, 4)$, $B(0, -11, 4)$ and $C(2, -3, 1)$. If D is the foot of the perpendicular from A to BC . Then the coordinates of D are
- (A) $(-4, 5, 2)$ (B) $(4, 5, -2)$
(C) $(4, -5, 2)$ (D) $(4, -5, -2)$

SPACE FOR ROUGH WORK

23 $\lim_{x \rightarrow 0} \frac{(1 - \cos 2x)(3 + \cos x)}{x \tan 4x} =$

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

24 If $y = \frac{x}{x+5}$, then $x \frac{dy}{dx} =$ _____

- (A) $y(1-y)$ (B) $y(y+1)$
(C) $y(2-y)$ (D) $y(y+2)$

25 Let $f: (-1, 1) \rightarrow \mathbb{R}$ be a differentiable function with $f(0) = -1$ and $f'(0) = 1$. If $g(x) = (f(2f(x)+2))^2$, then $g'(0) =$

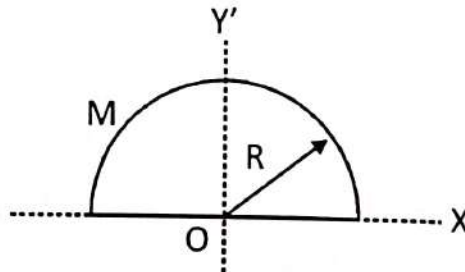
- (A) 0 (B) -2 (C) 4 (D) -4

SPACE FOR ROUGH WORK

- 26** When one mole of a monoatomic gas expands at constant pressure, the ratio of heat supplied that increases the internal energy of the gas and that used in expansion is
 (A) ∞ (B) 0 (C) $3/2$ (D) $2/3$
- 27** A spherical soap bubble of radius 1 cm is formed inside an other bubble of radius 3 cm. The radius of a single soap bubble which maintain the same pressure difference as inside the smaller and outside the larger soap bubble in cm is:
 (A) $1/4$ (B) $5/4$ (C) $3/4$ (D) $7/4$
- 28** If a planet of given density were made larger its force of attraction for an object on its surface would increase because of planet's greater mass but would decrease because of the greater distance from the object to the centre of the planet. Which effect predominates ?
 (A) Increase in mass.
 (B) Increase in radius.
 (C) Both affect attraction equality.
 (D) None of the above.

SPACE FOR ROUGH WORK

- 29 A semicircular disc of mass M and radius R lies in the $x - y$ plane with its centre at the origin, as shown. The moment of inertia of the disc about the x -axis is



- (A) $\frac{MR^2}{2}$ (B) $\frac{MR^2}{4}$ (C) $\frac{MR^2}{8}$ (D) $\frac{3}{4}MR^2$

- 30 Two boys start running towards each other from two points, they are 120 m apart. One runs with a speed of 5 m/s and other with a speed of 7 m/s. When and where do they meet each other from 1st point

- (A) 10 s, 50 m (B) 10 s, 70 m
(C) 24 s, 50 m (D) 17 s, 70 m

SPACE FOR ROUGH WORK

31 Which two of the following five physical parameters have the same dimensions ?

1. Energy density
2. Refractive index
3. Dielectric constant
4. Young's modulus
5. Magnetic field

- (A) 2 and 4 (B) 3 and 5
(C) 1 and 4 (D) 1 and 5

32 A flywheel of mass 100 kg and radius 1 m is rotating at the rate of 420 rev/min. Find the constant retarding torque to stop the wheel in 14 revolutions, the mass is concentrated at the rim. M.I. of the flywheel about its axis of rotation $I = mr^2$.

- (A) 1099 Nm (B) 1213 Nm
(C) 1567 Nm (D) 1849 Nm

SPACE FOR ROUGH WORK

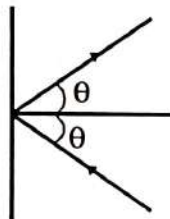
- 33** Given that p = momentum, c = speed of light, then the dimensions of pc are same as that of
- (A) power (B) force
(C) angular momentum (D) torque
- 34** A particle is moving along the x -axis. Its position at any instant is given by the equation $x = bt^2$ where b is a constant and $b = 1$. What is the instantaneous velocity at $t = 4$ s ? Find the average velocity from 4 s to 4.01 s.
- (A) 7.16 m/s, 14.1 m/s
(B) 8.00 m/s, 8.01 m/s
(C) 6.35 m/s, 5.91 m/s
(D) 9.42 m/s, 4.27 m/s
- 35** A bullet of mass 100 g is fired with velocity v into a wooden block of mass 900 g. If the bullet gets embedded into the block, what will be the velocity of the combination ?
- (A) $\frac{v}{2}$ (B) $\frac{v}{5}$ (C) $\frac{v}{7}$ (D) $\frac{v}{10}$

SPACE FOR ROUGH WORK

- 38** An iron ball of weight W is immersed in water at 4°C . Its weight in water is W_1 . If the weight of the ball in water at 54°C be W_2 , then which of the following relation is correct ?

- (A) $W_1 < W_2$ (B) $W_1 > W_2$
(C) $W_1 = W_2$ (D) $W = \frac{W_1 + W_2}{2}$

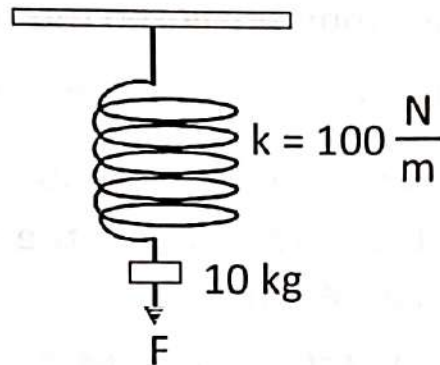
- 39** A batsman deflects a ball by an angle of 45° without changing its initial speed equal to 54 km/h . What is the impulse imparted to the ball ? Mass of ball is equal to 0.15 kg .



- (A) $3.491 \text{ kg m s}^{-1}$ (B) $4.157 \text{ kg m s}^{-1}$
(C) $5.826 \text{ kg m s}^{-1}$ (D) $6.325 \text{ kg m s}^{-1}$

SPACE FOR ROUGH WORK

- 40** A vertical spring of force constant 100 N/m is attached with a hanging mass of 10 kg . Now an external force is applied on the mass so that the spring is stretched by additional 2m . The work done by the force F is : ($g = 10 \text{ m/s}^2$)



(A) 200 J

(B) 400 J

(C) 450 J

(D) 600 J

SPACE FOR ROUGH WORK

- 41** In B_2H_6 ,
- (A) There is a boron-boron bond
 - (B) The structure is similar to that of C_2H_6
 - (C) The boron atoms are linked through hydrogen bridges
 - (D) All the atoms lie in the same plane.
- 42** Two metallic oxides contain 27.6% and 30.0% oxygen respectively. If the formula of the first oxide is M_3O_4 , that of the second will be
- (A) MO (B) MO_2 (C) M_2O_5 (D) M_2O_3
- 43** What is false about H_2O_2 ?
- (A) Acts as both oxidising and reducing agent
 - (B) Two OH bonds lie in the same plane
 - (C) Pale blue liquid
 - (D) Can be oxidised by O_3
- 44** If 50% of CO_2 converts to CO at the following equilibrium $C(s) + CO_2(g) \rightleftharpoons 2CO(g)$ and the equilibrium pressure is 12 atm, calculate K_p .
- (A) 12 atm (B) 16 atm
(C) 21 atm (D) 28 atm

SPACE FOR ROUGH WORK

45 Two gases P and Q having molecular weights 60 and 45 respectively are 'enclosed in a vessel. The weight of P is 0.5 g and that of Q is 0.2 g. The total pressure of the mixture is 750 mm. Calculate the partial pressure of the two gases in mm.

(A) 490, 260

(B) 410, 340

(C) 390, 360

(D) 380, 370

46 Which ion has the highest value of ionic radius ?

(A) Li^+

(B) F^-

(C) O^{2-}

(D) B^{3+}

47 In Haber process, 30 litres of dihydrogen and 30 litres of dinitrogen were taken for reaction which yielded only 50% of the expected product. What will be the composition of the gaseous mixture under the aforesaid condition in the end ?

(A) 20 litres ammonia, 25 litres nitrogen, 20 litres hydrogen

(B) 10 litres ammonia, 25 litres nitrogen, 15 litres hydrogen

(C) 20 litres ammonia, 10 litres nitrogen, 30 litres hydrogen

(D) 20 litres ammonia, 25 litres nitrogen, 15 litres hydrogen

SPACE FOR ROUGH WORK

- 48** A binary compound formed between the elements with atomic numbers 19 and 17 is expected to be a/an
- (A) water soluble compound forming a conducting solution in water.
(B) soft, easily deformed solid.
(C) solid with a low melting point.
(D) electrically non-conducting solid.
- 49** Which compound has the highest oxidation number for Mn ?
- (A) KMnO_4 (B) K_2MnO_4
(C) MnO_2 (D) Mn_2O_3
- 50** Calculate the enthalpy change accompanying the conversion of 10 g of graphite into diamond if the heats of combustion of C (graphite) and C (diamond) are -94.05 and -94.50 kcal respectively.
- (A) 0.120 kcal (B) 0.259 kcal
(C) 0.375 kcal (D) 0.487 kcal
- 51** Which of the following have identical bond orders ?
- (A) CN^- (B) NO^+
(C) O_2^- (D) Both (A) and (B)

SPACE FOR ROUGH WORK

52 Which of the following statements relating to the spectrum of hydrogen atom is false ?

- (A) The lines can be defined by quantum number.
- (B) The line of longest wavelength in the Balmer series corresponds to the transition between $n = 3$ and $n = 2$ levels.
- (C) The spectral lines are closer together at long wavelengths.
- (D) A continuum occurs at $n = \infty$.

53 The van der Waals constant 'a' for the gases O_2 , N_2 , NH_3 and CH_4 are 1.3, 1.390, 4.170 and 2.253 $L^2 \text{ atm mol}^{-2}$ respectively. The gas which can be most easily liquefied is

- (A) O_2 (B) N_2 (C) NH_3 (D) CH_4

54 In the reaction, $H_2 + I_2 \rightleftharpoons 2HI$, the concentrations of H_2 , I_2 and HI at equilibrium are 8.0, 3.0 and 28.0 moles per litre respectively. What is the equilibrium constant ?

- (A) 28.14 (B) 32.66
(C) 45.73 (D) 59.16

55 30 g of Mg and 30 g of O_2 are reacted and the residual mixture contains

- (A) 60 g of MgO only.
- (B) 40 g of MgO and 20 g of O_2 .
- (C) 45 g of MgO and 15 g of O_2 .
- (D) 50 g of MgO and 10 g of O_2 .

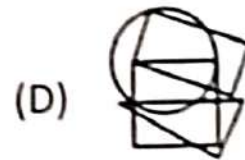
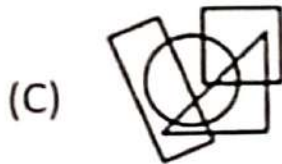
56 The press should not be afraid of upholding and supporting a just and righteous cause. It should be not be afraid of criticising the government in a healthy manner. The press has to be eternally vigilant to protect the rights of the workers, backward and suppressed sections of the society. It should also give a balanced view of the things so that people can be helped in the formation of a healthy public opinion.

The passage best supports the statement that

- (A) press has no role to play in a democracy.
- (B) the press is the only means to project to the masses the policies of the government.
- (C) the freedom of press is essential for the proper functioning of democracy.
- (D) the press can be used by the governments as an effective media for the upliftment of the backward sections of society.

SPACE FOR ROUGH WORK

- 57 Select the figure which satisfies the same conditions of placement of dots as in the given figure.



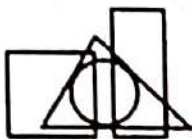
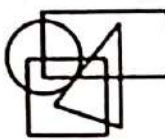
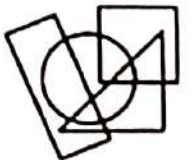

- 58 What is the angle between the two hands of a clock when the time shown by the clock is 6.30 p.m. ?

- (A) 00 (B) 50 (C) 30 (D) 150

SPACE FOR ROUGH WORK

- 57** Select the figure which satisfies the same conditions of placement of dots as in the given figure.



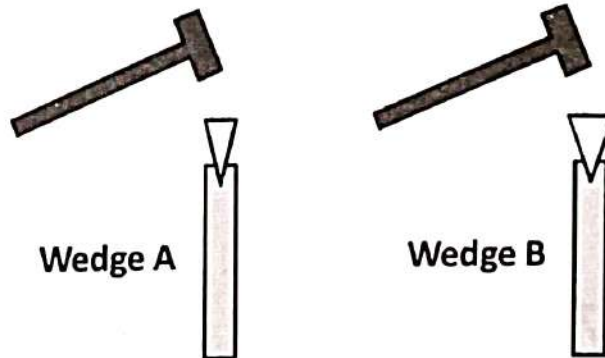
- (A) 
- (B) 
- (C) 
- (D) 

- 58** What is the angle between the two hands of a clock when the time shown by the clock is 6.30 p.m. ?

- (A) 00 (B) 50 (C) 30 (D) 150

SPACE FOR ROUGH WORK

- 59 Assuming the hammers are swung with equal force, which wedge will more easily split the board ?



- (A) Wedge A
 (B) Wedge B
 (C) Neither wedge will split the board.
 (D) The wedges will split the board with equal ease.
- 60 Choose the option which is the upper half of the word.

KNOWLEDGE

- (A) K N I W E D C E O
 (B) K N O W E D C E
 (C) N I W E D C E O K
 (D) K N O W I E D C E

Space for Rough work