

# SITJEE CLASSES

JEE MAINS 2025 2024-25

Test Number	Test Booklet No.
Write/Check this Code on your Answer Sheet	Write this number on your Answer Sheet

## : IMPORTANT INSTRUCTIONS :

01. Immediately fill in the particulars on this page of the Test Booklet with **Blue/Black Ball point Pen. Use of pencil is strictly prohibited**
02. The Answer Sheet is kept inside this Test Booklet. When you are directed to open the Test Booklet, take out the Answer Sheet and fill in the particulars carefully.
03. The test is of **180 Min.** duration
04. The Test Booklet consists of 90 questions. The maximum marks are 300. All the Ques.
05. There are three parts in the question paper A, B, C consisting of Physics, Chemistry, and Mathematics having 30 questions in each part of equal weightage. 20 Questions are MCQs and 5 Numericals are compulsory from each subject. Each subject is allotted 4 (four) marks for correct response
06. Candidates will be awarded marks as stated above in Instruction No.5 for correct response of each question. **ONE (1) marks** will be deducted for indicating incorrect response of each question. **No deduction** from the total score will be made **if no response** is indicated for an item in the Answer Sheet.
07. Use **Blue/Black Ball Point Pen only** for writing particulars/markings responses on **Side-1** and **Side-2** of the Answer Sheet. **Use of pencil is strictly prohibited.**
08. No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.
09. Rough work is to be done on the space provided for this purpose in the Test Booklet only. This space is given at the bottom of each page of the booklet.
10. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. **However, the candidates are allowed to take away this Test Booklet with them.**
11. The CODE for this Booklet is A. Make Sure that the CODE printed on **Side-2** of the Answer Sheet is the same as that on this booklet. In case of discrepancy, the candidate should immediately report the matter to the Invigilator for replacement of both the Test Booklet and the Answer Sheet.
12. Do not fold or make any stray marks on the Answer Sheet.
13. No part of the Test Booklet and Answer Sheet shall be detached under any circumstances.

Name of the Candidate : \_\_\_\_\_

Roll Number : In figures :

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In words : \_\_\_\_\_

Examination Centre Number :

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Name of Examination Centre (in Capital letters) : \_\_\_\_\_

Candidate's Signature : \_\_\_\_\_

Invigilator's Signature : \_\_\_\_\_

**PHYSICS**

**01)** A green light is incident from the water to the air-water interface at the critical angle ( $\theta$ ).

Identify the correct statement.

- A) The spectrum of visible light whose frequency is less than that of green light will come out of the air medium
- B) The entire spectrum of visible light will come out of the water at an angle of  $90^\circ$  to the normal
- C) The spectrum of visible light whose frequency is more than that of green light will come out to the air medium
- D) The entire spectrum of visible light will come out of the water at various angles to the normal

**02)** A man standing on the roof of a house of height  $h$  throws one particle vertically downwards and another particle horizontally with the same velocity  $u$ . The ratio of their velocities when they reach the earth's surface will be

- A) 1 : 1
- B) 1 : 2
- C)  $\sqrt{2gh + u^2} : u$
- D)  $\sqrt{2gh + u^2} : \sqrt{2gh}$

**03)** Two samples A and B of a gas initially at the same pressure and temperature are compressed from volume  $V$  to  $V/2$  (A isothermally and B adiabatically). The final pressure of A is

- A) less than the final pressure of B.
- B) greater than the final pressure of B.
- C) equal to the final pressure of B.
- D) twice the final pressure of B.

**04)** In a radioactive decay chain, the initial nucleus is  ${}_{90}^{232}\text{Th}$ . At the end, there are

$6\alpha$  - particles and  $4\beta$  - particles which are emitted. If the end nucleus is  ${}^A_Z\text{X}$ , then find A and Z.

- A)  $A=200; Z=81$
- B)  $A=208; Z=82$
- C)  $A=202; Z=80$
- D)  $A=208; Z=80$

**05)** A given quantity of an ideal gas is at pressure  $p$  and absolute temperature  $T$ . What is the

isothermal bulk modulus of the gas?

- A)  $\frac{3}{2}p$
- B)  $p$
- C)  $\frac{2}{3}p$
- D)  $2p$

**06)** A lamp emits monochromatic green light uniformly in all directions. The lamp is 3% efficient in converting electrical power to electromagnetic waves and consumes 100 W of power. The amplitude of the electric field associated with the electromagnetic radiation at a distance of 10 m from the lamp will be

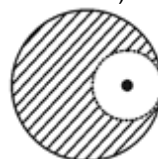
- A) 9.37 V/m
- B) 5.36 V/m
- C) 2.68 V/m
- D) 1.34 V/m

**07)** Three simple harmonic motions in the same direction having the same amplitude  $a$  and same period are superposed. If each differs in phase from the next by  $45^\circ$ , then

- A) the phase of the resultant motion relative to the first is  $90^\circ$ .
- B) the resultant amplitude is  $(1 + \sqrt{2})a$ .
- C) the energy associated with the resulting motion is  $(3 + 2\sqrt{2})$  times the energy associated with any single motion.
- D) both (2) and (3).

**08)** From a solid sphere of mass  $M$  and radius  $R$ , a spherical portion of radius  $\left(\frac{R}{2}\right)$  is removed (see

figure). Taking gravitational potential  $V = 0$  at  $r = \infty$ , what is the potential at the centre of the cavity thus formed? ( $G$ =gravitational constant)



- A)  $\frac{-GM}{R}$

- B)  $\frac{-GM}{2R}$   
 C)  $\frac{-2GM}{R}$   
 D)  $\frac{-2GM}{3R}$

**09)** When a rubber band is stretched by a distance  $x$ , it exerts a restoring force of magnitude

$F = ax + bx^2$ , where  $a$  and  $b$  are constants. What is the work done in stretching the unstretched rubber band by  $L$ ?

- A)  $aL^2 + bL^3$   
 B)  $\frac{1}{2} \left( \frac{aL^2}{2} + \frac{bL^3}{3} \right)$   
 C)  $\frac{aL^2}{2} + \frac{bL^3}{3}$   
 D)  $\frac{1}{2} (aL^2 + bL^3)$

**10)** A charged particle is released from rest in a region of steady and uniform electric as well as magnetic field which are parallel to each other. Find the direction in which the particle will move?

- A) Straight line  
 B) Cycloid  
 C) Helix  
 D) Circle

**11)** A cylinder with fixed capacity of 67.2 L contains helium gas at STP. How much amount of heat is needed to raise the temperature of the gas by  $20^\circ\text{C}$ ? [Take,  $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$ ]

- A) 700 J  
 B) 748 J  
 C) 350 J  
 D) 374 J

**12)** A magnet is suspended in the magnetic meridian with an untwisted wire. The upper end of wire is rotated through  $180^\circ$  to deflect the magnet by  $30^\circ$  from magnetic meridian. When this magnet is replaced by another magnet, the upper end of wire is rotated through  $270^\circ$  to deflect the magnet  $30^\circ$  from magnetic meridian. The ratio of magnetic moments of magnets is

- A) 8 : 5  
 B) 5 : 8  
 C) 1 : 8  
 D) 1 : 5

**13)** An arc lamp requires a direct current of 10 A at 80 V to function. If it is connected to a 220 V (rms), 50 Hz AC supply, the series inductor needed for it to work is equal to

- A) 80 H  
 B) 0.0444 H  
 C) 0.08 H  
 D) 0.065 H

**14)** Let the moment of inertia of a hollow cylinder of length 30 cm (inner radius 10 cm and outer radius 20 cm) about its axis be  $I$ . What is the radius of a thin cylinder of the same mass such that its moment of inertia about its axis is also  $I$ ?

A) 16 cm  
 B) 18 cm  
 C) 12 cm  
 D) 14 cm

**15)** The only possibility of heat flow in a thermos flask is through its cork which is  $75 \text{ cm}^2$  in area and 5 cm thick. Its thermal conductivity is  $0.0075 \text{ cal/cm s } ^\circ\text{C}$ . The outside temperature is  $40^\circ\text{C}$  and latent heat of ice is  $80 \text{ cal g}^{-1}$ . Time taken by 500 g of ice at  $0^\circ\text{C}$  in the flask to melt into water at  $0^\circ\text{C}$  is



- A) 7.42 hr  
 B) 4.72 hr  
 C) 4.27 hr  
 D) 2.47 hr

**16)** An aircraft with a wing-span of 40 m flies with a speed of  $1080 \text{ km h}^{-1}$  in the eastward direction at a constant altitude in the northern hemisphere, where the vertical component of earth's magnetic field is  $1.75 \times 10^{-5} \text{ T}$ . Then the e. m. f. that develops between the tips of the wings is

- A) 0.21 V  
 B) 0.35 V  
 C) 0.5 V  
 D) 2.1 V

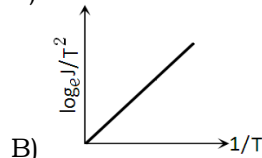
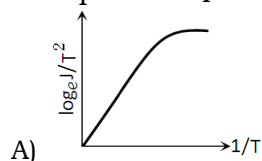
**17)** Drift speed of electrons, when 1.5 A of current flows in a copper wire of cross-section  $5 \text{ mm}^2$  is  $v$ . If the electron density in copper is  $9 \times 10^{28} / \text{m}^3$ , what is the value of  $v$  in mm/s?

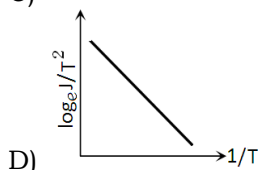
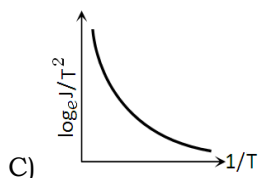
(Take, charge of electron to be  $= 1.6 \times 10^{-19} \text{ C}$ )

- A) 0.02  
 B) 0.2  
 C) 2  
 D) 0.1

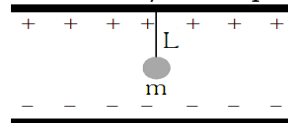
**18)** For a thermionic emitter (metallic), if  $J$  represents the current density and  $T$  is its absolute temperature, then the correct curve between

$\log_e \frac{J}{T^2}$  and  $\frac{1}{T}$  is





19) A small sphere carrying a charge 'q' is hanging in between two parallel plates by a string of length L. Time period of pendulum is  $T_0$ . When parallel plates are charged, the time period changes to T. The ratio  $T/T_0$  is equal to



A)  $\left(\frac{g + \frac{qE}{m}}{g}\right)^{1/2}$

B)  $\left(\frac{g}{g + \frac{qE}{m}}\right)^{1/2}$

C)  $\left(\frac{g}{g + \frac{qE}{m}}\right)^{3/2}$

D) None of these

20) A wire stretched between two rigid supports vibrates in its fundamental mode with a frequency of 45 Hz. The mass of the wire is  $3.5 \times 10^{-2}$  kg and its linear mass density is  $4.0 \times 10^{-2}$  kg/m.

Determine (i) the speed of a transverse waves on the string and (ii) the tension in the string?

- A) (i) 80 m/s (ii) 250 N  
 B) (i) 90 m/s (ii) 249 N  
 C) (i) 88 m/s (ii) 208 N  
 D) (i) 78.75 m/s (ii) 248 N

21) From the equation  $\tan \theta = \frac{rg}{v^2}$ , one can obtain

the angle of banking  $\theta$  for a cyclist taking a curve (the used symbols have their usual meanings).

Then say, it is

- A) neither numerically nor dimensionally correct.  
 B) both dimensionally and numerically correct.  
 C) numerically correct only.  
 D) dimensionally correct only.

22) A car of mass 1.2 tonnes is travelling along a straight horizontal road at a speed of  $20 \text{ms}^{-1}$  when it brakes sharply then skids. Friction brings the car to rest. If the coefficient of friction between the tyres and road is 0.8, Estimate the deceleration (in

$\text{ms}^{-2}$ ).



23) Sunlight of intensity  $1.3 \text{kWm}^{-2}$  is incident normally on a thin convex lens of focal length 20 cm. Ignore the energy loss of light due to the lens and assume that the lens aperture size is much smaller than its focal length. What is the average intensity of light, in  $\text{kWm}^{-2}$ , at a distance 22 cm from the lens on the other side?

24) A water tank has a spigot near its bottom. If the top of the tank is open to the atmosphere, estimate the speed in m/s at which the water leaves the spigot when the water level is 0.5 m above the spigot. (Given

$P_1 = P_{\text{atm}} = 1.01 \times 10^5 \text{Pa} = P_2$  both are open to atmosphere)

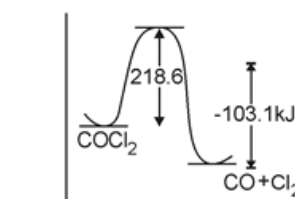
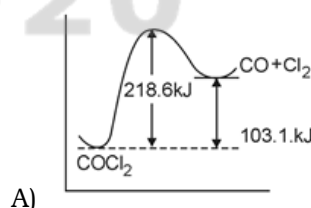
25) Consider two solid spheres P and Q each of density  $8 \text{gmcm}^{-3}$  and diameters 1 cm and 0.5 cm, respectively. Sphere P is dropped into a liquid of density  $0.8 \text{gmcm}^{-3}$  and viscosity  $\eta = 3$  poiseulles. Sphere Q is dropped into a liquid of density  $1.6 \text{gmcm}^{-3}$  and viscosity  $\eta = 2$  poiseulles. What is the ratio of the terminal velocities of P and Q?

### CHEMISTRY

26) What is the reaction coordinate diagram for the reaction  $\text{COCl}_2(\text{g}) \rightarrow \text{CO}(\text{g}) + \text{Cl}_2(\text{g})$ ,

$\Delta H = 103.1 \text{kJ}$  with  $\log k$

$$\left(\text{min}^{-1}\right) = \frac{-11420}{T} + 15.154?$$



- A) Both (a) and (b)  
 B) None of these  
 C) Both (a) and (b)  
 D) None of these

27) The enolic form of acetone contains

- A)  $10 \sigma$  -bonds,  $1 \pi$  -bonds and 1 lone pairs  
 B)  $9 \sigma$  -bonds,  $2 \pi$  -bonds and 1 lone pairs  
 C)  $9 \sigma$  -bonds,  $1 \pi$  -bond and 2 lone pairs  
 D)  $8 \sigma$  bonds,  $2 \pi$  -bonds and 1 lone pairs

**28)** Which of the following co-ordination compounds would exhibit optical isomerism?

- A) diammine dichloro platinum (II)
- B) pentaammine nitrocobalt (III) iodide
- C) tris-(ethylenediamine) cobalt (III) bromide
- D) trans-dicyanobis (ethylenediamine) chromium (III) chloride

**29)** 116 mg of a compound on vaporization in a Victor Meyer's apparatus displaces 44.8 ml of air measured at S.T.P. The molecular weight of the compounds is

- A) 44.8
- B) 58
- C) 116
- D) 232

**30)** The compound that can work both as an oxidizing and reducing agent is

- A)  $K_2Cr_2O_7$
- B)  $BaO_2$
- C)  $H_2O_2$
- D)  $KMnO_4$

**31)** During the process of electrolytic refining of copper, some metals present as impurity settle as 'anode mud'. These are

- A) Fe and Ni.
- B) Ag and Au.
- C) Pb and Zn.
- D) Sn and Ag.

**32)** Stability of the species  $Li_2$ ,  $Li_2^-$ , and  $Li_2^+$  increases in which one of the following order?

- A)  $Li_2 < Li_2^- < Li_2^+$
- B)  $Li_2^- < Li_2^+ < Li_2$
- C)  $Li_2^- < Li_2 < Li_2^+$
- D)  $Li_2 < Li_2^- < Li_2^+$

**33)** The test of ozone  $O_3$  can be done by

- A) Cu
- B) Au
- C) Hg
- D) Ag

**34)** Which one of the following complexes is paramagnetic?

- A)  $[Co(H_2O)_6]^{3+}$
- B)  $[Co(F)_6]^{3+}$
- C)  $[CoF_3(H_2O)_3]$
- D) All of these.

**35)** Toluene is nitrated and the resulting product is reduced with tin and hydrochloric acid. The product so obtained is diazotized and then heated with cuprous bromide. \_\_\_\_\_ is present in the reaction mixture that formed.

- A) mixture of o- and p-bromotoluenes

- B) mixture of o- and p-dibromobenzenes
- C) mixture of o- and m-bromotoluenes
- D) mixture of o- and p-bromoanilines

**36)** In  $CH_3CH_2OH$ , which bond dissociates heterolytically?

- A) O - H
- B) C - H
- C) C - O
- D) C - C

**37)** Which conformation of  $C_6H_6Cl_6$  is most powerful insecticide?

- A) aaaaaa
- B) aaaaae
- C) aaeeee
- D) aaeeee

**38)** 2.76 g of silver carbonate on being strongly heated yield a residue weighing

- A) 2.16 g
- B) 2.32 g
- C) 2.48 g
- D) 2.64 g

**39)** Glycine may be classed as all of the following except

- A) a zwitterion.
- B) a base.
- C) an acid.
- D) optically active acid.

**40)** What should be the freezing point of aqueous solution containing 17 gm of  $C_2H_5OH$  in 1000 gm of water?

(water  $K_f = 1.86 \text{ deg-kg mol}^{-1}$ )

- A)  $0.34^\circ C$
- B)  $0.0^\circ C$
- C)  $-0.34^\circ C$
- D)  $-0.69^\circ C$

**41)** On heating, compound (A) gives a gas (B) which is a constituent of air. This gas when treated with 3 moles of hydrogen ( $H_2$ ) in the presence of a catalyst gives another gas (C) which is basic in nature. Gas C on further oxidation in moist condition gives a compound (D) which is a part of acid rain. Find the compound (D).

- A)  $H_2SO_4$
- B)  $HNO_3$
- C)  $HNO_2$
- D) HCl

**42)** Some energy is required to ionize a H-atom if the electron occupies  $n = 5$  orbit. The ratio of the ionization enthalpy of H-atom (energy required to remove the electron from  $n = 1$  orbit) with \_\_\_\_\_ energy required to ionise H-atom if electron occupies  $n = 5$  orbit.

- A) 1:25

- B) 25:1  
C) 5:1  
D) 1:5

**43)** The standard molar heat of formation of ethane,  $\text{CO}_2$  and water (l) are respectively -21.1, -94.1 and -68.3 kcal. What will be the standard molar heat of combustion of ethane?

- A) -372 kcal  
B) -240 kcal  
C) 162 kcal  
D) 183.5 kcal

**44)** Successive (IE) values of three elements of third period are given below

Elements	(IE) <sub>1</sub>	(IE) <sub>2</sub>	(IE) <sub>3</sub>
X	513	4562	6920
Y	738	1451	7733
Z	1521	2666	3931

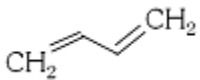
What are the atomic numbers of X, Y and Z?

- A) 11, 12, 18  
B) 11, 12, 14  
C) 11, 12, 13  
D) 11, 12, 15

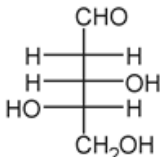
**45)** Which of the following vapours passed over heated copper to form acetone?

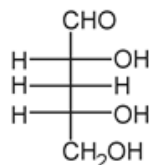
- A)  $\text{CH}_3 - \text{CH} - \text{CH}_3$   
|  
OH  
B)  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2\text{OH}$   
|  
CH<sub>3</sub>  
C)  $\text{CH}_3 - \text{C} - \text{OH}$   
|  
CH<sub>3</sub>  
D)  $\text{CH}_2 = \text{CH} - \text{CH}_2\text{OH}$

**46)** Which of the following represents the given mode of hybridisation  $\text{sp}^2 - \text{sp}^2 - \text{sp} - \text{sp}$  from left to right?

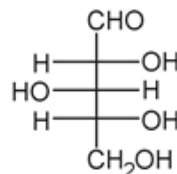
- A)  $\text{HC} \equiv \text{C} - \text{C} \equiv \text{CH}$   
B)  $\text{H}_2\text{C} = \text{CH} - \text{C} \equiv \text{CH}$   
C)   
D)  $\text{H}_2\text{C} = \text{C} = \text{C} = \text{CH}_2$

**47)** An organic compounds A ( $\text{C}_5\text{H}_{10}\text{O}_4$ ) is oxidised by  $\text{Br}_2/\text{H}_2\text{O}$  to an acid B ( $\text{C}_5\text{H}_{10}\text{O}_5$ ). A forms a triacetate and it is reduced by HI to n-pentane. Oxidation of A with  $\text{HIO}_4$  gives, among other products, 1.0 molecule of  $\text{CH}_2\text{O}$ , 1.0 molecule of  $\text{HCOOH}$ . The possible structure of A is

- A) 



B)

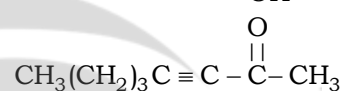
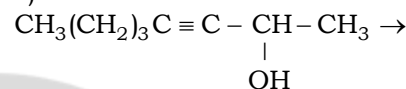


C)

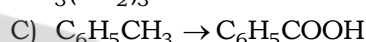
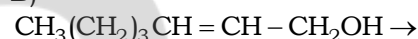
D) All of these

**48)** Which of the following oxidation reactions can be carried out with chromic acid in aqueous acetone at  $5 - 10^\circ\text{C}$ ?

A)



B)



D) All of above

**49)** For the equilibrium,  $2\text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{OH}^-$ , the value of  $\Delta G^\circ$  at 298 K is close to \_\_\_\_\_ kJ.

**50)** The molar conductivity of a solution of a weak acid  $\text{HX}(0.01\text{M})$  is 10 times smaller than the molar conductivity of a solution of a weak acid  $\text{HY}(0.10\text{M})$ . If  $\lambda_{\text{X}^-}^\circ \approx \lambda_{\text{Y}^-}^\circ$ , what is the difference in their  $\text{pK}_a$  value,  $\text{pK}_a(\text{HX}) - \text{pK}_a(\text{HY})$ ? (consider degree of ionisation of both acids to be  $\ll 1$ ).

## MATHEMATICS

**51)** What is the number of values of  $\theta \in (0, \pi)$  for which the system of linear equations

$$x + 3y + 7z = 0,$$

$$-x + 4y + 7z = 0,$$

$$(\sin 3\theta)x + (\cos 2\theta)y + 2z = 0$$

has a non-trivial solution?

A) 2

B) 1

C) 4

D) 3

**52)** Let  $f: [1/2, 1] \rightarrow \mathbb{R}$  (the set of all real numbers) be a positive, non-constant and differentiable function such that  $f'(x) < 2f(x)$  and  $f(1/2) = 1$ .

Then, find the interval in which the value of

$$\int_{1/2}^1 f(x) dx \text{ lies.}$$

- A)  $(e-1, 2e-1)$   
 B)  $(2e-1, 2e)$   
 C)  $\left(\frac{e-1}{2}, e-1\right)$   
 D)  $\left(0, \frac{e-1}{2}\right)$

**53)** If  $\frac{\sin^4 A}{a} + \frac{\cos^4 A}{b} = \frac{1}{a+b}$ , then the value of

$\frac{\sin^8 A}{a^3} + \frac{\cos^8 A}{b^3}$  is equal to

- A)  $\frac{a^2 b^2}{(a+b)^2}$   
 B)  $\frac{1}{(a+b)^3}$   
 C)  $\frac{a^3 b^3}{(a+b)^3}$   
 D) None of these

**54)** If  $(x+3)/(x-2) > 1/2$  then x present in the interval

- A)  $(-8, \infty)$   
 B)  $(8, \infty)$   
 C)  $(\infty, 8)$   
 D)  $(\infty, -8)$

**55)** Three normals to the parabola  $y^2 = x$  are drawn through a point  $(C, 0)$ , then

- A)  $C > \frac{1}{2}$   
 B)  $C = \frac{1}{2}$   
 C)  $C = \frac{1}{4}$   
 D) None of these

**56)** The value of  $\binom{30}{0}\binom{30}{10} - \binom{30}{1}\binom{30}{11}$

$+ \binom{30}{2}\binom{30}{12} + \dots + \binom{30}{20}\binom{30}{30}$

- A)  ${}^{30}C_{10}$   
 B)  ${}^{40}C_{30}$   
 C)  ${}^{60}C_{20}$   
 D)  ${}^{60}C_{30}$

**57)** The gradient of the radical axis of the circles  $x^2 + y^2 - 3x - 4y + 5 = 0$  and

$3x^2 + 3y^2 - 7x + 8y + 11 = 0$  is

- A)  $-\frac{2}{3}$

- B)  $-\frac{1}{10}$   
 C)  $-\frac{1}{2}$   
 D)  $\frac{1}{3}$

**58)** If  $\tan(\cot x) = \cot(\tan x)$ , then  $\sin 2x =$

- A)  $\frac{4}{(2n+1)\pi}$   
 B)  $(2n+1)\frac{\pi}{4}$   
 C)  $4\pi(2n+1)$   
 D) None of these

**59)** Let the unit vectors a and b be perpendicular and the unit vector c be inclined at an angle  $\theta$  to both a and b. If  $c = \alpha a + \beta b + \gamma (a \times b)$ , then

- A)  $\alpha = \beta = \cos\theta, \gamma^2 = -\cos 2\theta$   
 B)  $\alpha = \beta = \cos\theta, \gamma^2 = \cos 2\theta$   
 C)  $\alpha = \cos\theta, \beta = \sin\theta, \gamma^2 = \cos 2\theta$   
 D) None of these

**60)** The derivative of  $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$  with

respect to  $\tan^{-1}\left(\frac{2x\sqrt{1-x^2}}{1-2x^2}\right)$  at  $x = \frac{1}{2}$  is: (P. Y. -

2020)

- A)  $\frac{2\sqrt{3}}{5}$   
 B)  $\frac{\sqrt{3}}{12}$   
 C)  $\frac{2\sqrt{3}}{3}$   
 D)  $\frac{\sqrt{3}}{10}$

**61)** If the mean and variance of the following data: 6, 10, 7, 13, a, 12, b, 12 are 9 and respectively,

then  $(a-b)^2$  is equal to: (P. Y. - 2021)

- A) 24  
 B) 12  
 C) 32  
 D) 16

**62)** What are the variance and standard deviation of the number of heads in three tosses of a coin?

- A)  $\frac{3}{4}$  and  $\frac{\sqrt{3}}{2}$   
 B)  $\frac{\sqrt{3}}{2}$  and  $\frac{3}{4}$   
 C)  $\frac{4}{9}$  and  $\frac{3}{2}$



D)  $\frac{1}{2}$  and  $\frac{1}{\sqrt{2}}$

**63)** If  $x, 2x+2, 3x+3$  are in G.P., then the fourth term is

- A) -13.5  
B) -27  
C) 13.5  
D) 27

**64)**  $\int_0^{\infty} e^{-2x}(\sin 2x + \cos 2x) dx =$

- A) 0  
B)  $\frac{1}{2}$   
C) 1  
D)  $\infty$

**65)**  $\int x \sin^{-1} x dx =$

- A)  $\left(\frac{x^2}{2} + \frac{1}{4}\right) \sin^{-1} x - \frac{x}{4} \sqrt{1-x^2} + c$   
B)  $\left(\frac{x^2}{2} - \frac{1}{4}\right) \sin^{-1} x - \frac{x}{4} \sqrt{1-x^2} + c$   
C)  $\left(\frac{x^2}{2} + \frac{1}{4}\right) \sin^{-1} x + \frac{x}{4} \sqrt{1-x^2} + c$   
D)  $\left(\frac{x^2}{2} - \frac{1}{4}\right) \sin^{-1} x + \frac{x}{4} \sqrt{1-x^2} + c$

**66)** A car will hold 2 in the front seat and 1 in the rear seat. If among 6 persons 2 can drive, then the number of ways in which the car can be filled is

- A) 20  
B) 10  
C) 30  
D) None of these

**67)** Two consecutive sides of a parallelogram are  $4x+5y=0$  and  $7x+2y=0$ . If the equation to one diagonal is  $11x+7y=9$ , then the equation of the other diagonal is

- A)  $x-y=0$   
B)  $x+2y=0$   
C)  $2x+y=0$   
D) None of these

**68)** What is the sum of the infinite series  $\cot^{-1} 2 + \cot^{-1} 8 + \cot^{-1} 18 + \cot^{-1} 32 + \dots?$

- A)  $\frac{\pi}{2}$   
B)  $\pi$   
C)  $\frac{\pi}{4}$   
D) None of these

**69)** 25 people for program A, 50 people for

programme B, 10 people for both. So find number of employee employed only A.

**70)** If  $\alpha, \beta$  are the roots of the equation

$8x^2 - 3x + 27 = 0$  then find the value of

$$\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}.$$

**71)** The number of 5-digit natural numbers, such that the product of their digits is 36 is \_\_\_\_\_. (P.Y. - 2022)

**72)** For a real number  $\alpha$ , if the system

$$\begin{bmatrix} 1 & \alpha & \alpha^2 \\ \alpha & 1 & \alpha \\ \alpha^2 & \alpha & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$$
 of linear equations, has

infinitely many solutions, then find the value of  $1 + \alpha + \alpha^2$ .

**73)** What is the product of all the roots of

$$\left(\cos \frac{\pi}{3} + i \sin \frac{\pi}{3}\right)^{3/4} ?$$

**74)** If the line  $2x+y=k$  passes through the point which divides the line segment joining the point (1,1) and (2,4) in the ratio (3:2), then evaluate k.

**75)** Let there be three independent events  $E_1, E_2$  and  $E_3$ . The probability that only  $E_1$  occurs is  $\alpha$ , only  $E_2$  occurs is  $\beta$  and only  $E_3$  occurs is  $\gamma$ . Let 'p' denote the probability of none of events occurs that satisfies the equations  $(\alpha - 2\beta)p = \alpha\beta$  and  $(\beta - 3\gamma)p = 2\beta\gamma$ . All the given probabilities are assumed to lie in the interval (0, 1). Then,

$\frac{\text{Probability of occurrence of } E_1}{\text{Probability of occurrence of } E_3}$  is equal to \_\_\_\_.

(P. Y. - 2021)