



| PARTICULARS TO BE FILLED IN BY<br>THE CANDIDATE |  |                                    |     |
|---|--|------------------------------------|-----|
| Name of the Candidate                           |  | QUESTION BOOKLET NUMBER<br>4588141 |     |
| Roll Number                                     |  | UBTG                               |     |
| Application Number                              |  |                                    |     |
| Name of the Centre                              |  | Paper Code                         | 310 |
| Centre Code                                     |  | Question Paper Series              | A   |
| Date of the Test                                |  |                                    |     |
| Signature of the Candidate                      |  |                                    |     |

Maximum Marks : 150

Test Duration : 03 hours

**INSTRUCTIONS**

- Complete all entries on the cover page and put your signature in the space provided.
- Use only Ball Point Pen (black / blue) for making entries in the Question Booklet and the OMR Answer Sheet.

1. The Question Booklet consists of 56 pages and contains 150 questions. Count the number of pages and questions before attempting the questions. Discrepancy, if any, must immediately be brought to the notice of the Invigilator.
2. The Test Duration as specified above shall be reckoned from the moment of distribution of the Question Booklets.
3. Blank space in the Question Booklet may be used for rough work.
4. Each question is followed by four alternative answers. Select only one answer, which you consider as the most appropriate. Shade the relevant circle against the corresponding question number on the OMR Answer Sheet. Selecting more than one answer for a question, even if one of the selected answers is correct, would result in its being treated as an incorrect answer.
5. Answers should ONLY be marked on the OMR Answer Sheet. No answer should be written / marked on the Question Booklet.
6. The candidate is required to separate the original OMR Answer Sheet and its carbonless copy at the perforation carefully after the Admission Test. He / She shall handover the original OMR Answer Sheet and the Admit Card to the Invigilator before leaving his / her seat and take with him / her the carbonless copy of the OMR Answer Sheet and the Question Booklet.
7. Failure to handover the original OMR Answer Sheet and the Admit Card will lead to cancellation of the candidature.

SEAL



1. Temperature coefficient of a reaction is '2'. When temperature is increased from  $30^{\circ}\text{C}$  to  $90^{\circ}\text{C}$ , the rate of reaction is increased by :  
(a) 60 times  
(b) 64 times  
(c) 150 times  
(d) 400 times
2. For the reaction  $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$ , the rate is directly proportional to  $[\text{N}_2\text{O}_5]$ . At  $45^{\circ}\text{C}$ , 90% of the  $\text{N}_2\text{O}_5$  reacts in 3600 seconds. The value of the rate constant is :  
(a)  $3.20 \times 10^{-4} \text{ sec}^{-1}$   
(b)  $3.20 \times 10^{-3} \text{ sec}^{-1}$   
(c)  $6.40 \times 10^{-4} \text{ sec}^{-1}$   
(d)  $6.40 \times 10^{-3} \text{ sec}^{-1}$
3. In which of the following arrangements, the order is not according to the property indicated against it :  
(a)  $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$  increasing atomic size  
(b)  $\text{B} < \text{C} < \text{N} < \text{O}$  increasing first ionization energy  
(c)  $\text{I} < \text{Br} < \text{F} < \text{Cl}$  increasing electron gain enthalpy  
(d)  $\text{Li} < \text{Na} < \text{K} < \text{Rb}$  increasing metallic Radii

4. The ionic product of  $\text{Ni}(\text{OH})_2$  is  $2.0 \times 10^{-15}$ . The molar solubility of  $\text{Ni}(\text{OH})_2$  in 0.10M  $\text{NaOH}$  is :  
(a)  $2.0 \times 10^{-13}$   
(b)  $2.0 \times 10^{-14}$   
(c)  $1.0 \times 10^{-13}$   
(d)  $1.0 \times 10^{-14}$
5. The enthalpy of combustion of methane, graphite and dihydrogen at 298K are  $-890.3 \text{ KJ mol}^{-1}$ ,  $-393.5 \text{ KJ mol}^{-1}$  and  $-285.8 \text{ KJ mol}^{-1}$  respectively. Enthalpy of formation of  $\text{CH}_4(\text{g})$  will be :  
(a)  $-74.8 \text{ KJ mol}^{-1}$   
(b)  $-52.27 \text{ KJ mol}^{-1}$   
(c)  $+74.8 \text{ KJ mol}^{-1}$   
(d)  $+52.26 \text{ KJ mol}^{-1}$
6. Crystal field stabilisation energy for high spin  $d^4$  octahedral complex is :  
(a)  $-1.2\Delta_0$   
(b)  $-0.6\Delta_0$   
(c)  $-1.8\Delta_0$   
(d)  $-1.6\Delta_0 + P$



7. The mass of Carbon present in 0.5 mole of  $K_4[Fe(CN)_6]$  is :  
(a) 1.8 g  
(b) 18 g  
(c) 3.6 g  
(d) 36 g
8. According to Kinetic theory of gases, a gas molecule travels between two successive collisions :  
(a) in a circular path  
(b) in a wavy path  
(c) in a straight line path  
(d) with an accelerated velocity
9. The value of Van der Waals constant 'a' for gases  $O_2$ ,  $N_2$ ,  $NH_3$  and  $CH_4$  are 1.360, 4.170 and 2.253  $L^2 atm mol^{-2}$  respectively. The gas which can be most easily liquefied is :  
(a)  $O_2$   
(b)  $N_2$   
(c)  $NH_3$   
(d)  $CH_4$

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4

10. Camphor is often used in molecular mass determination because :

- (a) it has a very high cryoscopic constant  
(b) it is volatile  
(c) it is solvent for organic substances  
(d) it is readily available

11.  $Fe_3O_4$  is ferrimagnetic at room temperature but at 850 K it becomes :

- (a) diamagnetic  
(b) paramagnetic  
(c) ferromagnetic  
(d) non-magnetic

12. To get n-type semiconductor, the impurity to be added to Si should have the following number of valence electrons :

- (a) 1  
(b) 2  
(c) 3  
(d) 5

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[P.T.O.]



13. Poling process is used :
- (a) for removal of  $\text{Cu}_2\text{O}$  from Cu
  - (b) for removal of  $\text{Al}_2\text{O}_3$  from Al
  - (c) for removal of  $\text{Fe}_2\text{O}_3$  from Fe
  - (d) for removal of  $\text{Cu}_2\text{O}$  from  $\text{Cu}_2\text{O}_2$
14. A gas present in a cylinder filled with a frictionless piston expands against a constant pressure of 1 atm from a volume of 2 litres to a volume of 6 litres. In doing so it absorbs 800J heat from surroundings. Determine increase in internal energy of process :
- (a) 405.04 J
  - (b) 96.81 J
  - (c) 394.95 J
  - (d) 1205.04 J
15. Which statement is FALSE ?
- (a) Van der Waals constant 'a' is measure of magnitude of intermolecular attractive force with in the gas.
  - (b) At low temperature, intermolecular attraction is more significant and Van der Waals constant 'a' is high at low temperature.
  - (c) Van der Waals constant 'a' is independent of the pressure of the gas.
  - (d) Van der Waals gas approximates ideal gas behaviour when pressure approaches zero.

16. The resistance of a 0.1N solution of a salt is found to be  $2.5 \times 10^3$  ohms. Calculate the equivalent conductance of the solution :  $\frac{10^3}{10} = 10^2$
- Cell constant =  $1.15 \text{ cm}^{-1}$

- (a)  $2.30 \text{ ohm}^{-1} \text{ cm}^2 \text{ eqvt}^{-1}$
- (b)  $4.60 \text{ ohm}^{-1} \text{ cm}^2 \text{ eqvt}^{-1}$
- (c)  $5.23 \text{ ohm}^{-1} \text{ cm}^2 \text{ eqvt}^{-1}$
- (d)  $0.98 \text{ ohm}^{-1} \text{ cm}^2 \text{ eqvt}^{-1}$

17. Borazine is :

- (a)  $\text{B}_3\text{N}_3\text{H}_6$
- (b)  $\text{B}_2\text{H}_6$
- (c)  $\text{B}_2\text{N}_3\text{H}_6$
- (d)  $\text{B}_3\text{N}_2\text{H}_6$

18. When sodium is dissolved in liquid  $\text{NH}_3$ , a solution of deep blue colour is formed. The colour of the solution is due to :

- (a) Ammoniated electron
- (b) Sodium ion
- (c) Sodium amide
- (d) Ammoniated sodium ion





19. The respective number of bridging 'CO' groups in  $[\text{CO}_2(\text{CO})_8]$  and  $[\text{Mn}_2(\text{CO})_{10}]$  is/are :

- (a) 2, 0
- (b) 1, 0
- (c) 0, 1
- (d) 2, 2

20. One mole of  $\text{PdCl}_2 \cdot 4\text{NH}_3$  upon reaction with excess of  $\text{AgNO}_3$  gives two moles of  $\text{AgCl}$ . The coordination number of complex formed will be :

- (a) two
- (b) four
- (c) six
- (d) three

21. The correct electron gain enthalpy trend is :

- (a)  $\text{O} < \text{S} < \text{Se} < \text{Te} < \text{Po}$
- (b)  $\text{O} < \text{S} > \text{Se} > \text{Te} > \text{Po}$
- (c)  $\text{O} > \text{S} > \text{Se} > \text{Te} > \text{Po}$
- (d)  $\text{O} < \text{S} > \text{Se} < \text{Te} > \text{Po}$

22.  $\text{MnO}_4^-$  is Tetrahedral in geometry. There is  $\pi$  bonding between Mn and oxygen by the overlap of :

- (a) p - p Orbitals
- (b) s - p Orbitals
- (c) p - d Orbitals
- (d) s - d Orbitals

23. The highest magnetic moment among the following coordinated compound is shown by :

- (a)  $\text{K}_4[\text{Mn}(\text{CN})_6]$
- (b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- (c)  $\text{K}_2[\text{MnCl}_4]$
- (d)  $\text{Ni}(\text{CO})_4$

24. The transition metal oxides or halides does not exist among the following is :

- (a)  $\text{V}_2\text{O}_5$
- (b)  $\text{MnF}_5$
- (c)  $\text{CrF}_6$
- (d)  $\text{Mn}_2\text{O}_7$

25. Acidity of diprotic acids in aqueous solution increases in the order :

- (a)  $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$
- (b)  $\text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{Te}$
- (c)  $\text{H}_2\text{Te} < \text{H}_2\text{S} < \text{H}_2\text{Se}$
- (d)  $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{S}$

26. The commercial name of "Calgon" is :

- (a) Sodium aluminium silicate
- (b) Peroxodisulphate
- (c) Sodium sulphate decahydrate
- (d) Sodium hexametaphosphate

27. The correct order of an arrangement of the group 14 elements with decrease in their first ionization enthalpy is :

- (a)  $\text{C} > \text{Si} > \text{Ge} > \text{Sn} > \text{Pb}$
- (b)  $\text{C} > \text{Si} > \text{Ge} > \text{Pb} > \text{Sn}$
- (c)  $\text{C} > \text{Si} > \text{Sn} > \text{Ge} > \text{Pb}$
- (d)  $\text{C} > \text{Si} > \text{Pb} > \text{Sn} > \text{Ge}$

28. Which of the following oxoacids of phosphorus contains four 'P-OH' bonds ?

- (a) Orthophosphoric acid
- (b) Metaphosphoric acid
- (c) Hypophosphoric acid
- (d) Hypophosphorous acid

29. Which one is used for titration with  $\text{KMnO}_4$  in acidic medium ?

- (a)  $\text{HCl}$
- (b)  $\text{H}_2\text{SO}_4$
- (c)  $\text{HNO}_3$
- (d)  $\text{HClO}_4$

30. When manganese dioxide is fused with  $\text{KOH}$  or  $\text{K}_2\text{CO}_3$  in air, it gives :

- (a) Potassium manganate
- (b) Potassium Permanganate
- (c) Manganese heptoxide
- (d) Manganese Oxide

31. Which of the following alkaline earth metals have strong tendency towards the formation of metal chloride hydrates ?

- (a)  $\text{BaCl}_2$
- (b)  $\text{MgCl}_2$
- (c)  $\text{CaCl}_2$
- (d)  $\text{SrCl}_2$

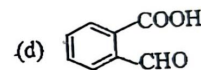
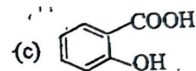
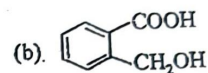
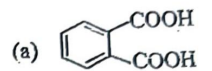
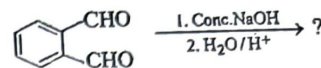
32. Which one of the following molecule is formed by p-p overlapping ?

- (a)  $\text{HCl}$
- (b)  $\text{Cl}_2$
- (c)  $\text{H}_2\text{O}$
- (d)  $\text{NH}_3$

33. Gadolinium belongs to 4f series. Its atomic number is 64. Which of the following is the correct electronic configuration of gadolinium ?

- (a)  $[\text{Xe}]4f^75d^16s^2$
- (b)  $[\text{Xe}]4f^65d^26s^2$
- (c)  $[\text{Xe}]4f^36d^2$
- (d)  $[\text{Xe}]4f^95s^1$

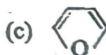
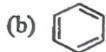
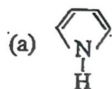
34. The product in the following reaction is :



35. In the polysaccharides, the monosaccharides are linked to each other by :

- (a) Glycosidic linkage
- (b) Peptide linkage
- (c) Nucleosidic linkage
- (d) Hydrogen bonding

36. Select the non-aromatic compound :



37. The IUPAC name of is :

(a) 2-Methyl-3-bromohexanal

(b) 2-Methyl-3-bromobutanal

(c) 3-Bromo-2-methylbutanal

(d) 3-Bromo-2-methylpentanal

38. The human body does not produce :

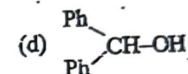
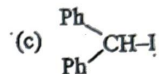
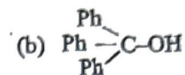
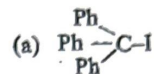
(a) Vitamins

(b) Enzymes

(c) Proteins

(d) Hormones

39.  $\text{Ph}-\text{CH}(\text{Ph})-\text{O}-\text{C}(\text{Ph})_2 + \text{aq. HI} \longrightarrow \text{X}$ . X will be :



40. Tincture Iodine is :

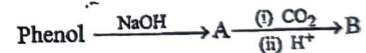
(a) aqueous solution of  $\text{I}_2$  + ether

(b) alcoholic solution of  $\text{I}_2$  + water

(c) solution of  $\text{I}_2$  in aqueous KI

(d) aqueous solution of KI

41. During the following sequence of reactions :



The main product B formed is :

(a) Salicylic acid

(b) Salicylaldehyde

(c) Benzoquinone

(d) Aspirin



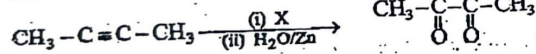
42. Which of the following reacts with phenol to give Bakelite ?

- (a) HCHO
- (b) CH<sub>3</sub>CHO
- (c) (CH<sub>2</sub>CHO)<sub>2</sub>
- (d) CH<sub>3</sub>COCH<sub>3</sub>

43. Which of the following alkyl halides is hydrolysed by SN<sup>2</sup> mechanism?

- (a) C<sub>6</sub>H<sub>5</sub>CH<sub>2</sub>Br
- (b) CH<sub>3</sub>Br
- (c) H<sub>2</sub>C=CHCH<sub>2</sub>Br
- (d) (CH<sub>3</sub>)<sub>3</sub>Br

44. In the reaction





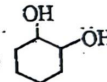

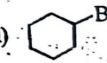
X will be :

- (a) HNO<sub>3</sub>
- (b) O<sub>2</sub>
- (c) O<sub>3</sub>
- (d) KMnO<sub>4</sub>

45. 3-Phenyl propene on reaction with HBr gives (as a major product) :

- (a) C<sub>6</sub>H<sub>5</sub>-CH<sub>2</sub>CH(Br)CH<sub>2</sub>Br
- (b) C<sub>6</sub>H<sub>5</sub>CH(Br)CH<sub>2</sub>CH<sub>3</sub>
- (c) C<sub>6</sub>H<sub>5</sub>-CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>Br
- (d) C<sub>6</sub>H<sub>5</sub>-CH(Br)CH=CH<sub>2</sub>

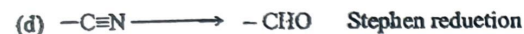
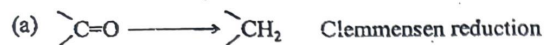
46. Predict the product   $\xrightarrow[2.\text{alc. KOH}]{1.\text{PBr}_3}$  ?

- (a) 
- (b) 
- (c) 
- (d) 

47. How many chiral centres are present in natural penicillin ?

- (a) 3
- (b) 4
- (c) 5
- (d) 6

48. Which one of the following pairs is not correctly matched ?



49. Name the reaction given below :



(a) Finkelstein reaction

(b) Swarts reaction

(c) Etard reaction

(d) Wurtz reaction

50. Pick-out the correct relationship :

(a) Antibiotics  $\longrightarrow$  Bacterial infection  $\longrightarrow$  Ranitidine

(b) Antipyretics  $\longrightarrow$  Reduce body temperature  $\longrightarrow$  Paracetamol

(c) Antiseptics  $\longrightarrow$  Wound infection  $\longrightarrow$  Saccharin

(d) Transquillizers  $\longrightarrow$  Psychotherapeutic agent  $\longrightarrow$  Phenolphthalein

51. The error in the measurement of the radius of a sphere is 2%. What will be the percentage error in the estimation of the volume of the sphere ?

(a) 2%

(b) 4%

(c) 6%

(d) 8%

52. A car accelerates from rest at a constant rate  $\alpha$  for some time after which it decelerates at a constant rate  $\beta$  to come to rest. If the total time elapsed is  $t$  seconds, the total distance travelled is :

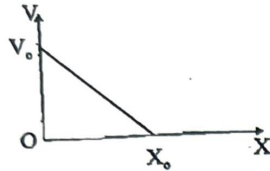
(a)  $\frac{4\alpha\beta}{(\alpha+\beta)}t^2$

(b)  $\frac{2\alpha\beta}{(\alpha+\beta)}t^2$

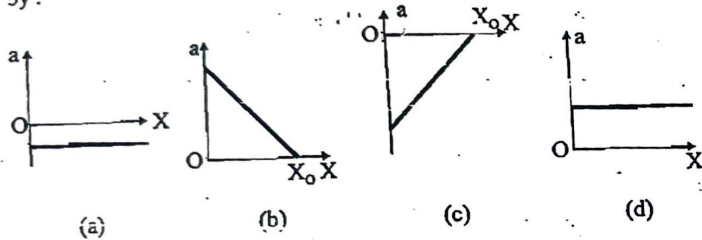
(c)  $\frac{\alpha\beta}{2(\alpha+\beta)}t^2$

(d)  $\frac{\alpha\beta}{4(\alpha+\beta)}t^2$

53. The velocity – displacement graph of a particle is shown in the figure below (in the figure 'O' refers to origin),



The acceleration – displacement graph of the same particle is represented by:



54. The velocity of a particle is  $V = V_0 + gt + Ft^2$ . Its position is  $X = 0$  at  $t = 0$ ; then its displacement after unit time ( $t = 1$ ) would be :
- (a)  $V_0 + g + F$   
 (b)  $V_0 + \frac{g}{2} + \frac{F}{3}$   
 (c)  $V_0 + g^2 + F^3$   
 (d)  $V_0 + 2g + 3F$

55. A body travels for 15 sec. starting from rest with constant acceleration. If it travels distances  $S_1$ ,  $S_2$  and  $S_3$  in the first five seconds, second five seconds and next five seconds respectively, the relation between  $S_1$ ,  $S_2$  and  $S_3$  will be :

- (a)  $S_1 = S_2 = S_3$   
 (b)  $5S_1 = 3S_2 = S_3$   
 (c)  $S_1 = \frac{1}{3}S_2 = \frac{1}{5}S_3$   
 (d)  $S_1 = \frac{1}{5}S_2 = \frac{1}{3}S_3$

56. A rubber ball is released from a height of 5m above the floor. It bounces back repeatedly, always rising to  $\frac{81}{100}$  of the height through which it falls again. What is the average speed of the ball? (Take,  $g = 10 \text{ ms}^{-2}$ )

- (a)  $3.0 \text{ ms}^{-1}$   
 (b)  $3.5 \text{ ms}^{-1}$   
 (c)  $2.0 \text{ ms}^{-1}$   
 (d)  $2.5 \text{ ms}^{-1}$

57. When a long spring is stretched by 2 cm, its potential energy is  $U$ . If the spring is stretched by 10 cm, the potential energy stored in it will be :

- (a)  $U/5$   
 (b)  $5U$   
 (c)  $10U$   
 (d)  $25U$

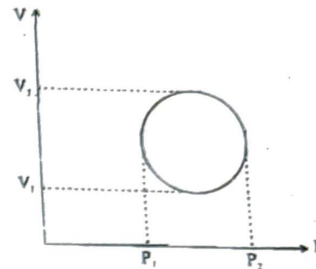
58. A ballet dancer has a moment of inertia of  $4 \text{ kg-m}^2$  when her arms reach her body and  $16 \text{ kg-m}^2$  when her arms are stretched. When two arms are pressed against her body, the speed of the dancer's rotation is 12 rounds/s. Then when the arms are stretched, the rotation speed becomes :
- 1 round/s
  - 2 round/s
  - 3 round/s
  - 4 round/s
59. If  $\vec{v}_1$  and  $\vec{v}_2$  represent the C.M. velocities of two particles of masses  $m_1$  and  $m_2$  respectively with  $m_1 > m_2$ , among the following which will be correct relation between their velocities :
- $|\vec{v}_1| = 0$
  - $|\vec{v}_1| = |\vec{v}_2|$
  - $|\vec{v}_1| < |\vec{v}_2|$
  - $|\vec{v}_1| > |\vec{v}_2|$
60. A geostationary satellite is orbiting around an arbitrary planet P at a height of  $11R$  above the surface of P, R being the radius of P. What is the time period of another satellite (in hours) at a height of  $2R$  from the surface of 'P', if the time period of first satellite is 24 hours :
- $6\sqrt{2}$
  - $\frac{6}{\sqrt{2}}$
  - 3
  - 5

61. The escape velocity of a projectile on the earth's surface is  $11.2 \text{ km/s}$ . A body is projected out with thrice this speed. What will be the speed of the body far away from the earth? Ignore the presence of sun and other planets :
- $11.7 \text{ km/sec}$ .
  - $31.7 \text{ km/sec}$ .
  - $42.4 \text{ km/sec}$ .
  - $73.2 \text{ km/sec}$ .
62. If  $E$  be the energy required to raise a satellite to a height  $h$  above the surface of the earth and  $E'$  be the energy to put the same satellite into orbit at that height, then :
- $E = E'$
  - $E = mgh$  and  $E' = \frac{mgR}{2(1+\frac{h}{R})}$
  - $E = \frac{mgh}{1+\frac{h}{R}}$  and  $E' = \frac{mgR}{2(1+\frac{h}{R})}$
  - $E = \frac{mgh}{1+\frac{h}{R}}$  and  $E' = \frac{mgR}{1+\frac{h}{R}}$



63. The period of revolution of the planet A round the sun is 8 times that of B. The distance of A from sun is how many times greater than that of B from the sun?
- (a) 5  
(b) 4  
(c) 3  
(d) 2
64. Water rises in a capillary tube to a height of 2.0 cm. How much will the water rise through another capillary tube whose radius is one third of the first tube?
- (a)  $2 \times 10^{-2}$  m  
(b)  $4 \times 10^{-2}$  m  
(c)  $6 \times 10^{-2}$  m  
(d)  $8 \times 10^{-2}$  m
65. A Carnot engine having an efficiency of  $\frac{1}{10}$  as heat engine, is used as a refrigerator. If the work done on the system is 10J, the amount of energy absorbed from the reservoir at low temperature is :
- (a) 01 J  
(b) 90 J  
(c) 99 J  
(d) 100 J

66. In the cyclic process shown in the adjoining P-V diagram, the work done is :



- (a)  $\pi \left( \frac{V_2 - V_1}{2} \right)^2$   
(b)  $\pi \left( \frac{P_2 - P_1}{2} \right)^2$   
(c)  $\pi (P_2 V_2 - P_1 V_1)$   
(d)  $\frac{\pi}{4} (P_2 - P_1) (V_2 - V_1)$
67. In an adiabatic expansion of the air, the volume is increased by 4%. What is the percentage change in pressure? (For air  $\gamma = 1.4$ )
- (a) 3.6%  
(b) 5.6%  
(c) 7.6%  
(d) 9.6%

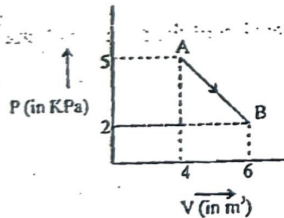
68. Two gases having volume 11 and 21 are at the same temperature. The ratio of the average kinetic energy of the molecules in the two gases :

- (a) 1 : 1
- (b) 1 : 2
- (c) 2 : 1
- (d) 3 : 2

69. Air is filled at  $60^\circ\text{C}$  in a vessel of open mouth. The vessel is heated to a temperature  $T$  so that  $1/4$ th part of air escapes. Assuming the volume of the vessel remains constant, the value of  $T$  is :

- (a)  $80^\circ\text{C}$
- (b)  $444^\circ\text{C}$
- (c)  $333^\circ\text{C}$
- (d)  $171^\circ\text{C}$

70. One mole of an ideal diatomic gas undergoes a transition from A to B along a path AB as shown in the figure :



The change in internal energy of the gas during the transition is :

- (a) 20 kJ
- (b) -20 kJ
- (c) 16 kJ
- (d) -16 kJ

71. A particle is executing SHM along a straight line. Its velocities at distances  $x_1$  and  $x_2$  from the mean position are  $v_1$  and  $v_2$ , respectively. Its time period is :

- (a)  $2\pi\sqrt{\frac{x_1^2 + x_2^2}{v_1^2 + v_2^2}}$
- (b)  $2\pi\sqrt{\frac{x_2^2 - x_1^2}{v_1^2 - v_2^2}}$
- (c)  $2\pi\sqrt{\frac{v_1^2 + v_2^2}{x_1^2 + x_2^2}}$
- (d)  $2\pi\sqrt{\frac{v_1^2 - v_2^2}{x_1^2 - x_2^2}}$

72. Two organ pipes A and B of length 33 cm and 33.5 cm respectively produces 3 beats per second when sounded together. The frequency of larger pipe is :

- (a) 223 Hz
- (b) 406 Hz
- (c) 198 Hz
- (d) 201 Hz

73. A wave is given by the equation  
 $y = 4.5 \sin \pi (200t - 0.04x) + 4.5 \sin 2 \pi (100t + 0.02x)$  cm. The maximum amplitude of the produced stationary wave is :

- (a) 9 cm
- (b) 4.5 cm
- (c) 2.25 cm
- (d) 18 cm

74. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration  $\alpha$ , what will be the time period of the pendulum ? (take  $g$  to be acceleration due to gravity)

- (a)  $T = 2 \pi \sqrt{\frac{6}{g}}$
- (b)  $T = 2 \pi \sqrt{\frac{6}{g - \alpha}}$
- (c)  $T = 2 \pi \sqrt{\frac{6}{g + \alpha}}$
- (d)  $T = 2 \pi \sqrt{\frac{6}{g^2 + \alpha^2}}$

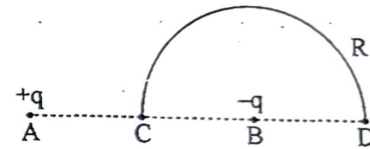
75. A spring of force constant  $K$  is cut into lengths of ratio 1 : 2 : 3. They are connected in series and the new force constant is  $K'$ . If they are connected in parallel and force constant is  $K''$ , then  $K' : K''$  is :

- (a) 1 : 6
- (b) 1 : 9
- (c) 1 : 11
- (d) 1 : 14

76. What speed should a galaxy move with respect to us so that the sodium line at 589.0 nm is observed at 589.0 nm ?

- (a) 406 km/s
- (b) 106 km/s
- (c) 206 km/s
- (d) 306 km/s

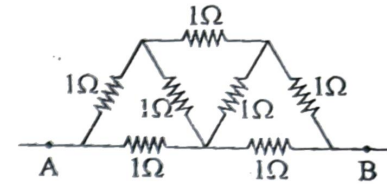
77. Charges  $+q$  and  $-q$  are placed at points A and B respectively which are at a distance  $2L$  apart, C is the midpoint between A and B. The work done in moving a charge  $+Q$  along the semi circle CRD is :



- (a)  $\frac{qQ}{4\pi\epsilon_0 L}$
- (b)  $\frac{qQ}{2\pi\epsilon_0 L}$
- (c)  $\frac{qQ}{6\pi\epsilon_0 L}$
- (d)  $\frac{qQ}{6\pi\epsilon_0 L}$

78. In a region, the potential is represented by,  
 $V(x, y, z) = 6x - 8xy - 8y + 6yz$ ,  
 where  $V$  is in volts and  $x, y, z$  are in meters. The electric force experienced by a charge of  $2C$  situated at a point  $(1, 1, 1)$  is :
- (a)  $6\sqrt{5} N$   
 (b)  $30N$   
 (c)  $24N$   
 (d)  $4\sqrt{35} N$
79. The internal resistance of a  $2.1 V$  cell which gives a current of  $0.2A$  through a resistance of  $10\Omega$  is :
- (a)  $0.8 \Omega$   
 (b)  $1.0 \Omega$   
 (c)  $0.2 \Omega$   
 (d)  $0.5 \Omega$
80. The charge flowing through a resistance  $R$  varies with time  $t$  as  $Q = at - bt^2$ , where  $a$  and  $b$  are positive constants. The total heat produced in  $R$ , between the time  $t = 0$  to  $t = \frac{a}{2b}$ , is :
- (a)  $\frac{a^3R}{2b}$   
 (b)  $\frac{a^3R}{b}$   
 (c)  $\frac{a^3R}{6b}$   
 (d)  $\frac{a^3R}{3b}$

81. In the network shown in figure each resistance is  $1\Omega$ . The effective resistance between A and B is :

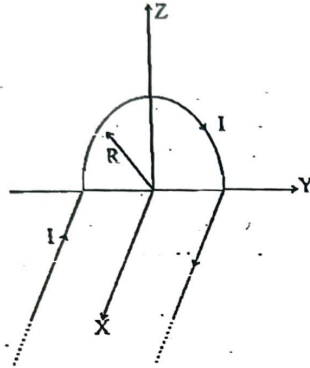


- (a)  $\frac{4}{3} \Omega$   
 (b)  $\frac{3}{2} \Omega$   
 (c)  $7 \Omega$   
 (d)  $\frac{8}{7} \Omega$
82. A copper wire of diameter  $1 \text{ cm}$  has a resistance of  $0.25 \Omega$ . It is drawn under pressure so that its diameter is reduced to  $50\%$ . The new resistance of the wire will be :
- (a)  $2 \Omega$   
 (b)  $4 \Omega$   
 (c)  $6 \Omega$   
 (d)  $8 \Omega$
83.  $n$  number of resistances, each of  $r$  ohm, when connected in parallel give an equivalent resistance of  $R$  ohm. If these resistances were connected in series, the combination would have a resistance in ohm, equals to :
- (a)  $n^2R$   
 (b)  $\frac{R}{n^2}$   
 (c)  $\frac{R}{n}$   
 (d)  $nR$



84. A wire carrying current  $I$  has the shape as shown in adjoining figure : linear part of the wire are very long and parallel to  $x$ -axis while semi circular portion of radius  $R$  is lying in  $Y$ - $Z$  plane. Magnetic field at point  $O$  is :

- (a)  $\vec{B} = -\frac{\mu_0}{4\pi} \frac{I}{R} (\pi\hat{i} + 2\hat{k})$   
 (b)  $\vec{B} = \frac{\mu_0}{4\pi} \frac{I}{R} (\pi\hat{i} - 2\hat{k})$   
 (c)  $\vec{B} = \frac{\mu_0}{4\pi} \frac{I}{R} (\pi\hat{i} + 2\hat{k})$   
 (d)  $\vec{B} = -\frac{\mu_0}{4\pi} \frac{I}{R} (\pi\hat{i} - 2\hat{k})$



85. A long straight wire of radius 'a' carries a steady current  $I$ . The current is uniformly distributed over its cross-section. The ratio of magnetic fields  $B$  and  $B'$ , at radial distances  $a/2$  and  $2a$  respectively, from the axis of the wire is :

- (a) 1  
 (b) 4  
 (c)  $\frac{1}{4}$   
 (d)  $\frac{1}{2}$

86. The magnetic flux linked with a coil, in Webers, is given by the equation  $2t^2 + 3t + 14$ . The magnitude of the induced emf at  $t = 3$  seconds is :

- (a) 4 V  
 (b) 9 V  
 (c) 15 V  
 (d) 20 V

87. The electric field part of an electromagnetic wave in a medium is represented by,

$$E_x = 0,$$

$$E_y = 2.5 \frac{N}{C} \cos \left[ \left( 2\pi \times 10^6 \frac{\text{rad}}{\text{m}} \right) t - \left( \pi \times 10^{-2} \frac{\text{rad}}{\text{s}} \right) x \right], \quad E_z = 0.$$

The wave is :

- (a) moving along (-ve)  $x$ -direction with frequency  $2\pi \times 10^6$  Hz and wavelength 200 m  
 (b) moving along (+ve)  $x$ -direction with frequency  $10^6$  Hz and wavelength 100 m  
 (c) moving along (+ve)  $x$ -direction with frequency  $10^6$  Hz and wavelength 200 m  
 (d) moving along (+ve)  $x$ -direction with frequency  $2\pi \times 10^6$  Hz and wavelength 200 m

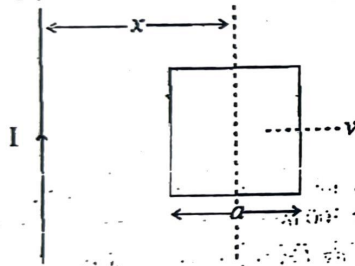
88. A circuit when connected to an A.C. source of 12 V gives a current of 0.2 A. The same circuit when connected to a D.C. source of 12 V, gives a current of 0.4A. The circuit is :

- (a) series LR  
 (b) series RC  
 (c) series LC  
 (d) series LCR

89. The potential difference across the resistance, capacitance and inductance are 80V, 40V and 100V respectively in a LCR circuit. The power factor of this circuit is :

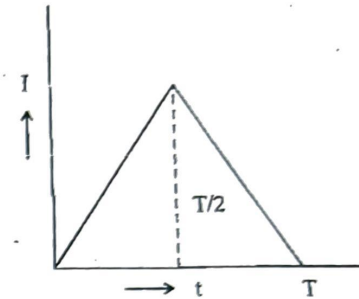
- (a) 0.4
- (b) 0.5
- (c) 0.8
- (d) 1.0

90. A conducting square frame of side 'a' and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity v. The emf induced in the frame will be proportional to :

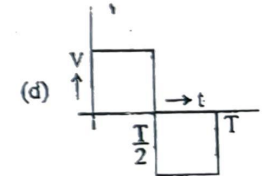
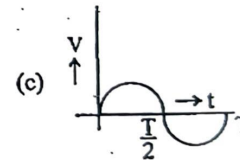
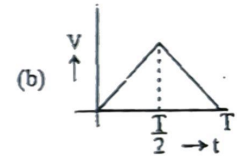
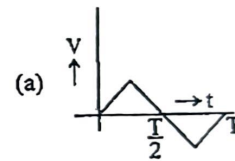


- (a)  $\frac{I}{x^2}$
- (b)  $\frac{I}{(2x-a)^2}$
- (c)  $\frac{I}{(2x+a)^2}$
- (d)  $\frac{I}{(2x-a)(2x+a)}$

91. The current (I) in the inductance is varying with time according to the plot shown in the figure :



Which one of the following is the correct variation of voltage with time in the coil ?



92. A capacitor of capacitance  $c$  is connected across an A.C. source of voltage  $v$ , given by,

$$v = v_0 \sin \omega t$$

The displacement current between the plates of the capacitor, would then be given by :

(a)  $I_d = v_0 \omega c \cos \omega t$

(b)  $I_d = \frac{v_0}{\omega c} \cos \omega t$

(c)  $I_d = \frac{v_0}{\omega c} \sin \omega t$

(d)  $I_d = v_0 \omega c \sin \omega t$

93. For a plane electromagnetic wave propagating in  $x$ -direction, which one of the following combination gives the correct possible directions for electric field (E) and magnetic field (B) respectively :

(a)  $\hat{j} + \hat{k}, \hat{j} + \hat{k}$

(b)  $-\hat{j} + \hat{k}, -\hat{j} - \hat{k}$

(c)  $\hat{j} + \hat{k}, -\hat{j} + \hat{k}$

(d)  $-\hat{j} + \hat{k}, -\hat{j} + \hat{k}$

94. Two slits in Young's experiments have widths in the ratio 1 : 25. The ratio of intensity at the maxima and minima in the interference pattern

$$\frac{I_{\max}}{I_{\min}} \text{ is :}$$

(a)  $\frac{5}{1}$

(b)  $\frac{25}{16}$

(c)  $\frac{9}{4}$

(d)  $\frac{121}{49}$

95. Two polaroids  $P_1$  and  $P_2$  are placed with their axis perpendicular to each other. Unpolarised light  $I_0$  is incident on  $P_1$ . A third polaroid  $P_3$  is kept in between  $P_1$  and  $P_2$  such that its axis makes an angle  $45^\circ$  with that of  $P_1$ . The intensity of transmitted light through  $P_2$  is :

(a)  $\frac{I_0}{4}$

(b)  $\frac{I_0}{8}$

(c)  $\frac{I_0}{16}$

(d)  $\frac{I_0}{2}$

96. A parallel beam of monochromatic light of wavelength  $5000\text{\AA}$  is incident normally on a single narrow slit of width  $0.001 \text{ mm}$ . The light is focused by a convex lens on a screen placed in the focal plane. The first minimum will be formed for the angle of diffraction equal to :

(a)  $0^\circ$

(b)  $15^\circ$

(c)  $30^\circ$

(d)  $50^\circ$

97. The angular resolution of a 10 cm diameter telescope at a wavelength of  $5000\text{\AA}$  is :

(a)  $6.1 \times 10^{-2}$

(b)  $6.1 \times 10^{-3}$

(c)  $6.1 \times 10^{-4}$

(d)  $6.1 \times 10^{-5}$

98. What is the de Broglie wavelength associated with an electron moving with a speed of  $5.4 \times 10^6 \text{ m/s}$  ?

(a) 0.135 nm

(b) 0.335 nm

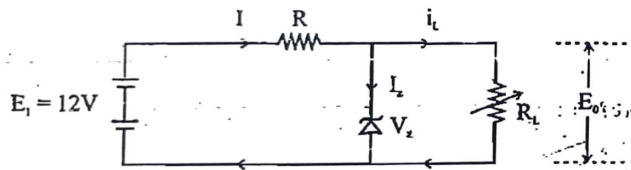
(c) 0.935 nm

(d) 1.235 nm

99. A old wooden tool is found to contain only 6.0% of  $^{14}_6\text{C}$  (half life 5730 yr) that a sample of fresh wood would. Approximately how old is the tool ? (note :  $\frac{\log 16.7}{\log 2} = 4.06$ )

- (a) 1432 yr
- (b) 2864 yr
- (c)  $2.86 \times 10^4$  yr
- (d)  $2.3 \times 10^4$  yr

100. A 7.2 V Zener is used in the circuit shown in figure below and the load current is to vary from 12 to 100 mA. Find the value of series resistance R to maintain a voltage of 7.2 V across the load. The input voltage is constant at 12 V and the minimum Zener current is 10 mA :



- (a)  $13.5 \Omega$
- (b)  $23.5 \Omega$
- (c)  $33.5 \Omega$
- (d)  $43.5 \Omega$

101. Which of the following is the contrapositive of 'if two triangles are identical, then these are similar' ?

- (a) if two triangles are not similar, then they are not identical.
- (b) if two triangles are not identical, then these are not similar.
- (c) if two triangles are not identical, then these are similar.
- (d) if two triangles are not similar, then these are identical.

102. A person throws two fair dice. He wins Rs. 15 for throwing a doublet (same number on the two dice), wins Rs. 12 when the throw results in the sum of 9, and loses Rs. 6 for any other outcome on the throw. Then the expected gain/loss (in Rs.) of the person is :

- (a)  $\frac{1}{2}$  gain.
- (b)  $\frac{1}{4}$  loss
- (c)  $\frac{1}{2}$  loss
- (d) 2 gain

103. The probability when a hand of 7 cards is dealt from a well shuffled deck of 52 cards, it contains all 4 kings is :

- (a)  $\frac{9}{1547}$
- (b)  $\frac{1}{1547}$
- (c)  $\frac{46}{7735}$
- (d)  $\frac{1}{7735}$



104. Suppose that it is 9 to 7 against a person A who is now 35 years of age living till he is 65; and 3 to 2 against a person B now 45 living till he is 75; the chance, that one at least of these two will be alive 30 years hence, is :

- (a)  $\frac{53}{80}$
- (b)  $\frac{27}{80}$
- (c)  $\frac{15}{16}$
- (d)  $\frac{14}{27}$

105. Let n be a two digit natural number. If n is selected at random, then find the probability such that  $2^n - 2$  is a multiple of 3 :

- (a)  $\frac{1}{4}$
- (b)  $\frac{1}{2}$
- (c)  $\frac{1}{3}$
- (d) 0

106. A bag contains four one-rupee coins, two twenty-five paise coins and five ten-paise coins. In how many ways can an amount, not less than Re. 1 be taken out from the bag ? (Consider coins of the same denominations to be identical.)

- (a) 71
- (b) 72
- (c) 73
- (d) 80

4 (2) C  
2 (25) P  
5 (10) "

$\frac{7}{4}$

107. If the function  $f(x) = \begin{cases} \frac{\log(1+ax) - \log(1-bx)}{x}, & \text{if } x \neq 0 \\ K, & \text{if } x = 0 \end{cases}$

is continuous at  $x = 0$ , then the value of K is :

- (a)  $a + b$
- (b)  $a - b$
- (c)  $\frac{a}{b}$
- (d)  $ab$

108. If the sum of two unit vectors is a vector of length  $\frac{1+\sqrt{3}}{\sqrt{2}}$ , then the angle

between the two given vectors is :

- (a) 0
- (b)  $\frac{\pi}{3}$
- (c)  $\frac{\pi}{2}$
- (d)  $\frac{\pi}{6}$

109. If the function  $f(x) = \begin{cases} (\cos x)^{1/x}, & x \neq 0 \\ K, & x = 0 \end{cases}$  is continuous at  $x = 0$ , then the value of  $K$  is :

- (a) 0
- (b) 1
- (c) -1
- (d) e

110. If  $\vec{a}, \vec{b}, \vec{c}$  are unit vectors such that  $\vec{a}$  is perpendicular to the plane of

$\vec{b}, \vec{c}$  and the angle between  $\vec{b}, \vec{c}$  is  $\frac{\pi}{3}$ , then  $\left| \vec{a} + \vec{b} + \vec{c} \right|$  is :

- (a) 0
- (b) 1
- (c) 2
- (d) 3

111. The general solution of the D.E.  $x \frac{dy}{dx} + 2y = x^2, (x \neq 0)$  is :

- (a)  $4x^2y = x^4 + c$
- (b)  $4xy^2 = y^4 + c$
- (c)  $4xy = y^4 + c$
- (d)  $xy = x^2 + cy^3$

112. Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a differentiable function for all values of  $x$  and has the property that  $f(x)$  and  $f'(x)$  have opposite signs for all values of  $x$ . Then :

- (a)  $f(x)$  is an increasing function
- (b)  $f(x)$  is a decreasing function
- (c)  $f^2(x)$  is a decreasing function
- (d)  $|f(x)|$  is an increasing function

113. A particular solution of the differential equation  $(x-y)(dx+dy) = dx - dy$  given that  $y(0) = -1$ , is :

- (a)  $\log |x-y| = x + y$
- (b)  $\log |x-y| = x + y + 1$
- (c)  $\log |x-y| = x + y - 1$
- (d)  $\log |x-y| = x - y - 1$

114. Let  $f : \mathbb{R} \rightarrow \mathbb{R}$  be a differentiable function  $\forall x \in \mathbb{R}$ . If the tangent drawn to the curve at any point  $x \in (a, b)$  always lies below the curve, then :

- (a)  $f'(x) > 0, f''(x) < 0 \quad \forall x \in (a, b)$
- (b)  $f'(x) < 0, f''(x) < 0 \quad \forall x \in (a, b)$
- (c)  $f'(x) > 0, f''(x) > 0 \quad \forall x \in (a, b)$
- (d) None of these

115. A stone is dropped into a quiet lake and waves move in circles at the speed of 5 cm/s. At the instant when the radius of the circular wave is 10 cm, how fast is the enclosed area increasing?

- (a)  $10\pi \text{ cm}^2/\text{s}$
- (b)  $20\pi \text{ cm}^2/\text{s}$
- (c)  $50\pi \text{ cm}^2/\text{s}$
- (d)  $100\pi \text{ cm}^2/\text{s}$

116. If  $e^{y(x+1)} = 1$ , then  $\left(\frac{dy}{dx}\right)^2$  is equal to:

- (a)  $\frac{d^2y}{dx^2}$
- (b)  $\frac{1}{2} \frac{dy}{dx}$
- (c) 0
- (d) 1

117. The value of  $\int \frac{e^x(1+x)}{\cos^2(xe^x)} dx$  is:

- (a)  $\tan(xe^x) + c$
- (b)  $-\tan(xe^x) + c$
- (c)  $\operatorname{cosec}(xe^x) + c$
- (d)  $\sec(xe^x) + c$

118. If  $\int_a^b x^3 dx = 0$  and  $\int_a^b x^2 dx = \frac{2}{3}$ , then the value of a and b are:

- (a)  $a = 1, b = -1$
- (b)  $a = -1, b = 1$
- (c)  $a = 1, b = 1$
- (d)  $a = -1, b = -1$

119. The area bounded by the curves  $y = \cos x$  and  $y = \sin x$  between the ordinates  $x = 0$  and  $x = \frac{3\pi}{2}$  is:

- (a)  $4\sqrt{2} + 2$
- (b)  $4\sqrt{2} - 2$
- (c)  $4\sqrt{2} + 1$
- (d)  $4\sqrt{2} - 1$



120. The equation of the plane passing through the intersection of the planes  $x + 2y + 3z = 4$  and  $4x + 3y + 2z = -1$  and the origin is:

- (a)  $17x - 14y + 11z = 0$
- (b)  $17x + 14y - 11z = 0$
- (c)  $-17x + 14y + 11z = 0$
- (d)  $17x + 14y + 11z = 0$

121. A perpendicular is drawn from a point on the line  $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z}{1}$  to the plane  $x + y + z = 3$  such that the foot of the perpendicular Q also lies on the plane  $x - y + z = 3$ . Then the co-ordinates of Q are :

- (a) (1, 0, 2)
- (b) (2, 0, 1)
- (c) (-1, 0, 4)
- (d) (4, 0, -1)

122. The line  $\frac{x}{k} = \frac{y}{2} = \frac{z}{-12}$  makes an isosceles triangle with the planes  $2x + y + 3z - 1 = 0$  and  $x + 2y - 3z - 1 = 0$  if value of k is :

- (a) 1
- (b) -2
- (c) 3
- (d) 4

123. The area bounded by the curve  $y = \sin^{-1}x$  and the lines  $x = 0$ ,  $|y| = \pi/2$  is :

- (a) 2
- (b) 4
- (c) 8
- (d) 16

124. The area under the curve  $y = \frac{(\ln x)}{x^2}$  from  $x = 1$  to  $x = \infty$  is :

- (a) 1
- (b)  $\infty$
- (c)  $\frac{1}{2}$
- (d)  $\frac{1}{4}$

125. The eccentricity of the ellipse  $5x^2 + 9y^2 = 1$  is :

- (a) 1/2
- (b) 4/5
- (c) 3/4
- (d) 2/3

126. A plane meets the co-ordinate axes in A, B and C such that the centroid of the triangle ABC is the point (a, b, c), then equation of the plane is :

- (a)  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$
- (b)  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 2$
- (c)  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 3$
- (d)  $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = \frac{1}{3}$

127. If  $f(x) = 1 + \alpha x$ ,  $\alpha \neq 0$  is the inverse of itself, then the value of  $\alpha$  is :

- (a) -1
- (b) 1
- (c) 0
- (d) 2

128. The  $x$  and  $y$ -axes are rotated through an angle  $\frac{\pi}{4}$  radians about the origin to get new axes  $x'$  and  $y'$ . The equation for the hyperbola  $2xy = 9$  in the new co-ordinates will be :

- (a)  $x'^2 - y'^2 = 9$
- (b)  $2x'y' = 9$
- (c)  $\frac{x'^2}{9} - \frac{y'^2}{9} = 2$
- (d)  $x'y' = 1$

129. Locus of midpoints of the chords of contact of  $x^2 + y^2 = 2$  from the points on the line  $3x + 4y = 10$  is a circle with centre  $P$ . If  $O$  be the origin then  $OP$  is equal to :

- (a)  $\frac{1}{2}$
- (b)  $\frac{1}{3}$
- (c)  $\frac{1}{4}$
- (d) 1

130. A point  $P(x, y)$  moves in  $x$ - $y$  plane such that  $x = a \cos^2 \theta$  and  $y = 2a \sin \theta$ , where  $\theta$  is a parameter. The locus of the point  $P$  is :

- (a) circle
- (b) ellipse
- (c) unbounded parabola
- (d) part of the parabola

131. If  $P = [x \ y \ z]$ ,  $Q = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$  and  $R = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$ , then

$[ax^2 + by^2 + cz^2 + 2hxy + 2gzx + 2fyz]$  is :

- (a)  $(PQ)R$
- (b)  $(PR)Q$
- (c)  $P(RQ)$
- (d) None of these

132. The number of 6-digit numbers that can be formed using the three digits 0, 1 and 2 is :

- (a)  $3 \times 2^5$
- (b)  $2 \times 3^3$
- (c)  $3^6$
- (d)  $2 \times 3^6$



133. Let  $\alpha, \beta$  be the roots of  $x^2 - x + p = 0$  and  $\gamma, \delta$  be the roots of  $x^2 - 4x + q = 0$ . If  $\alpha, \beta, \gamma$  and  $\delta$  are in G.P., then the integer values of  $p$  and  $q$  respectively are :

- (a)  $-2, 3$
- (b)  $-6, 3$
- (c)  $-6, -32$
- (d)  $-2, -32$

134. Solving the following equations for  $x$  and  $y$

$$3x + y - 4z + 5w = 2$$

$$2x - 3y - 2z + 3w = 5$$

with  $w > z$  and  $0 < w < 1$ , we get :

- (a)  $x < 1, y < 0$
- (b)  $x < 1, y > 0$
- (c)  $x < 0, y < 0$
- (d)  $x > 1, y > 0$

135. If  ${}^{28}C_{2r} : {}^{24}C_{2r-1} = 225 : 11$ , then  $r$  is equal to :

- (a) 24
- (b) 14
- (c) 7
- (d) 21

136. If  $A = \begin{pmatrix} 0 & -\tan \frac{\theta}{2} \\ \tan \frac{\theta}{2} & 0 \end{pmatrix}$  and  $(I_2 + A)(I_2 - A)^{-1} = \begin{pmatrix} a & -b \\ b & a \end{pmatrix}$ , where  $I_2$  denote the  $2 \times 2$  identity matrix, then  $13(a^2 + b^2)$  is equal to :

- (a) 1
- (b) 0
- (c) 13
- (d) 2

137. The number of distinct values of  $\theta$  satisfying  $0 \leq \theta \leq \pi$  and satisfying the equation  $\sin \theta + \sin 5\theta = \sin 3\theta$ , is :

- (a) 6
- (b) 7
- (c) 8
- (d) 9

138. The value of the determinant

$$\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (a^y + a^{-y})^2 & (a^y - a^{-y})^2 & 1 \\ (a^z + a^{-z})^2 & (a^z - a^{-z})^2 & 1 \end{vmatrix}$$

where  $a > 0$  and  $x, y, z \in \mathbb{R}$  is :

- (a)  $a^x a^y a^z$
- (b) 1
- (c) 0
- (d)  $a^x + a^y + a^z$

139. If the value of the determinant

$$\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix}$$

is positive then :

- (a)  $abc < -8$
- (b)  $abc > -8$
- (c)  $abc > -2$
- (d)  $abc > 1$

140. Let  $Z$  be those complex number which satisfy  $|Z+5| \leq 4$  and

$$Z(1+i) + \bar{Z}(1-i) \geq -10, (i = \sqrt{-1}).$$

If the maximum value of  $|Z+1|^2$  is  $a+b\sqrt{2}$ , then the value of  $(a+b)$  is :

- (a) 32
- (b) 16
- (c) 64
- (d) 48

141. If  $W = \frac{Z}{Z - \frac{i}{2}}$  and  $|W| = 1$ , then  $Z$  lies on :

- (a) a parabola
- (b) a straight line
- (c) a circle
- (d) an ellipse

142. Six boys and six girls sit along a line alternately in  $x$  ways; and along a circle (again alternately in  $y$  ways); then :

- (a)  $x = y$
- (b)  $y = 12x$
- (c)  $x = 10y$
- (d)  $x = 12y$

143. The range of the function  $f(x) = \{|\sin x| + |\cos x|\}$ , where  $\{.\}$  denotes the greatest integer function, is :

- (a)  $\{0\}$
- (b)  $\{1\}$
- (c)  $\{0, 1\}$
- (d)  $\{1, \sqrt{2}\}$

144. If  $\sin x + \sin^2 x + \sin^3 x = 1$ , then  $\cos^6 x - 4 \cos^4 x + 8 \cos^2 x$  is equal to :

- (a) 1
- (b) 2
- (c) 3
- (d) 4

145. The value of  $\int_{\frac{1}{e}}^{\tan x} \frac{tdt}{1+t^2} + \int_{\frac{1}{e}}^{\cot x} \frac{dt}{t(1+t^2)}$  is equal to :

- (a) -1
- (b) 1
- (c) 0
- (d) e

146. The value of  $\sin^{-1} \left( \frac{\sin x + \cos x}{\sqrt{2}} \right)$ ,  $-\frac{\pi}{4} < x < \frac{\pi}{4}$  is :

- (a)  $\pi/4$
- (b)  $x + \pi/4$
- (c)  $\frac{\pi}{4} - x$
- (d) x

147. If  $f: R \rightarrow S$  defined by

$f(x) = \sin x - \sqrt{3} \cos x + 1$  is onto, then the interval of S is :

- (a) [0, 3]
- (b) [-1, 1]
- (c) [0, 1]
- (d) [-1, 3]

148. Relation R in the set of all integers defined as  $xRy$  if and only if  $2x+5y$  is a multiple of 7, then R is :

- (a) only reflexive
- (b) reflexive and symmetric but not transitive
- (c) reflexive and transitive but not symmetric
- (d) an equivalence relation

149. The following data was observed from a study of car complaints received from 360 respondents at Khan's Car Care Workshop, viz, engine problem, transmission problem or mileage problem. Of those surveyed, there was no one who faced exactly two of these problems. There were 180 respondents who faced engine problems, 240 who faced transmission problems and 300 who faced mileage problems. How many of them faced all the three problems ?

- (a) 90
- (b) 120

150. Let  $f: R \rightarrow R$  be defined by  $f(x) = \frac{x}{1+x^2}$ ,  $x \in R$ . Then the range of f is :

- (a)  $(-1, 1) - \{0\}$
- (b)  $[-\frac{1}{2}, \frac{1}{2}]$
- (c)  $R - [-\frac{1}{2}, \frac{1}{2}]$
- (d)  $R - [-1, 1]$



**ALIGARH MUSLIM UNIVERSITY, ALIGARH**  
**ANSWER KEY (B. TECH.) ADMISSION TEST 2022-23**

**SERIES: A**

| Q.No. | Answer |
|-------|--------|
| 1     | B      |
| 2     | C      |
| 3     | B      |
| 4     | A      |
| 5     | C      |
| 6     | B      |
| 7     | D      |
| 8     | C      |
| 9     | C      |
| 10    | A      |
| 11    | B      |
| 12    | D      |
| 13    | A      |
| 14    | C      |
| 15    | B      |
| 16    | B      |
| 17    | A      |
| 18    | A      |
| 19    | A      |
| 20    | B      |
| 21    | B      |
| 22    | C      |
| 23    | C      |
| 24    | B      |
| 25    | A      |
| 26    | D      |
| 27    | B      |
| 28    | C      |
| 29    | B      |
| 30    | A      |
| 31    | B      |
| 32    | B      |
| 33    | A      |
| 34    | B      |
| 35    | A      |
| 36    | D      |
| 37    | D      |
| 38    | A      |
| 39    | A      |
| 40    | B      |

| Q.No. | Answer |
|-------|--------|
| 41    | A      |
| 42    | A      |
| 43    | B      |
| 44    | C      |
| 45    | B      |
| 46    | A      |
| 47    | B      |
| 48    | B      |
| 49    | B      |
| 50    | B      |
| 51    | C      |
| 52    | C      |
| 53    | C      |
| 54    | B      |
| 55    | C      |
| 56    | D      |
| 57    | D      |
| 58    | C      |
| 59    | C      |
| 60    | C      |
| 61    | B      |
| 62    | C      |
| 63    | B      |
| 64    | C      |
| 65    | B      |
| 66    | D      |
| 67    | B      |
| 68    | A      |
| 69    | D      |
| 70    | B      |
| 71    | B      |
| 72    | C      |
| 73    | B      |
| 74    | D      |
| 75    | C      |
| 76    | D      |
| 77    | D      |
| 78    | D      |
| 79    | D      |
| 80    | C      |

| Q.No. | Answer |
|-------|--------|
| 81    | D      |
| 82    | B      |
| 83    | A      |
| 84    | A      |
| 85    | A      |
| 86    | C      |
| 87    | C      |
| 88    | A      |
| 89    | C      |
| 90    | D      |
| 91    | D      |
| 92    | A      |
| 93    | B      |
| 94    | C      |
| 95    | B      |
| 96    | C      |
| 97    | C      |
| 98    | A      |
| 99    | D      |
| 100   | D      |
| 101   | A      |
| 102   | C      |
| 103   | D      |
| 104   | A      |
| 105   | B      |
| 106   | C      |
| 107   | A      |
| 108   | D      |
| 109   | B      |
| 110   | C      |
| 111   | A      |
| 112   | C      |
| 113   | B      |
| 114   | C      |
| 115   | D      |
| 116   | A      |
| 117   | A      |
| 118   | B      |
| 119   | B      |
| 120   | D      |

| Q.No. | Answer |
|-------|--------|
| 121   | B      |
| 122   | B      |
| 123   | A      |
| 124   | A      |
| 125   | D      |
| 126   | C      |
| 127   | A      |
| 128   | A      |
| 129   | A      |
| 130   | D      |
| 131   | A      |
| 132   | B      |
| 133   | D      |
| 134   | A      |
| 135   | C      |
| 136   | C      |
| 137   | A      |
| 138   | C      |
| 139   | B      |
| 140   | D      |
| 141   | B      |
| 142   | D      |
| 143   | B      |
| 144   | D      |
| 145   | B      |
| 146   | B      |
| 147   | D      |
| 148   | D      |
| 149   | C      |
| 150   | B      |