

# AMUEEE Question Paper 2017

Duration : 3 : 00 Hrs

Exam AMUEEE		Total Questions 150		
Marks for Correct Answer 1	Negative Marks 0.25	Physics 50	Chemistry 50	Mathematics 50

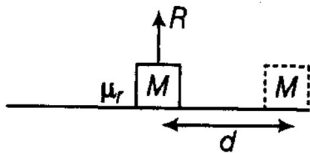
## Physics

1. The velocity of a transverse wave in a string is directly proportional to  $\sqrt{T}$  and inversely proportional to  $\sqrt{u}$ . In a measurement, the mass applied at the end of string is 3.0 g, length of string is 1 m and mass of string is 5 g. If possible error in measuring mass is 0.1 g and that of length is 1mm, the percentage error in measurement of velocity is

- (a) 4.5%
- (b) 2.7%
- (c) 2.1%
- (d) 3.7%

Correct: b

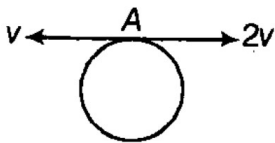
2. If reaction is R and coefficient of friction  $\mu_r$ , what is the work done against friction in moving a body by distance d?



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

Correct: c

3. Two small particles of equal masses start moving in opposite directions from a point A in a horizontal circular orbit. Their tangential velocities are v and 2v respectively, as shown in the figure. Between collisions, the particles move with constant speeds. After making how many elastic collisions, other than that at A, these two particles will again reach the point A?



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

Correct: c

4. The displacement of a body is given by  $x = 4t + 5t^3$  where x is in metre and t is in second. The difference between the average velocity of the body in the time-interval t=1 s to t=2 s and its instantaneous- velocity at t=1s is

- (a) 20.0 m/s
- (b) 22.5 m/s
- (c) 27.0 m/s
- (d) 39.0 m/s

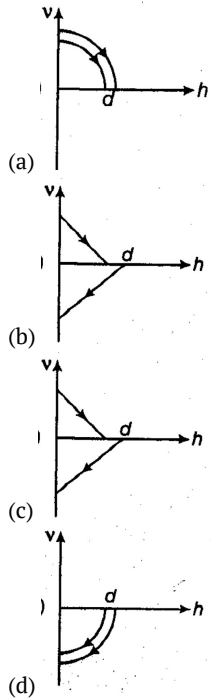
Correct: a

5. A drunkard walking in a narrow lane takes 5 steps forward and 3 steps backward followed again by 5 steps forward and 3 steps backward and so on. Each step is 1m long and requires 1s. Determine how long the drunkard takes to fall in a pit 13 m away from the starting point?

- (a) 37 s
- (b) 13 s
- (c) 49
- (d) 18 s

Correct: a

6. A ball is dropped vertically from a height  $d$  above the ground. It hits the ground and bounces up vertically to a height  $d/2$ . Neglecting subsequent motion and air resistance, its velocity  $v$  varies with the height  $h$  above the ground as



Correct: b

7. Two seconds after projection, a projectile is moving at  $30^\circ$  above the horizontal, after one more second, it is moving horizontally. The initial speed of the projectile is (Take  $g = 10\text{ms}^{-2}$ )

- (a) 10 m/s
- (b)  $10/3$  m/s
- (c) 20 m/s
- (d) 2013 m/s

Correct: d

8. A thin circular ring of mass  $M$  and radius  $r$  is rotating about its axis at angular velocity  $\omega$ . Two particles, each of mass  $m$  are attached gently to the ring at points which are at opposite ends of diameter of the ring. New angular velocity of the ring is

- (a)  $\frac{M\omega}{M+2m}$
- (b)  $\frac{\omega(M+2m)}{M}$
- (c)  $\omega$
- (d)  $\frac{\omega m}{(M+2m)}$

Correct: a

9. A particle of mass  $m$  is moving with a constant velocity along a line parallel to the positive direction of X-axis. The magnitude of its angular momentum with respect to the origin

- (a) is zero.
- (b) goes on increasing as  $x$  increases.
- (c) goes on decreasing as  $x$  increases.
- (d) remains constant for all positions of the particle.

Correct: d

10. A satellite of mass  $M$  is revolving in circular orbit of radius  $r$  around the earth. Time of revolution of the satellite is

- (a)  $T \propto r^{\frac{1}{2}}$
- (b)  $T \propto r^{\frac{3}{2}}$
- (c)  $T \propto r^{-\frac{1}{2}}$
- (d)  $T \propto r^{-\frac{3}{2}}$

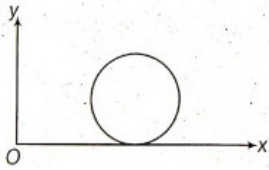
Correct: b

11. One end of massless spring of spring constant 100 N/m and natural length 0.49 m is fixed and other end is connected to a body of mass 0.5 kg lying on a frictionless horizontal table. The spring remains horizontal. If the body is made to rotate at an angular velocity of 2 rad/s, then the elongation of the spring will be

- (a) 2 cm
- (b) 1 cm
- (c) 0.5 cm
- (d) 0.25 cm

Correct: b

12. A disc of mass M and radius R is rolling with angular speed  $\omega$  on a horizontal surface as shown in figure. The magnitude of angular momentum of the disc about the origin O is (here v is the linear velocity of the disc)



- (a)  $\frac{3}{2}MR^2\omega^2$
- (b)  $MR^2\omega$
- (c) MRv
- (d)  $\frac{3}{2}MRv$

Correct: d

13. The only force acting on a 2 kg body that is moving in xy-plane has a magnitude of 5 N. The body initially has a velocity of 4 m/s in the positive x-direction. Some time later, the body has a velocity of 6 m/s in the positive y-direction. The work done on the body by the 5 N force during this time is

- (a) 20 J
- (b) 40 J
- (c) 52 J
- (d) 72 J

Correct: a

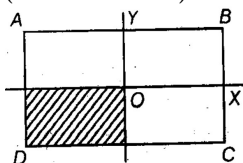
14. A simple pendulum has time period  $T_1$ . The point of suspension is now moved upward according to the relation  $y = kt^2$ , ( $k = 1\text{m/s}^2$ ) where y is the vertical displacement. The time period now becomes  $T_2$ .

The ratio of  $\frac{T_1^2}{T_2^2}$  ( $g = 10\text{m/s}^2$ ) is

- (a) 5/6
- (b) 6/5
- (c) 1
- (d) 4/5

Correct: b

15. Figure shows a rectangular copper plate with its centre of mass at the origin O and side  $AB = 2BC = 2$  m. If a quarter part of the plate (shown as shaded) is removed, the centre of mass of the remaining plate would lie at



- (a)  $\frac{1}{12}m, \frac{1}{6}m$
- (b)  $\frac{1}{6}m, \frac{1}{12}m$
- (c)  $\frac{1}{3}m, \frac{1}{6}m$
- (d)  $\frac{1}{3}m, \frac{1}{2}m$

Correct: b

16. Two long conductors, separated by a distance  $d$  carry currents  $I_1$  and  $I_2$  in the same direction. They exert a force  $F$  on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to  $3d$ . The new value of force between them is

- (a)  $-2F$
- (b)  $F/3$
- (c)  $-2F/3$
- (d)  $-F/3$

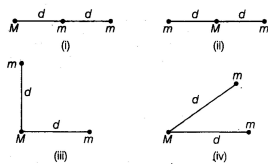
Correct: c

17. Two identical cells are first connected in series and then in parallel. The ratio of power consumed by them is

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

Correct: a

18. Three particles, two with masses  $m$  and one with mass  $M$ , might be arranged in any of the four configurations shown below. Rank the configurations according to the magnitude of the gravitational force on  $M$ , least to greatest



- (a) (i), (i), (iii), (iv)
- (b) (ii), (i), (iii), (iv)
- (c) (ii), (i), (iv), (iii)
- (d) (ii), (iii), (iv), (i)

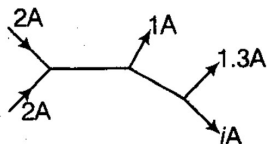
Correct: b

19. A cylinder of radius  $R$  made of a material of thermal conductivity  $K_1$ , is surrounded by a cylindrical shell of inner radius  $R$  and outer radius  $2R$  and made of a material of thermal conductivity  $K_2$ . The two ends of the combined system are maintained at two different temperatures. There is no loss of heat across the cylindrical surface and the system is in steady state. The effective thermal conductivity of the system is

- (a)  $\frac{3K_1+K_2}{4}$
- (b)  $\frac{K_1+3K_2}{4}$
- (c)  $K_1 + K_2$
- (d)  $\frac{K_1K_2}{K_1+K_2}$

Correct: b

20. The strength of current  $i$  in the given figure is



- (a) 1.7 A
- (b) 1.3 A
- (c) 3.7 A
- (d) 1.0 A

Correct: a

21. Two solid spheres of the same metal but of mass  $M$  and  $8M$  fall simultaneously in a viscous liquid. If their terminal velocities are  $v$  and  $nv$ , then the value of  $n$  will be

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

(d) 2

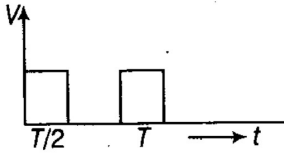
Correct: c

22. 1A current flows through an infinitely long straight wire. The magnetic field produced at a point 1 m away from it is

- (a)  $2 \times 10^{-3} \text{T}$
- (b)  $\frac{2}{10} \text{T}$
- (c)  $2 \times 10^{-7} \text{T}$
- (d)  $2\pi \times 10^{-6} \text{T}$

Correct: c

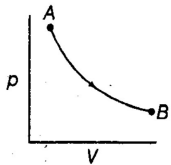
23. The rms value of potential difference  $V_0$  shown in figure is



- (a)  $V_0$
- (b)  $\frac{V_0}{\sqrt{2}}$
- (c)  $\frac{V_0}{2}$
- (d)  $\frac{V_0}{\sqrt{3}}$

Correct: b

24. A sample of an ideal gas undergoes an isothermal process as shown by the curve AB in the pV diagram. If  $\Delta Q$ ,  $\Delta U$  and  $\Delta W$  represent the amount of heat absorbed the change in internal energy and the work done respectively, then which of the following statement is correct?



- (a)  $\Delta Q = +ve, \Delta U = 0, \Delta W = -ve$
- (b)  $\Delta Q = +ve, \Delta U = 0, \Delta W = +ve$
- (c)  $\Delta Q = +ve, \Delta U = 0, \Delta W = 0$
- (d)  $\Delta Q = +ve, \Delta U = +ve, \Delta W = +ve$

Correct: b

25. An electric field  $\vec{E} = 30x^2 \hat{i}$  exists in space. Then, the potential difference  $V_A - V_0$ , where  $V_0$  is the potential at the origin and  $V_A$  is the potential at  $x=2$  m, is given by

- (a)  $-80 \hat{j}$
- (b)  $120 \hat{j}$
- (c)  $-120 \hat{j}$
- (d)  $80 \hat{j}$

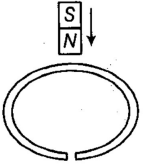
Correct: a

26. A rocket is moving at a speed of 200 m/s towards a stationary target. While moving it emits a wave of frequency 1000 Hz. Some of the sound reaching the target gets reflected back to the rocket as an echo. The frequency of the echo as detected by the rocket is (velocity of sound = 330 m/s)

- (a) 1000 Hz
- (b) 1580 Hz
- (c) 2540 Hz
- (d) 4080 Hz

Correct: d

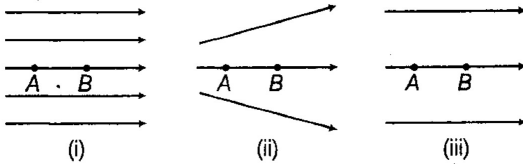
27. A copper ring having a cut such that it does not form a complete loop is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. Then acceleration of the falling magnet is



- (a)  $g$
- (b) less than  $g$
- (c) more than  $g$
- (d) zero

Correct: a

28. Figure shows three arrangements of electric field lines. In each arrangement, a proton is released from rest at point A and then accelerated through point B by the electric field. Points A and B have equal separations in the three arrangements. If  $p_1, p_2$  and  $p_3$  are linear momentum of the proton at point B in the three arrangement respectively, then



- (a)  $p_1 > p_3 > p_2$
- (b)  $p_1 > p_2 > p_3$
- (c)  $p_2 > p_1 > p_3$
- (d)  $p_1 = p_2 = p_3$

Correct: b

29. The electromagnetic wave used in LASIK eye surgery is

- (a) ultraviolet ray
- (b) X-ray
- (c) microwave
- (d) radio wave

Correct: a

30. Two bulbs consume the same power when operated at 200 V and 300 V, respectively. When these bulbs are connected in series across a DC source of 500 V, then the ratio of potential difference across them is

- (a)  $2/3$
- (b)  $4/9$
- (c)  $6/27$
- (d)  $8/24$

Correct: b

31. Two identical conducting spheres A and B carry equal charge. They are initially separated by a distance much larger than their diameters and the force between them is  $F$ . A third identical conducting sphere C is uncharged. Sphere C is first touched to A, then to B and removed. As a result, the force between A and B now is

- (a)  $F/16$
- (b)  $F/4$
- (c)  $3F/8$
- (d)  $F/2$

Correct: c

32. The bending of beam of light around corners of obstacles is called

- (a) reflection
- (b) refraction
- (c) diffraction
- (d) interference

Correct: c

33. An inverter battery operated on 24 V and has negligible internal resistance. It is rated at 140 ampere-hour. What external resistance would have to be connected to the battery, if it were to be discharged in 14 hours.

- (a)  $1.6\Omega$

- (b)  $2.4\Omega$
- (c)  $5.9\Omega$
- (d)  $10.0\Omega$

Correct: b

34. Light travels in a straight line because

- (a) it is not absorbed by atmosphere
- (b) its velocity is very high
- (c) diffraction effect is negligible
- (d) None of the above

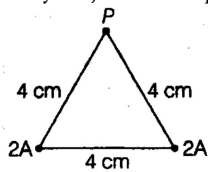
Correct: c

35. Mirage is a phenomenon due to

- (a) reflection of light
- (b) refraction of light
- (c) total internal reflection of light
- (d) diffraction of light

Correct: c

36. Two long straight wires vertically pierced the plane of the paper at vertices of an equilateral triangle as shown in figure. They each carry  $2\text{ A}$ , out of the paper. The magnetic field at the third vertex P has magnitude.



- (a)  $10^{-5}\text{ T}$
- (b)  $14 \times 10^{-5}\text{ T}$
- (c)  $17 \times 10^{-5}\text{ T}$
- (d)  $0.85 \times 10^{-5}\text{ T}$

Correct: c

37. There are four lenses  $L_1, L_2, L_3$  and  $L_4$  of focal lengths, 2, 4, 6 and 8 cm respectively. Two of these lenses form a telescope of length 10 cm and magnifying power 4. The objective and eye lenses are

- (a)  $L_2, L_3$
- (b)  $L_1, L_4$
- (c)  $L_3, L_2$
- (d)  $L_4, L_1$

Correct: d

38. A magnetic field cannot

- (a) change the velocity of a charged particle.
- (b) change the momentum of a charged particle.
- (c) change the kinetic energy of a charged particle.
- (d) change the trajectory of a charged particle.

Correct: c

39. The de-Broglie wavelength of a tennis ball of mass 60 g moving with a velocity of 10 m/s is Given: Planck's constant  $=6.63 \times 10^{-34}\text{ J s}$

- (a)  $10^{-16}\text{ m}$
- (b)  $10^{-25}\text{ m}$
- (c)  $10^{-31}\text{ m}$
- (d)  $10^{-33}\text{ m}$

Correct: d

40. What will be the ratio of de-Broglie wavelengths of proton and  $\alpha$ -particle of the same energy?

- (a) 2:1
- (b) 1:2
- (c) 4:1

(d) 1:4

Correct: a

41. An alternating voltage  $V = 200\sqrt{2} \sin(100\pi t)$  volt is connected to a  $1\mu\text{F}$  capacitor through an AC ammeter. The reading of the ammeter

- (a) 40 mA
- (b)  $20\sqrt{2}$  mA
- (c) 20 mA
- (d)  $10\sqrt{2}$  mA

Correct: c

42. In Young's double slit experiment using monochromatic light of wavelength  $\lambda$ , the intensity of light at a point on the screen where the path difference is  $\lambda$ , is  $k$  units. The intensity of the light at a point, where path difference is  $\lambda/3$  is

- (a)  $k/2$
- (b)  $k/3$
- (c)  $k/4$
- (d)  $2k/3$

Correct: c

43. The mass-defect in a nuclear fusion reaction is 0.3 per cent. The amount of energy released in one kg of fusion reaction is

- (a)  $2.7 \times 10^{23}$  J
- (b)  $2.7 \times 10^{19}$  J
- (c)  $2.7 \times 10^{16}$  J
- (d)  $2.7 \times 10^{14}$  J

Correct: d

44. In a stack of three polarising sheets, the first and the third are crossed while the middle one has its axis at  $45^\circ$  to the axes of the other two. The fraction of intensity of an incident unpolarised beam of light that is transmitted by the stack is

- (a)  $1/2$
- (b)  $1/3$
- (c)  $1/4$
- (d)  $1/8$

Correct: d

45. A proton (p) and an  $\alpha$ -particle are accelerated through the same potential difference  $V$  volt. The de-Broglie wavelengths associated with the proton and the  $\alpha$ -particle,  $\lambda_p$  and  $\lambda_\alpha$  respectively are in the ratio

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

Correct: b

46. The wave nature of electron was first experimentally verified by

- (a) Louis Victor de-Broglie
- (b) James Frank and Gustav Hertz
- (c) C.J. Davisson and L.H. Germer
- (d) Hans Geiger and Ernst Marsden

Correct: a

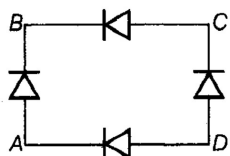
47. In a semiconductor crystal if the current flows due to breakage of crystal bonds, then the semiconductor is called

- (a) donor
- (b) acceptor
- (c) intrinsic semiconductor
- (d) extrinsic semiconductor

Correct: c

48. In adjoining figure, the input (A.C.) is across the terminals A and C and the output is across B and D. Then output is





- (a) zero
- (b) the same as input
- (c) half wave rectified
- (d) full wave rectified

Correct: d

49. Consider the following

- (i) Submarine communications
- (ii) A.M. radio
- (iii) Shortwave radio
- (iv) Radar

Arrange the above in increasing frequency of the waves associated with them (a) (iv), (iii), (ii), (i)

- (b) (i), (ii), (iii), (iv)
- (c) (ii), (i), (iv), (iii)
- (d) (ii), (iii), (iv), (i)

Correct: b

50. For a CE transistor amplifier the audio signal voltage across the collector resistance of  $2\text{k}\Omega$  is 2 V. The current amplification factor of the transistor is 100. If the base resistance is  $1\text{k}\Omega$ , the input signal voltage and base current are respectively

- (a) 0.01 V,  $10\ \mu\text{A}$
- (b) 0.04 V,  $10\ \mu\text{A}$
- (c) 0.01 V,  $10\ \mu\text{A}$
- (d) 0.04 V,  $10\ \mu\text{A}$

Correct: a

## Chemistry

51. Aniline is insoluble in water and possesses a vapour pressure of 10.15 mm Hg at 373 K. It can be conveniently purified by

- (a) sublimation
- (b) crystallisation
- (c) steam distillation
- (d) simple distillation

Correct: c

52. Which of the following has the maximum vapour pressure?

- (a) HCl
- (b) HBr
- (c) Hf
- (d) HI

Correct: a

53. IUPAC name of  $(\text{CH}_3)_3\text{C} - \text{CH} = \text{CH}_2$  is

- (a) 3, 3, 3-trimethyl-1-propene
- (b) 1, 1, 1-trimethyl-2-propene
- (c) 3, 3-dimethylbut-1-ene
- (d) 2,2-dimethyl-3-butene

Correct: c

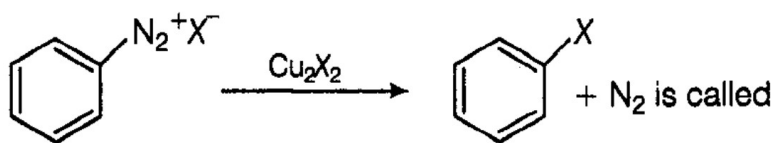
54. Which of the following is most soluble in water?

- (a)  $\text{CsClO}_4$
- (b)  $\text{NaClO}_4$
- (c)  $\text{KClO}_4$

(d)  $\text{LiClO}_4$

Correct: d

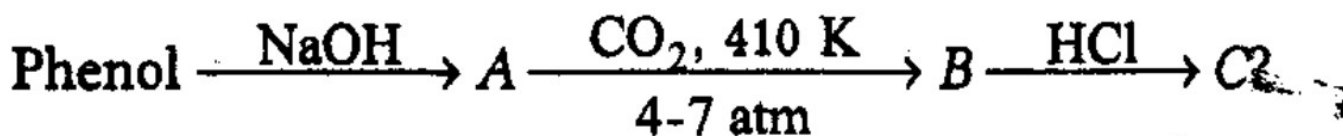
55. The reaction,



- (a) Etard's reaction
- (b) Sandmeyer's reaction
- (c) Wurtz-Fittig reaction
- (d) Perkin's reaction

Correct: b

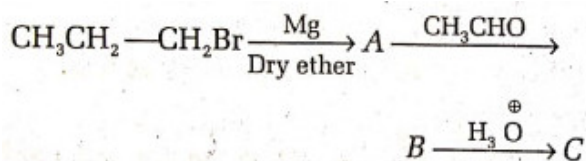
56. What is the compound 'C' in the following sequence of the reaction,



- (a) Benzoic acid
- (b) Salicylic acid
- (c) Benzaldehyde
- (d) Salicylaldehyde

Correct: b

57. In the reaction sequence



the product 'C' is

- (a) 1-propanol
- (b) 2-butanol
- (c) 2-butanol
- (d) 2-pentanol

Correct: d

58. Arrange the following carbanions in order of their decreasing stability

- (i)  $\text{H}_3\text{C} - \text{C} \equiv \text{C}^-$
- (ii)  $\text{H} - \text{C} \equiv \text{C}^-$
- (iii)  $\text{H}_3\text{C} - \text{CH}_2^-$

- (a)  $i > ii > iii$
- (b)  $ii > i > iii$
- (c)  $iii > ii > i$
- (d)  $iii > ii > i$

Correct: b

59. The following reaction,  $\text{R} - \text{X} + \text{NaI} \rightarrow \text{R} - \text{I} + \text{NaX}$  where,  $\text{X} = \text{Cl}, \text{Br}$  is known as

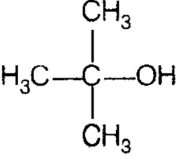
- (a) Swarts reaction
- (b) Finkelstein reaction
- (c) Sandmeyer's reaction
- (d) Wurtz-Fittig reaction

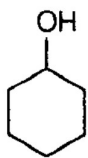
Correct: b

60. The crystal field splitting energy (CFSE) for  $[\text{CoCl}_6]^{4-}$  is about  $18000\text{cm}^{-1}$ . What would be the CFSE value of  $[\text{CoCl}_4]^{2-}$ ?
- (a)  $18000\text{cm}^{-1}$   
 (b)  $8000\text{cm}^{-1}$   
 (c)  $16000\text{cm}^{-1}$   
 (d)  $2000\text{cm}^{-1}$

Correct: b

61. The fastest dehydration reaction could be expected in

- (a) 
- (b)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$   
 (c)  $\text{CH}_3 - (\text{CH}_2)_4 - \text{OH}$

- (d) 

Correct: a

62. Amongst the following interhalogen compounds which one is used for the production of  $\text{UF}_6$  during  $^{235}\text{U}$  enrichment process?
- (a)  $\text{ClF}_3$   
 (b)  $\text{ClF}_5$   
 (c)  $\text{IF}_3$   
 (d)  $\text{IF}_5$

Correct: a

63. Which one of the following is known as animal starch?
- (a) Amylose  
 (b) Cellulose  
 (c) Glycogen  
 (d) Amylopectin

Correct: c

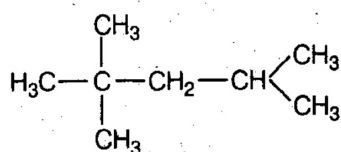
64. Nucleotides are joined together by between 5' and 3' carbon atoms of pentose sugar
- (a) glycosidic linkage  
 (b) peptide linkage  
 (c) ether linkage  
 (d) phosphodiester linkage

Correct: d

65. The drug which was designed to prevent the interaction of histamine with the receptors present in the stomach wall
- (a) cimetidine  
 (b) nardil  
 (c) iproniazid  
 (d) phenelzine

Correct: a

66. What is the IUPAC name for the following compound?



- (a) 1,3 - pentamethyl propane

- (b) 1, 1, 3, 3-tetramethylbutane
- (c) 2, 4, 4-trimethylpentane
- (d) 2, 2, 4-trimethylpentane

Correct: d

67. Which one of the following set of metals deposits an anode mud during the process of electrolytic refining of copper?

- (a) Sn and Ag
- (b) Pb and Zn
- (c) Ag and Au
- (d) Fe and Ni

Correct: c

68. Which of the following has highest hydration energy?

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

Correct: a

69. The structure of  $\text{B}_2\text{F}_4$  is

- (a) square planar
- (b) distorted tetrahedral
- (c) angular
- (d) T-shaped

Correct: d

70. For complexes  $[\text{NiCl}_4]^{2-}$  and  $\text{Ni}(\text{CO})_4$  which one of the following statement is true

- (a)  $[\text{NiCl}_4]^{2-}$  is diamagnetic while  $[\text{Ni}(\text{CO})_4]$  is paramagnetic and both the complexes have square planar geometry.
- (b)  $[\text{NiCl}_4]^{2-}$  is paramagnetic while  $[\text{Ni}(\text{CO})_4]$  is diamagnetic and both the complexes have tetrahedral geometry.
- (c)  $[\text{NiCl}_4]^{2-}$  is paramagnetic while  $[\text{Ni}(\text{CO})_4]$  is diamagnetic and both the complexes have square planar geometry.
- (d)  $[\text{NiCl}_4]^{2-}$  is diamagnetic while  $[\text{Ni}(\text{CO})_4]$  is paramagnetic and both the complexes have tetrahedral geometry

Correct: b

71. Ziegler catalyst to manufacture polyethylene is made by the reaction

- (a)  $\text{TiCl}_4$  with  $\text{Al}(\text{CH}_3)_3$
- (b)  $\text{TiCl}_4$  with  $\text{CH}_3\text{Cl}$
- (c)  $\text{TiCl}_4$  with  $(\text{C}_6\text{H}_5)_3\text{CCl}$
- (d)  $\text{TiCl}_4$  with  $\text{ZnCl}_2$

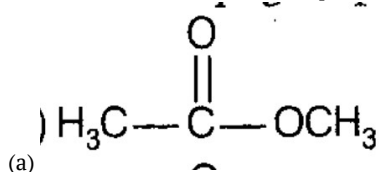
Correct: a

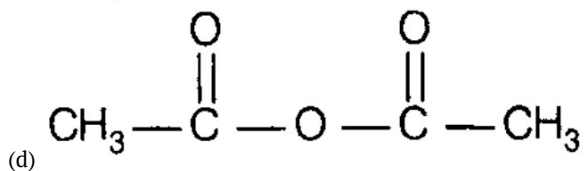
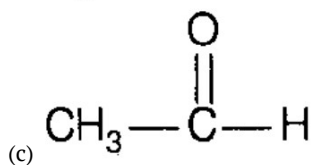
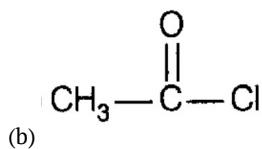
72. Primary valency of Co in  $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$  is

- (a) + 1
- (b) + 2
- (c) + 3
- (d) + 6

Correct: c

73. The most reactive to nucleophilic attack at the carbonyl group is





Correct: b

74. By the action of conc.  $\text{H}_2\text{SO}_4$ , phosphorus changes to

- (a) phosphorus acid
- (b) orthophosphoric acid
- (c) metaphosphoric acid
- (d) pyrophosphoric acid

Correct: b

75. Tear gas is

- (a)  $\text{CCl}_3\text{NO}_2$
- (b)  $\text{COCl}_2$
- (c)  $\text{ClC}_2\text{H}_4-\text{S}-\text{C}_2\text{H}_4\text{Cl}$
- (d)  $\text{C}_6\text{H}_5-\text{S}-\text{Br}$

Correct: a

76. Which of the following statements is wrong about the oxides of nitrogen? (a)  $\text{N}_2\text{O}_5$  is an anhydride of  $\text{HNO}_3$

- (b)  $\text{NO}$  is in acidic oxide
- (c)  $\text{N}_2\text{O}_3$  is an anhydride of  $\text{HNO}_2$
- (d)  $\text{NO}$  is not an anhydride of an acid

Correct: c

77. Inert pair effect is concerned with

- (a) pair of s-electrons
- (b) pair of p-electrons
- (c) pair of d-electrons
- (d) pair of f-electrons

Correct: a

78. Copper is extracted from sulphide ore using the method

- (a) auto-reduction
- (b) carbon reduction
- (c)  $\text{CO}$  reduction
- (d) biochemical reduction

Correct: a

79. The photochemical smog is

- (a) formed due to oxidation of hydrocarbons trapped in flowing air in the presence of sunlight
- (b) formed due to oxidation of smoke trapped in stagnant air mass in the presence of sunlight
- (c) formed due to heterogeneous combination of smoke and fog in air in the presence of sunlight
- (d) formed due to oxidation of hydrocarbons trapped in stagnant air mass in the presence of sunlight.

Correct: d

80. A compound  $C_5H_{10}O$  (A) forms a phenyl hydrazone and gives negative Tollen's test and a positive Iodoform reaction. It also gives n-pentane on reduction. The compound (A) is

- (a) pentanal
- (b) 2-pentanone
- (c) 3-pentanone
- (d) allyl alcohol

Correct: b

81. Which of the following chelating ligands can be used to remove the excess of copper in the biosystems?

- (a) D-penicillamine
- (b) Desferrioxamine B
- (c) EDTA
- (d) Dimercaprol

Correct: a

82. Which of the following is an example of thermosetting polymers?

- (a) Bakelite
- (b) PVC
- (c) Nylon 6, 6
- (d) Buna-S

Correct: a

83. Arrange  $H_2O$ ,  $H_2S$  and  $H_2Se$  in order of increasing acidity.

- (a)  $H_2O$
- (a)  $T_1 < T_2 < T_3$
- (b)  $T_3 < T_2 < T_1$
- (c)  $T_2 < T_3 < T_1$
- (d)  $T_1 < T_3 < T_2$

Correct: a

86. The root means square velocity of hydrogen at STP is  $1.83 \times 10^5 \text{ cm sec}^{-1}$  and its mean free path is  $1.78 \times 10^{-5} \text{ cm}$ . What will be the collision number at STP?

- (a)  $9.476 \times 10^9 \text{ sec}^{-1}$
- (b)  $9.746 \times 10^{-9} \text{ sec}^{-1}$
- (c)  $9.746 \times 10^9 \text{ sec}^{-1}$
- (d)  $9.647 \times 10^9 \text{ sec}^{-1}$

Correct: a

87. Which of the following gases has high Boyle's temperature?

- (a) Ar
- (b)  $CO_2$
- (c)  $O_2$
- (d) He

Correct: b

88. The difference between  $\bar{C}_p$  and  $\bar{C}_v$  is [ $\bar{C}_p$  and  $\bar{C}_v$  signify molar quantities]

- (a) larger in case of gases in comparison to solids and liquids
- (b) larger in case of liquids in comparison to gases and solids
- (c) larger in case of solids in comparison to gases liquids
- (d) equal in solids, liquids and gases

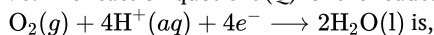
Correct: a

89. The rate of chemisorption of a gas

- (a) decreases with increasing pressure
- (b) increases with increasing pressure
- (c) is independent of pressure
- (d) is independent of temperature

Correct: b

90. The reaction quotient (Q) for the reduction of  $O_2$  to  $H_2O$  in acid solution,



[where,  $\alpha_{H^+}$  = activity of  $H^+$ ,  $p_{O_2}$  = pressure of  $O_2$ , when it is present in the reaction,  $p^0$  = pressure of  $O_2$  at standard state)].

(a)  $Q = \frac{p^0}{\alpha_{H^+}^4 + p_{O_2}}$

(b)  $Q = \frac{p_{O_2}}{\alpha_{H^+}^4 + p^0}$

(c)  $Q = \frac{\alpha_{H^+}^4 + p_{O_2}}{p^0}$

(d)  $Q = \frac{\alpha_{H^+}^4 + p^0}{p_{O_2}}$

Correct: a

91. Water +  $CH_3OH$  mixture shows positive deviation from ideal solution behaviour. 100mL of water is mixed with 100mL of  $CH_3OH$ . Then, total volume of the mixture will be

(a) 200 mL

(b) less than 200 ml because of additional H-bonding between  $H_2O$  and  $CH_3OH$

(c) more than 200 ml because H-bonding within  $H_2O$  molecules vanishes.

(d) more than 200 mL because H-bond between  $H_2O$  and  $CH_3OH$  is weaker than that between  $H_2O$  and  $H_2O$

Correct: d

92. 0.02 molar solution of NaCl having degree of dissociation of 90% at  $27^\circ C$  has osmotic pressure equal to

(a) 0.94 bar

(b) 9.4 bar

(c) 0.094 bar

(d)  $9.4 \times 10^{-4}$  bar

Correct: a

93. The first order gaseous decomposition of  $N_2O_4$  into  $NO_2$  has a k value of  $4.5 \times 10^3 s^{-1}$  at  $1^\circ C$  and an energy of activation of 58 kJ  $mole^{-1}$ . At what temperature would be  $1.00 \times 10^4 s^{-1}$ ??

(a) 274 K

(b) 283 K

(c) 273 K

(d) 293 K

Correct: c

94. For the reaction,  $S_{(rhombic)} + O_2 \rightarrow SO_2$ ,  $\Delta H = -298 kJmol^{-1}$  at  $25^\circ C$  and 1atm. Therefore, E for the reaction should be

(a)  $-298 kJmol^{-1}$

(b)  $-298 + 8.314 \times 298 kJmol^{-1}$

(c)  $-298 - 8.314 \times 298 kJmol^{-1}$

(d)  $-298 - 2 \times 8.314 \times 298 kJmol^{-1}$

Correct: a

95. The ratio of the half-life time ( $t_{1/2}$ ) to the three quarter life-time, ( $t_{3/4}$ ), for a reaction that is second order

(a) depends directly on concentration of reactants

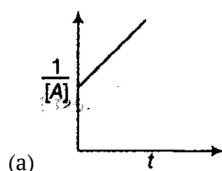
(b) is independent of concentration of reactant

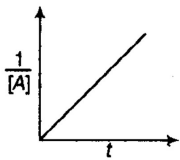
(c) depends inversely on the concentration of reactants

(d) depends directly to the square of concentration of reactants

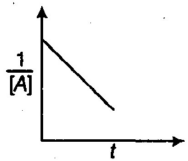
Correct: b

96. For a second order reaction, (2A Product),  $\frac{1}{[A]}$  vs t is represented as

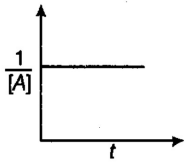




(b)



(c)



(d)

Correct: a

97. The solubility of pure oxygen in water at  $20^{\circ}\text{C}$  and 1.0 atmosphere pressure is  $138 \times 10^{-3}$  mol/litre. What will be the concentration of oxygen at  $20^{\circ}\text{C}$  and partial pressure of 0.21 atmosphere?

- (a)  $2.9 \times 10^{-4}$  mol/litre
- (b)  $5.8 \times 10^{-4}$  mol/litre
- (c)  $7.6 \times 10^{-4}$  mol/litre
- (d)  $11.6 \times 10^{-4}$  mol/litre

Correct: a

98. Calculation the maximum work done in expanding 16 g of oxygen at 300K and occupying a volume of  $5\text{dm}^3$  isothermally until volume becomes  $25\text{dm}^3$

- (a)  $-2.01 \times 10^3\text{J}$
- (b)  $+2.01 \times 10^3\text{J}$
- (c)  $1.20 \times 10^{22}$
- (d)  $2 \times 10^{-3}$

Correct: a

99. The  $K_{\text{sp}}$  of  $\text{PbCO}_3$  and  $\text{PbCO}_3$ , are  $1.5 \times 10^{-15}$  and  $1 \times 10^{-15}$  respectively at 298 K. The concentration of  $\text{Pb}^{2+}$  ions in a saturated reactants solution containing  $\text{MgCO}_3$  and  $\text{PbCO}_3$  is

- (a)  $1.5 \times 10^{-8}\text{M}$
- (b)  $3 \times 10^{-8}\text{M}$
- (c)  $2 \times 10^{-8}\text{M}$
- (d)  $2.5 \times 10^{-8}\text{M}$

Correct: b

100. In a suspension the diameter of the dispersed particles is of the order

- (a)  $10\text{ \AA}$
- (b)  $100\text{ \AA}$
- (c)  $1000\text{ \AA}$
- (d)  $2000\text{ \AA}$

Correct: d

## Mathematics

101. The value of  $\sin(2 \sin^{-1} 0.8)$  is

- (a) 0.96
- (b) 0.80
- (c) 0.64
- (d) 0.18



Correct: a

102. Let  $P = \{\theta; \sin \theta - \cos \theta = \sqrt{2} \cos \theta\}$  denotes the greatest integer function is

- (a)  $P \subset Q$  and  $Q - P = \phi$
- (b)  $Q \not\subset P$
- (c)  $P \not\subset Q$
- (d)  $P = Q$

Correct: d

103. The function  $f(x) = x - [x]$  where  $[ ]$  denotes the greatest integer function is

- (a) continuous everywhere
- (b) continuous at integer points only
- (c) continuous at non-integer points only
- (d) nowhere continuous

Correct: c

104. The value of the integral  $\int_{-2}^0 \frac{dx}{\sqrt{12-x^2-4x}}$  is

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

Correct: b

105. The range of the function  $f(x) = \frac{2+x}{2-x}, x \neq 2$  is

- (a)  $\mathbb{R}$
- (b)  $\mathbb{R} - \{-1\}$
- (c)  $\mathbb{R} - \{1\}$
- (d)  $\mathbb{R} - \{2\}$

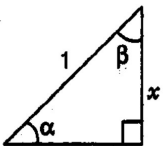
Correct: b

106. Let  $R$  and  $S$  be any two equivalence relations on a set  $X$ . Then which of the following is incorrect statement

- (a)  $R \cup S$  is an equivalence relation on  $X$
- (b)  $R^{-1}$  is an equivalence relation
- (c)  $R^{-1} \cap S^{-1}$  is an equivalence relation on  $X$
- (d)  $\Delta$  is an equivalence relation on  $X$ , where  $\Delta$  is the diagonal relation on  $X$ .

Correct: a

107. Using the information from the figure,  $\cos^{-1} x$  is equal to



- (a)  $\frac{\pi}{2} + \cos x$
- (b)  $\frac{\pi}{2} + \sin x$
- (c)  $\frac{\pi}{2} - \sin^{-1} x$
- (d)  $\frac{\pi}{2} + \sin^{-1} x$

Correct: c

108. Let  $f(x)$  be a function defined by  $f(x) = \begin{cases} 4x - 5, & \text{if } x \leq 2 \\ x - \lambda, & \text{if } x > 2 \end{cases}$  if  $\lim_{x \rightarrow 2} f(x)$  exists

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

Correct: b

109. The graph  $y^2 + 2xy + 50|x| = 625$  divides the plane into regions. Then, the area of bounded regions is

- (a) 500 sq units
- (b) 1250 sq units
- (c) 2500 sq units
- (d) 800 sq units

Correct: b

110. The equation of the circle whose radius is 5 and which touches the circle  $x^2 + y^2 - 2x - 4y - 20 = 0$  externally at the point (5,5) is

- (a)  $(x - 9)^2 + (y - 8)^2 = 5^2$
- (b)  $(x - 5)^2 + (y - 5)^2 = 5^2$
- (c)  $(x - 0)^2 + (y - 0)^2 = 5^2$
- (d) None of the above

Correct: a

111. The variance of 20 observations is 5. If each observation is multiplied by 2, then the variance of the resulting observation is

- (a) 10
- (b) 20
- (c) 30
- (d) 40

Correct: b

112. The only integral root of the equation

$$\begin{vmatrix} 2 - y & 2 & 3 \\ 2 & 5 - y & 6 \\ 3 & 4 & 10 - y \end{vmatrix}$$

- (a)  $y = 3$
- (b)  $y = 2$
- (c)  $y = 1$
- (d) None of these

Correct: c

113. A man repays a loan of ₹ 3250 by paying ₹ 20 in the first month and then increases the payment by 15 every month. How long will it take him to clear the loan?

- (a) 20 months
- (b) 25 months
- (c) 30 months
- (d) 35 months

Correct: a

114. If the two positive numbers whose difference is 12 and whose AM exceeds the GM by 2, then the numbers are

- (a) 18,6
- (b) 16,4
- (c) 14,2
- (d) None of these

Correct: b

115. The coefficients of three consecutive terms in the expansion of  $(1 + x)^n$  are in the ratio 1:7:42 then the value of n is

- (a) 55
- (b) 54
- (c) 56
- (d) 66

Correct: a

116. The number of words with or without meaning which can be made using all the letters of the word AGAIN. If these words are written as in a dictionary, then the 50th word is

- (a) NAAGI
- (b) NAAIG
- (c) NAIAG
- (d) NAIGA

Correct: b

117. Let  $a_1, a_2, a_3, \dots, a_n$  be in AP. If

$$\frac{1}{a_1 a_n} + \frac{1}{a_2 a_{n-1}} + \dots + \frac{1}{a_n a_1} = \frac{K}{a_1 + a_n} \left[ \frac{1}{a_1} + \frac{1}{a_2} + \dots + \frac{1}{a_n} \right]$$

then K is equal to

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

Correct: b

118. If both roots of the equation  $x^2 - 2(a - 1)x + (2a + 1) = 0$  are positive, where a is a real number, then

- (a)  $a \in (4, \infty)$
- (b)  $a \in (-\infty, 0] \cup [4, \infty)$
- (c)  $a \in (1, \infty)$
- (d)  $a \in [4, \infty)$

Correct: d

119. The length 'x' of a rectangle is decreasing at the rate of 6 cm/min and the width y is increasing at the rate of 4 cm/min. When x=8 cm and y=4 cm, the rate of change of the area of the rectangle is

- (a) 8
- (b) 16
- (c) 24
- (d) 32

Correct: a

120. If p and q are the order and degree of the differential equation  $y \frac{dy}{dx} + x^3 \left( \frac{d^2y}{dx^2} \right)^2 + xy = \cos x$

- (a)  $p < 9$
- (b)  $p = 9$
- (c)  $p > 9$
- (d) None of these

Correct: a

121. The solution of the differential equation

$$\frac{dy}{dx} = \frac{2xy - y^2}{2xy - x^2},$$

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

Correct: b

122. Let g(x) be the inverse of an invertible function f(x) which is differentiable at  $x = c$ , then  $g'(f(c))$  equals

- (a)  $f'(C)$
- (b)  $\frac{1}{f'(c)}$
- (c)  $f(c)$
- (d)  $\frac{1}{f(c)}$

Correct: b

123. A five-digit number divisible by 3 is to be formed using the numbers 0, 1, 3, 4 and 5 without repetition. The total number of ways this can be done is

- (a) 216
- (b) 600
- (c) 240
- (d) 3125

Correct: a

124. If X follows a binomial distribution with parameters  $n = 100$ ,  $p = \frac{1}{3}$ , then  $P(X=r)$  is maximum, when r is equal to

- (a) 32
- (b) 34
- (c) 33
- (d) 31

Correct: c

125.  $y = a \cos(\log x) + b \sin(\log x)$  is a solution of the differential equation

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

Correct: a

126. The shortest distance between the lines  $\vec{r} = (4\hat{i} - \hat{j}) + \lambda(\hat{i} + 2\hat{j} - 3\hat{k})$  and  $\vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(2\hat{i} + 4\hat{j} - 5\hat{k})$  is

- (a)  $\frac{2}{\sqrt{5}}$
- (b)  $\frac{2}{5}$
- (c)  $\frac{6}{\sqrt{5}}$
- (d)  $\frac{1}{\sqrt{5}}$

Correct: c

127. The solution set of the inequality

$$\log_{\tan(x/3)}(x^2 - 3x + 2) \geq 2$$

- (a)  $\left(\frac{1}{2}, 2\right)$
- (b)  $\left[\frac{1}{2}, 2\right)$
- (c)  $\left[\frac{1}{2}, 1\right) \cup \left(2, \frac{5}{2}\right]$
- (d)  $\left(\frac{1}{2}, \frac{5}{2}\right)$

Correct: c

128. The minimum value of  $9^x + 9^{1-x}$ ,  $x \in \mathbb{R}$  is

- (a) 2
- (b) 3
- (c) 6
- (d) 9

Correct: c

129. Area of one loop formed by  $|y| = |\sin x|$  is

- (a) 0
- (b) 2
- (c) 4
- (d)  $2\pi$

Correct: c

130. The function  $y = c_1 \cos x + c_2 \sin x$  is a solution of the DE, where  $c_1$  and  $c_2$  are real numbers

- (a)  $\frac{d^2y}{dx^2} = y$

- (b)  $\frac{d^2y}{dx^2} + y = 0$   
 (c)  $\frac{d^2y}{dx^2} + xy = 0$   
 (d)  $\frac{d^2y}{dx^2} - xy = 0$

Correct: b

131. If  $\int_0^\infty [3e^{-x}] dx = l$  where  $[.]$  denotes the greatest integer function, then the value of  $l$  is

- (a) 0  
 (b)  $\ln 3$   
 (c)  $e^3$   
 (d)  $3e^{-1}$

Correct: b

132.  $\int_1^{\sqrt{3}} \frac{dx}{1+x^2}$  equals

- (a)  $\frac{\pi}{3}$   
 (b)  $\frac{2\pi}{3}$   
 (c)  $\frac{\pi}{6}$   
 (d)  $\frac{\pi}{12}$

Correct: d

133.  $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \cos^2 x} dx$  is equal to

- (a)  $\cot x - \tan x + C$   
 (b)  $\tan x + \cot x + C$   
 (c)  $\tan x + \csc x + C$   
 (d)  $e^x \cos x + C$

Correct: b

134. The integral  $\int e^x(1 + \tan x) \sec x dx$  equals

- (a)  $e^x \cot x + c$   
 (b)  $e^x \tan x + c$   
 (c)  $e^x \sec x + c$   
 (d)  $e^x \cos x + c$

Correct: c

135. The area of the region bounded by the two parabolas  $y = x^2$  and  $y=x$  is

- (a)  $1/3$   
 (b)  $2/3$   
 (c) 1  
 (d)  $1/6$

Correct: d

136. Differentiate  $y = \sin^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ ,  $0 < x < 1$  with respect to

- (a)  $\frac{-2}{1+x^2}$   
 (b)  $\frac{2}{1-x^2}$   
 (c)  $\frac{1}{1+x^2}$   
 (d)  $\frac{1}{1-x^2}$

Correct: a

137. The angle between the line  $x - 2y + z = 0 = x + 2y - 2z$  and the plane  $5x - 2y - 2 + 17 = 0$  is

- (a)  $30^\circ$   
 (b)  $60^\circ$   
 (c)  $90^\circ$   
 (d)  $0^\circ$

Correct: d

138. If  $y = e^{x+e^{x+e^{x+\dots}}}$ , then  $\frac{dy}{dx}$  is equal to

- (a)  $\frac{y}{1-y}$
- (b)  $\frac{x}{1-y}$
- (c)  $\frac{x}{1-x}$
- (d)  $\frac{y}{1-x}$

Correct: a

139. If  $\lim_{x \rightarrow 0} |x|^{\lfloor \cos x \rfloor} = 1$  where  $\lfloor \cdot \rfloor$  denotes the greatest integer function, then the value of  $l$  is

- (a) 1
- (b) -1
- (c) 0
- (d) does not exist

Correct: a

140. A polygon has 44 diagonals. The number of its sides are

- (a) 9
- (b) 8
- (c) 11
- (d) 7

Correct: c

141. If  $\cot^{-1}(\sqrt{\cos \alpha}) - \tan^{-1}(\sqrt{\cos \alpha}) = x$  then  $\sin x$  is equal to

- (a)  $\tan^2(\alpha/2)$
- (b)  $\cot^2(\alpha/2)$
- (c)  $\tan \alpha$
- (d)  $\cot(\alpha/2)$

Correct: a

142. If  $a, b, c$  are roots of the equation  $x^3 + px + q = 0$ , then the value of  $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$  is

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

Correct: c

143. If  $y = \sin mx$ , then the value of the

determinant  $\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix}$ , where  $y_n = \frac{d^n y}{dx^n}$  is

- (a)  $m^9$
- (b)  $m^2$
- (c)  $m^3$
- (d) None of these

Correct: d

144. If  $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$  be such that  $A^{-1} = \lambda A$ . Then, the value of  $\lambda$  is

- (a) 1/17
- (b) 1/18
- (c) 1/19
- (d) 1/21

Correct: c

145. If  $A = \begin{bmatrix} \alpha & 0 \\ 1 & 1 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$  and  $A^2 = B$ , then the value of  $\alpha$  is

- (a)  $\alpha = \pm 1$
- (b)  $\alpha = 4$
- (c) not possible
- (d) Both (a) and (b)

Correct: c

146. Let  $0 < \alpha < \pi$ ,  $0 < \beta < \pi$  and  $\cos \alpha + \cos \beta - \cos(\alpha + \beta) = \frac{3}{2}$ . Then the relation between  $\alpha$  and  $\beta$  will be

- (a)  $\alpha = \beta$
- (b)  $\alpha > \beta$
- (c)  $\alpha < \beta$
- (d)  $\alpha = \frac{\beta}{3}$

Correct: a

147. If  $\sin^{-1} x - \cos^{-1} x = \frac{\pi}{6}$ , then the value of  $x$  is

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

Correct: a

148. If  $\mathbb{R}$  is the set of real numbers and  $f: \mathbb{R} \rightarrow \mathbb{R}$  is a function defined by  $f(x) = \sin x$ , then  $f^{-1}([-1, 1])$  is

- (a)  $\{x \mid x = n\pi, n \text{ is an integer}\}$
- (b)  $\{x \mid x = \frac{1}{2} + 2n\pi, n \text{ is an integer}\}$
- (c)  $\mathbb{R}$
- (d) null set  $\phi$

Correct: c

149. The function  $f(x) = \cos x$  is strictly decreasing on

- (a)  $[0, \pi]$
- (b)  $(0, \pi)$
- (c)  $(0, \pi]$
- (d)  $(0, \pi)$

Correct: d

150. Let  $R$  be a reflexive relation on a finite set  $A$  having  $n$  elements and let there be  $m$  ordered pairs in  $R$ , then

- (a)  $m \geq n$
- (b)  $m \leq n$
- (c)  $m = n$
- (d) None of these

Correct: a