

## PROVISIONAL ANSWER KEY

Question Paper Code: 7/2024/OL

Exam: KEAM2024 07

Date of Test: 07-06-2024

1. Choose the INCORRECT dimensions:

- A) Linear momentum:  $MLT^{-1}$
- B) Angular momentum:  $ML^2T^{-1}$
- C) Speed of Light:  $M^0LT^{-2}$
- D) Kinetic energy:  $ML^2T^{-2}$
- E) Angular frequency:  $M^0L^0T^{-1}$

Correct Answer : Option C

2. The length of the side of a cube is  $1.1 \times 10^{-2} \text{ m}$ . Its volume in  $\text{m}^3$  up to correct significant figures is

- A)  $1.4 \times 10^{-6}$
- B)  $1.33 \times 10^{-6}$
- C)  $1.23 \times 10^{-6}$
- D)  $1.42 \times 10^{-6}$
- E)  $1.3 \times 10^{-6}$

Correct Answer : Option E

3. A person travels in a car from  $p$  to  $q$  with uniform speed  $u$  and returns to  $p$  with uniform speed  $v$ . The average speed for his round trip is

- A)  $\frac{u+v}{2}$
- B)  $\frac{uv}{u+v}$
- C)  $\sqrt{uv}$
- D)  $\frac{2uv}{u+v}$
- E)  $\sqrt{\frac{uv}{u+v}}$

Correct Answer : Option D

4. If  $\vec{a} = 0.4\hat{i} + 0.3\hat{j} + b\hat{k}$  is a unit vector, then the value of  $b$  is

- A)  $\sqrt{3}$
- B)  $\frac{2}{\sqrt{5}}$

- C)  $\frac{\sqrt{5}}{2}$
- D)  $\frac{1}{\sqrt{3}}$
- E)  $\frac{\sqrt{3}}{2}$

**Correct Answer :** Option E

5. The velocity (v)-time (t) graph for the motion of a body is a straight line making an angle  $60^\circ$  with the time axis. Then the body is moving with an acceleration (in  $\text{m s}^{-2}$ ) of
- A) 1
  - B)  $\frac{\sqrt{3}}{2}$
  - C)  $\frac{1}{\sqrt{3}}$
  - D)  $\sqrt{3}$
  - E) zero

**Correct Answer :** Option D

6. A body of weight  $W$  is suspended from the ceiling of a room through a chain of weight  $w$ . The ceiling pulls the chain by a force
- A)  $w$
  - B)  $Wg$
  - C)  $\frac{w+W}{2g}$
  - D)  $\frac{w-W}{2}$
  - E)  $w+W$

**Correct Answer :** Option E

7. The coefficient of friction between the road and the tyres of a cyclist is 0.1. The maximum speed with which he can take a circular turn of radius 2 m without skidding is ( $g=10 \text{ ms}^{-2}$ )
- A)  $\sqrt{2} \text{ ms}^{-1}$
  - B)  $\sqrt{3} \text{ ms}^{-1}$
  - C)  $\sqrt{5} \text{ ms}^{-1}$
  - D)  $2 \text{ ms}^{-1}$
  - E)  $3 \text{ ms}^{-1}$

**Correct Answer :** Option A

8. A person standing in an elevator, experiences weight loss, when the elevator
- A) moves down with uniform velocity
  - B) moves upward with constant acceleration
  - C) moves downward with constant acceleration
  - D) moves upward with uniform velocity
  - E) moves down with variable acceleration

**Correct Answer :** Option C

9. The ratio of the maximum kinetic energy to the maximum potential energy of a bob of a simple pendulum executing small oscillations is
- A) 1 : 1
  - B) 1 : 2
  - C) 2 : 1
  - D) 1 : 4
  - E) 4 : 1

**Correct Answer :** Option A

10. A constant force of 6 N acting on a stationary body displaces it by 3 m in 2 s. The average power delivered is
- A) 18 W
  - B) 15 W
  - C) 12 W
  - D) 9 W
  - E) 6 W

**Correct Answer :** Option D

11. A block of mass 3 kg executes simple harmonic motion under the restoring force of a spring. The amplitude and the time period of the motion are 0.1 m and 3.14 s respectively. The maximum force exerted by the spring on the block is
- A) 1.2 N
  - B) 3 N
  - C) 12 N
  - D) 30 N
  - E) 90 N

**Correct Answer :** Option A

12. The principle involved in the performance of a circus acrobat is the conservation of
- A) translational energy
  - B) linear momentum
  - C) angular momentum
  - D) mass
  - E) rotational energy

**Correct Answer :** Option C

13. For a smoothly running analog clock, the ratio of the angular velocity of the minute hand to the angular velocity of hour hand is
- A) 2
  - B) 12
  - C) 24
  - D) 60
  - E) 360

Correct Answer : Option B

14. The height above the surface of the earth at which the acceleration due to gravity becomes half of that on the surface of the earth is ( $R$  is the radius of earth)
- A)  $R$
  - B)  $2R$
  - C)  $4R$
  - D)  $\frac{R}{2}$
  - E)  $\frac{R}{4}$

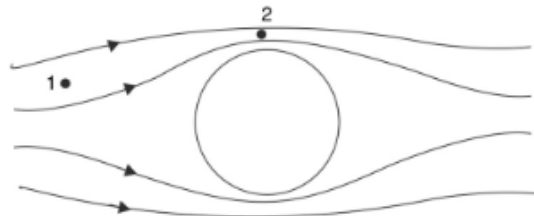
Correct Answer : Option E

15. A particle of 100 g mass is projected vertically up with a kinetic energy of 20 J. The maximum height reached by the particle is ( $g = 10 \text{ ms}^{-2}$ ) (neglecting air resistance)
- A) 5 m
  - B) 10 m
  - C) 15 m
  - D) 20 m
  - E) 25 m

Correct Answer : Option D

A ball is projected in still air. With respect to the ball the streamlines appear as shown in the figure. If speed of air passing through the region 1 and 2 are  $v_1$  and  $v_2$ , respectively and the respective pressures,  $P_1$  and  $P_2$ , respectively, then

16.



- A)  $v_1 = v_2; P_1 = P_2$
- B)  $v_1 > v_2; P_1 > P_2$
- C)  $v_1 < v_2; P_1 < P_2$
- D)  $v_1 > v_2; P_1 < P_2$
- E)  $v_1 < v_2; P_1 > P_2$

Correct Answer : Option E

17. If the radii of two soap bubbles are respectively 2 cm and 3 cm, then the ratio of the excess pressures inside the soap bubbles is
- A) 5:3
  - B) 3:2
  - C) 2:3
  - D) 1:1
  - E) 3:5

Correct Answer : Option B

18. The elastic energy stored per unit volume in a stretched wire is ( $Y$  = Young's modulus of the material of the wire;  $S$  = stress acting on the wire)
- A)  $\frac{1}{2} \left( \frac{S}{Y} \right)$
  - B)  $\frac{1}{2} \left( \frac{S}{Y^2} \right)$
  - C)  $\frac{1}{2} \left( \frac{S^2}{Y} \right)$
  - D)  $\frac{1}{2} \left( \frac{S^2}{Y^2} \right)$
  - E)  $\frac{1}{2} (SY)$

Correct Answer : Option C

19. The zeroth law of thermodynamics leads to the concept of
- A) carnot engine
  - B) work
  - C) temperature
  - D) heat
  - E) internal energy

Correct Answer : Option C

If  $m_a$  and  $m_i$  are the slopes of the adiabatic and isothermal curves for an ideal gas, then

20.  $\left( \frac{c_p}{c_v} = \gamma \right)$
- A)  $m_a = \gamma m_i$
  - B)  $m_i = \gamma m_a$
  - C)  $m_a m_i = \gamma$
  - D)  $m_a m_i = \gamma^2$

E)  $\sqrt{\frac{m_a}{m_i}} = \gamma$

**Correct Answer :** Option A

**21.** The work done by a gas on the system is zero in

- A) adiabatic process
- B) isothermal compression
- C) isochoric process
- D) isobaric process
- E) isothermal expansion

**Correct Answer :** Option C

If  $c_p$ ,  $c_v$  and  $f$  are the specific heat capacity at constant pressure, specific heat capacity at

**22.** constant volume and number of degrees of freedom for a polyatomic gaseous system, then

the ratio  $\frac{c_p}{c_v}$  is equal to

- A)  $\frac{3+f}{4+f}$
- B)  $\frac{3}{4f}$
- C)  $\frac{4f}{3}$
- D)  $\frac{f}{3}$
- E)  $\frac{4+f}{3+f}$

**Correct Answer :** Option E

When the number of molecules per unit volume of an ideal gas is  $0.8 \times 10^{24}$  the mean free

**23.** path length for its molecules is  $2.2 \times 10^{-5} m$ . If the number of molecules per unit volume is

$1.0 \times 10^{24}$ , then the mean free path is

- A)  $17.6 \times 10^{-5} m$
- B)  $1.76 \times 10^{-5} m$
- C)  $3.52 \times 10^{-5} m$
- D)  $35.2 \times 10^{-5} m$
- E)  $8.8 \times 10^{-5} m$

**Correct Answer :** Option B

24. A particle executes a linear SHM with an amplitude  $a$  and angular velocity  $\omega$ . The ratio between its acceleration amplitude and displacement amplitude is

- A)  $\frac{\omega}{4}$
- B)  $\omega^2$
- C)  $\omega$
- D)  $\frac{\omega}{2}$
- E)  $2\omega$

Correct Answer : Option B

25. Speed of a transverse wave on a stretched string under tension  $T$  and linear density  $\mu$  is

- A)  $\sqrt{\frac{\mu}{T}}$
- B)  $\sqrt{\frac{T}{\mu}}$
- C)  $\sqrt{\mu T}$
- D)  $\mu T$
- E)  $\frac{\mu}{T}$

Correct Answer : Option B

26. The lowest frequency of the air column in an open pipe of length  $L$  is ( $v$ = velocity of sound in air)

- A)  $\frac{v}{2L}$
- B)  $\frac{v}{4L}$
- C)  $\frac{v}{L}$
- D)  $\frac{v}{8L}$
- E)  $\frac{2v}{L}$

Correct Answer : Option B

27. If  $E$  is the electric field intensity between the plates of a charged parallel plate capacitor, energy stored per unit volume in it is (permittivity of free space =  $\epsilon_0$ )

- A)  $\epsilon_0 E^2$

- B)  $\frac{1}{2}\epsilon_0 E^2$
- C)  $\frac{1}{8}\epsilon_0 E^2$
- D)  $\frac{1}{4}\epsilon_0 E^2$
- E)  $\frac{1}{16}\epsilon_0 E^2$

Correct Answer : Option B

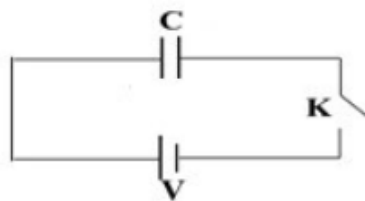
28. Two like charges kept in air medium experience a force  $F$ , when they are separated by a certain distance  $r$ . When the same charges are kept in a dielectric medium at the same distance of the separation the force between them is  $0.5F$ . The dielectric constant of the medium is

- A) 5
- B)  $\frac{3}{2}$
- C)  $\frac{5}{2}$
- D) 2
- E)  $\frac{2}{5}$

Correct Answer : Option D

The energy stored in the capacitor after closing the key K is

29.



- A)  $\frac{3}{4}CV^2$
- B)  $\frac{1}{4}CV^2$
- C)  $\frac{1}{2}CV^2$
- D)  $CV^2$
- E)  $\frac{3}{2}CV^2$

Correct Answer : Option C



30. Masses of three copper wires are in the ratio 1 : 3 : 5 and their lengths are in the ratio 5 : 3 : 1. Then the ratio of their electric resistances is
- A) 125 : 15 : 1  
 B) 5 : 3 : 1  
 C) 1 : 25 : 125  
 D) 1 : 3 : 5  
 E) 5 : 21 : 25

Correct Answer : Option A

31. Mobility  $\mu$  of an electron is related to average collision time  $\tau$  as  
 (e=electronic charge, m=mass of the electron)

- A)  $\frac{1}{\tau} = m\mu$   
 B)  $\mu = \frac{m\tau}{e}$   
 C)  $\frac{1}{\mu} = \tau$   
 D)  $\mu = \frac{e\tau}{m}$   
 E)  $\mu\tau = e m$

Correct Answer : Option D

32. The electric power delivered by a transmission cable of resistance  $R_c$  at a voltage  $V$  is  $P$ . The power dissipated is

- A)  $\frac{PV}{R_c}$   
 B)  $\frac{PR_c}{V}$   
 C)  $PVR_c$   
 D)  $\frac{P^2R_c}{V^2}$   
 E)  $\frac{P^2R_c^2}{V}$

Correct Answer : Option D

33. The ratio of radii of the circular paths of a proton and a deuteron when projected perpendicular to the direction of a uniform magnetic field with the same speed is

- A) 1 : 1  
 B) 1 : 2  
 C) 2 : 1  
 D) 4 : 1  
 E) 1 : 4

**Correct Answer :** Option B

- 34.** An alternative form of Biot-Savart's law is
- A) Gauss's law
  - B) Ohm's law
  - C) Coulomb's law
  - D) Ampere's circuital law
  - E) Joule's law

**Correct Answer :** Option D

- In an LCR series resonance circuit driven by the alternating voltage  $V = V_0 \sin \omega t$ ,
- 35.** inductance  $L = 1 \mu\text{H}$ , capacitance  $C = 1 \mu\text{F}$  and resistance  $R = 1 \text{ k}\Omega$ . The resonant angular frequency (in  $\text{rad s}^{-1}$ ) is :
- A)  $10^6$
  - B)  $10^{-6}$
  - C)  $10^{12}$
  - D)  $10^{-12}$
  - E)  $10^{16}$

**Correct Answer :** Option A

- 36.** Electromagnetic waves of frequency  $5 \times 10^{14} \text{ Hz}$  lie in the
- A) ultraviolet region
  - B) infrared region
  - C) visible region
  - D) radio region
  - E) Microwave region

**Correct Answer :** Option C

- 37.** Whenever light travels from rarer medium into denser medium its
- A) frequency increases
  - B) wavelength increases
  - C) frequency decreases
  - D) wavelength decreases
  - E) wavelength remains unchanged

**Correct Answer :** Option D

- Young's double-slit experiment is carried out by using green, red and blue lights, one at a time. The fringe widths recorded are  $\beta_G$ ,  $\beta_R$  and  $\beta_B$  respectively. Then
- 38.**
- A)  $\beta_G < \beta_R < \beta_B$
  - B)  $\beta_B < \beta_R < \beta_G$
  - C)  $\beta_G < \beta_B < \beta_R$
  - D)  $\beta_B < \beta_G < \beta_R$

E)  $\beta_G = \beta_R = \beta_B$

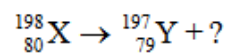
Correct Answer : Option D

39. The number of de Broglie waves associated with Bohr electron when it completes one revolution in its third orbit is

- A) 1
- B) 3
- C) 5
- D) 6
- E)  $\infty$

Correct Answer : Option B

40. The particle which is expected to be emitted along with Y in the following nuclear reaction is



- A)  $\alpha$  - particle
- B)  $\beta^+$  - particle
- C)  $\beta^-$  - particle
- D) proton
- E) neutron

Correct Answer : Option D

41. In a nuclear fusion process, the masses of the fusing nuclei are  $M_A$  and  $M_B$ . Then the mass of the product nucleus  $M_C$  is related to  $M_A$  and  $M_B$  as

- A)  $M_C < M_A + M_B$
- B)  $M_C > M_A + M_B$
- C)  $M_C = |M_A - M_B|$
- D)  $M_C = M_A + M_B$
- E)  $M_C = \frac{M_A + M_B}{2}$

Correct Answer : Option A

42. The electron concentration ( $n_e$ ) and hole concentration ( $n_h$ ) in semiconductor are related to the number of intrinsic charge concentration  $n_i$  as

- A)  $n_e n_h = n_i^2$
- B)  $n_e + n_h = n_i^2$
- C)  $n_e + n_h = 2n_i^2$
- D)  $n_e n_h = n_i$
- E)  $n_e n_h^2 = n_i$

**Correct Answer :** Option A

**43.** The half-life period of a radioactive element is 2 days. If  $\frac{1}{32}$  part of the initial amount remains undecayed after a time  $t$ , then the value of  $t$  in days is

- A) 8
- B) 10
- C) 6
- D) 12
- E) 4

**Correct Answer :** Option B

**44.** An intrinsic semiconductor at  $T = 0$  K behaves like

- A) insulator
- B) n- type semiconductor
- C) p- type semiconductor
- D) conductor
- E) superconductor

**Correct Answer :** Option A

**45.** When a diode is reverse biased

- A) applied voltage in the p - side is positive
- B) the depletion layer width decreases
- C) the applied voltage is in the opposite direction of barrier potential
- D) minority carriers are not allowed to cross the barrier
- E) the barrier height increases

**Correct Answer :** Option E

**46.** 10 g of alcohol is dissolved in 90 g of water. The percentage of alcohol in the solution is

- A) 10%
- B) 90%
- C) 20%
- D) 100%
- E) 1%

**Correct Answer :** Option A

**47.** Which of the following set of quantum numbers possible?

- A)  $n = 3, l = 2, m_l = -4, m_s = \frac{1}{2}$
- B)  $n = 2, l = 2, m_l = 0, m_s = \frac{1}{2}$
- C)  $n = 2, l = 2, m_l = -1, m_s = 1$
- D)  $n = 3, l = 2, m_l = -2, m_s = \frac{1}{2}$
- E)  $n = 3, l = 3, m_l = -2, m_s = \frac{1}{2}$

**Correct Answer :** Option D

**48.** The electronic configuration of Pd (Z=46) is

- A)  $[\text{Kr}] 4d^8 5s^2 5p^0$
- B)  $[\text{Kr}] 4d^9 5s^1 5p^0$
- C)  $[\text{Kr}] 4d^{10} 5s^0 5p^0$
- D)  $[\text{Kr}] 4d^5 5s^2 5p^3$
- E)  $[\text{Kr}] 4d^6 5s^2 5p^2$

**Correct Answer :** Option C

**49.** Which of the following has square planar structure?

- A)  $\text{NH}_4^+$
- B)  $\text{XeF}_4$
- C)  $\text{CCl}_4$
- D)  $\text{SiCl}_4$
- E)  $\text{CH}_4$

**Correct Answer :** Option B

**50.** Which of the following molecule is paramagnetic?

- A)  $\text{O}_2$
- B)  $\text{C}_2$
- C)  $\text{N}_2$
- D)  $\text{F}_2$
- E)  $\text{H}_2$

**Correct Answer :** Option A

**51.** The vapour pressure of  $\text{H}_2\text{O}$  at 323K is 95 mm of Hg. 176g of sucrose (Molar mass =  $342 \text{ gmol}^{-1}$ ) is added to 900g of  $\text{H}_2\text{O}$  at 323K. The vapour pressure of solution is about

- A) 93.94 mm
- B) 92.88 mm
- C) 96.06 mm
- D) 95.33 mm
- E) 94.06 mm

**Correct Answer :** Option E

**52.** Which of the following statement is incorrect?

- A) The greater the disorder in an isolated system, the higher is the entropy.
- B) The crystalline solid state of a substance is the state of lowest entropy.
- C) Entropy is not the measure of average chaotic motion of particles in the system.
- D) The gaseous state of a substance is state of highest entropy.
- E)  $\Delta S$  is related to  $q$  and  $T$  for a reversible reaction as  $\Delta S = q_{\text{rev}}/T$ .

Correct Answer : Option C

53.  $\text{PCl}_5(\text{g})$ ,  $\text{PCl}_3(\text{g})$  and  $\text{Cl}_2(\text{g})$  are at equilibrium at 500 K. The equilibrium concentrations of  $\text{PCl}_3(\text{g})$ ,  $\text{Cl}_2(\text{g})$  and  $\text{PCl}_5(\text{g})$  are respectively 4.0 M, 4.0 M and 2.0 M. Calculate  $K_c$  for the reaction,

$$\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$$

- A)  $2 \text{ mol dm}^{-3}$
- B)  $4 \text{ mol dm}^{-3}$
- C)  $6 \text{ mol dm}^{-3}$
- D)  $8 \text{ mol dm}^{-3}$
- E)  $10 \text{ mol dm}^{-3}$

Correct Answer : Option D

54. Which of the following statement is true with regard to Daniell cell?

- A) Oxidation occurs at cathode
- B) Reduction occurs at anode
- C)  $E^0$  cell is 1.1 V
- D) Electrical energy produces chemical reaction
- E) Electrolytes are aqueous solutions of  $\text{CuSO}_4$  and  $\text{FeSO}_4$ .

Correct Answer : Option C

55. The conductivity of  $0.02 \text{ mol L}^{-1}$  KCl solution is  $0.248 \text{ S m}^{-1}$ . Its molar conductivity is

- A)  $20 \text{ S m}^2 \text{ mol}^{-1}$
- B)  $1.24 \times 10^{-3} \text{ S m}^2 \text{ mol}^{-1}$
- C)  $1.24 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$
- D)  $2.48 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$
- E)  $1.24 \times 10^{-2} \text{ S m}^2 \text{ mol}^{-1}$

Correct Answer : Option E

56. Which of the following compound has the lowest boiling point?

- A) Carbon disulphide
- B) Water
- C) Ethanol
- D) Benzene
- E) Chloroform

Correct Answer : Option A

57. Radioactive decay follows

- A) first order
- B) second order
- C) third order
- D) zero order
- E) Pseudo first order

**Correct Answer :** Option A

**58.** In which of the following system, the number of moles of the substance present at equilibrium not be shifted by change in the volume of the system at constant temperature?

- A)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$
- B)  $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$
- C)  $\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons \text{CH}_4(\text{g})$
- D)  $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$
- E)  $\text{NO}_2(\text{g}) + \text{SO}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g}) + \text{NO}(\text{g}) + \text{H}_2\text{O}(\text{g})$

**Correct Answer :** Option E

**59.** Which of the following has the least atomic radius?

- A) B
- B) C
- C) N
- D) O
- E) F

**Correct Answer :** Option E

**60.** Which of the following tripositive ion has smallest size?

- A)  $\text{Ce}^{3+}$
- B)  $\text{Nd}^{3+}$
- C)  $\text{La}^{3+}$
- D)  $\text{Sm}^{3+}$
- E)  $\text{Gd}^{3+}$

**Correct Answer :** Option E

**61.** Lanthanides (Ln) when heated with carbon at 2773K form product with general formula

- A)  $\text{LnC}$
- B)  $\text{Ln}_2\text{C}_3$
- C)  $\text{LnC}_3$
- D)  $\text{LnC}_2$
- E)  $\text{Ln}_3\text{C}_2$

**Correct Answer :** Option D

**62.** Which of the following is an acidic oxide?

- A)  $\text{CrO}_3$
- B)  $\text{CrO}$
- C)  $\text{V}_2\text{O}_4$
- D)  $\text{V}_2\text{O}_5$
- E)  $\text{V}_2\text{O}_3$

**Correct Answer :** Option A

63. The catalyst used in the Wacker process is

- A)  $V_2O_5$
- B)  $PdCl_2$
- C)  $TiCl_4$  with  $Al(CH_3)_3$
- D) Fe
- E) Mo

Correct Answer : Option B

64. The coordination number of Pt and Fe in the complexes  $[PtCl_6]^{2-}$  and  $[Fe(C_2O_4)_3]^{3-}$  are respectively

- A) 4 and 6
- B) 6 and 6
- C) 4 and 4
- D) 6 and 8
- E) 4 and 8

Correct Answer : Option B

65. The IUPAC name of  $HOCH_2(CH_2)_3CH_2COCH_3$

- A) 2-oxo-heptan-7-ol
- B) 7-hydroxyheptan-2-one
- C) hydroxyheptan-6-one
- D) 2-oxo-heptan-7-ol
- E) hydroxy pentyl methyl ketone

Correct Answer : Option B

66. Which of the following statement is incorrect with Kolbe's electrolytic method?

- A) It gives an alkane with even number of carbon atoms at the anode.
- B) At anode decarboxylation and formation of methyl radical occurs.
- C) Methane cannot be prepared by this method.
- D) At anode acetate ion accepts electrons to give acetate free radical.
- E) At cathode hydrogen gas is liberated.

Correct Answer : Option D

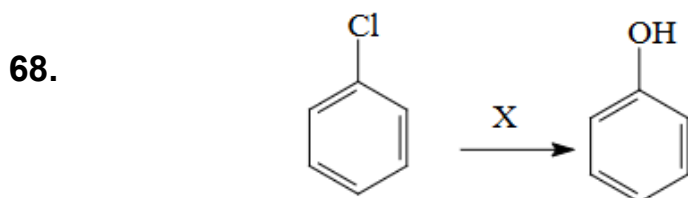
67. Which of the following substitution reaction with methane requires  $HIO_3$  as an oxidising agent?

- A) Chlorination
- B) Bromination
- C) Iodination
- D) Fluorination
- E) Friel-Crafts acylation

Correct Answer : Option C



The reagents and conditions (X) required for the following conversion



- A)  $X = \text{H}_2\text{O}, 623 \text{ K}, 300 \text{ atm} \ \& \ \text{H}^+$
- B)  $X = \text{KOH}, 443 \text{ K}, 100 \text{ atm} \ \& \ \text{H}^+$
- C)  $X = \text{NaOH}, 368 \text{ K}, 300 \text{ atm} \ \& \ \text{H}^+$
- D)  $X = \text{warm}, \text{H}_2\text{O} \ \& \ \text{H}^+$
- E)  $X = \text{NaOH}, 623 \text{ K}, 300 \text{ atm} \ \& \ \text{H}^+$

**Correct Answer :** Option E

69. Which of the following statement is incorrect?

- A) (-)-2-bromooctane reacts with NaOH gives (+)-octan-2-ol by  $\text{S}_{\text{N}}2$  reaction.
- B) 2-Bromobutane reacts with NaOH gives racemic mixture by  $\text{S}_{\text{N}}1$  reaction.
- C)  $\beta$ -elimination of 2-bromopentane gives pent-1-ene as major product.
- D) The hybridization of the carbon in the intermediate formed in  $\text{S}_{\text{N}}1$  reaction is  $\text{sp}^2$ .
- E) Primary alkyl halide undergoes  $\text{S}_{\text{N}}2$  faster than secondary alkyl halide.

**Correct Answer :** Option C

70. Compound 'X' ( $\text{C}_6\text{H}_6\text{O}$ ) reacts with aqueous NaOH to give compound 'Y'. 'Y' reacts with  $\text{CO}_2$  followed by acidification to give compound 'Z'. The compounds X, Y and Z are respectively

- A) benzene, phenol, salicylaldehyde
- B) phenol, benzene, benzoic acid
- C) phenol, sodium phenoxide, benzophenone
- D) benzaldehyde, sodium phenoxide, salicylic acid
- E) phenol, sodium phenoxide, salicylic acid

**Correct Answer :** Option E

71. The decreasing order of basic strength in aqueous solution of amines is

- A) Dimethylamine > Methylamine > Trimethylamine > Ammonia
- B) Methylamine > Dimethylamine > Trimethylamine > Ammonia
- C) Trimethylamine > Dimethylamine > Methylamine > Ammonia
- D) Ammonia > Trimethylamine > Dimethylamine > Methylamine
- E) Ammonia > Dimethylamine > Trimethylamine > Methylamine

**Correct Answer :** Option A

72. The melting point of  $\beta$ -form of crystalline glucose is

- A) 473 K
- B) 303 K
- C) 423 K
- D) 371 K

E) 503 K

**Correct Answer :** Option C

**73.** Kjeldahl method can be used to estimate nitrogen in

- A) azobenzene
- B) aniline
- C) o-nitrophenol
- D) nitrobenzene
- E) pyridine

**Correct Answer :** Option B

**74.** Which of the following vitamin deficiency causes increased fragility of RBCs and muscular weakness?

- A) Vitamin A
- B) Vitamin B<sub>12</sub>
- C) Riboflavin
- D) Vitamin D
- E) Vitamin E

**Correct Answer :** Option E

**75.** Which of the following is the most reactive in aromatic electrophilic substitution reaction?

- A) Benzene
- B) Chlorobenzene
- C) Phenol
- D) Benzaldehyde
- E) Nitrobenzene

**Correct Answer :** Option C

Let  $A, B, C$  denote the set of students in a college who play football, basketball and cricket

**76.** respectively. If  $n(A) = 60, n(B) = 55, n(C) = 70, n(A \cup B \cup C) = 100$  and  $n(A \cap B \cap C) = 20$ , then the number of students who play exactly two of these sports is

- A) 40
- B) 45
- C) 60
- D) 75
- E) 85

**Correct Answer :** Option B

**77.** Let  $f(x) = \sqrt{4-x^2}, g(x) = \sqrt{x^2-1}$ . Then the domain of the function  $h(x) = f(x) + g(x)$  is equal to

- A)  $(-\infty, -1] \cup [1, \infty)$
- B)  $(-\infty, -2] \cup [2, \infty)$
- C)  $[-2, -1]$

- D)  $[-2, -1] \cup [1, 2]$   
E)  $[1, 2]$

Correct Answer : Option D

78. The range of the function  $f(x) = 8 + \sqrt{x-5}$  is

- A)  $(-\infty, 5]$   
B)  $[5, \infty)$   
C)  $(-\infty, 5] \cup [8, \infty)$   
D)  $[5, 8]$   
E)  $[8, \infty)$

Correct Answer : Option E

79. If  $x$  satisfies the inequality  $-3 < \frac{1}{2} + \frac{-3x}{2} \leq 6$ , then  $x$  lies in the interval

- A)  $\left[ \frac{-11}{3}, \frac{7}{3} \right)$   
B)  $\left( \frac{-11}{3}, \frac{7}{3} \right]$   
C)  $\left( \frac{7}{3}, \frac{11}{3} \right]$   
D)  $\left[ \frac{-10}{3}, \frac{7}{3} \right)$   
E)  $\left[ \frac{7}{3}, \frac{10}{3} \right)$

Correct Answer : Option A

80. Let  $f(x) = 6x^2 + 9x + 10$  and  $g(x) = x^2 - 9x - 9$ . Then the value of  $(f \circ g)(10)$  is equal to

- A) 10  
B) 15  
C) 25  
D) 35  
E) 45

Correct Answer : Option C

81. If the complex number  $\frac{2+i}{\lambda+i}$  lies on the line  $y = x$  of the first quadrant, then the value of  $\lambda$  is equal to

- A) 3

- B) -3
- C) 2
- D) -2
- E) 0

Correct Answer : Option B

82. Let  $z = x + iy$ , where  $y > 0$ . If  $z + \bar{z} = 6$  and  $|z| + |\bar{z}| = 10$ , then  $z =$

- A)  $3 + 2i$
- B)  $3 + 5i$
- C)  $3 + 3i$
- D)  $3 + 4i$
- E)  $3 + i\sqrt{5}$

Correct Answer : Option D

83. If the complex number  $2 + i$  is rotated through an angle  $90^\circ$  in the anti-clockwise direction about the origin in the complex plane, then the resulting complex number is

- A)  $2 - i$
- B)  $1 + 2i$
- C)  $-1 + 2i$
- D)  $-2 + i$
- E)  $1 - 2i$

Correct Answer : Option C

84. The number of positive integers that have at most seven digits and contain only the digits 0 and 9 is

- A) 112
- B) 127
- C) 136
- D) 142
- E) 150

Correct Answer : Option B

85. The sum of first 20 terms of the G.P  $\sqrt{3} + \frac{-1}{\sqrt{3}} + \frac{1}{3\sqrt{3}} + \frac{-1}{3^2\sqrt{3}} + \dots$  is equal to

- A)  $\frac{\sqrt{3}}{4} \left( \frac{3^{20} - 1}{3^{19}} \right)$
- B)  $\frac{\sqrt{3}}{2} \left( \frac{3^{20} - 1}{3^{19}} \right)$
- C)  $\frac{\sqrt{3}}{4} \left( \frac{3^{20} - 1}{3^{20}} \right)$

D)  $\sqrt{3} \left( \frac{3^{20} - 1}{3^{19}} \right)$

E)  $\frac{\sqrt{3}}{2} \left( \frac{3^{20} - 1}{3^{20}} \right)$

**Correct Answer :** Option A

**86.** Let  $A = \{1, 3, 5, 7, \dots, 21\}$ . The number of ways 4 numbers, containing always 11, can be selected from the set  $A$  is equal to

- A) 120
- B) 160
- C) 240
- D) 260
- E) 320

**Correct Answer :** Option A

**87.** The relation  $R$  in the set of integers  $\mathbb{Z}$  is given by  $R = \{(a, b) : b = 2a + 3\}$ . Then the relation  $R$  is

- A) reflexive, symmetric and transitive
- B) neither reflexive nor symmetric nor transitive
- C) not reflexive but symmetric and transitive
- D) reflexive and symmetric but not transitive
- E) reflexive but not symmetric and transitive

**Correct Answer :** Option B

**88.** The value of the sum  $\sum_{k=0}^{48} \frac{1}{(k+1)(k+2)}$  is equal to

- A)  $\frac{51}{50}$
- B)  $\frac{51}{49}$
- C)  $\frac{49}{50}$
- D)  $\frac{48}{49}$
- E)  $\frac{50}{49}$

**Correct Answer :** Option C

**89.** If the G.M. of the numbers 2 and  $\alpha$  is 16, then the A.M. of these two numbers is equal to

- A) 10
- B) 20

- C) 45
- D) 50
- E) 65

**Correct Answer :** Option E

**90.** Let  $a_n = \frac{n(n-5)}{n+2}$ ,  $n = 1, 2, 3, \dots$ . If  $a_m = \frac{12}{5}$  for some  $m$ , then the value of  $m$  is equal to

- A) 6
- B) 7
- C) 8
- D) 9
- E) 10

**Correct Answer :** Option C

**91.** In the binomial expansion of  $\left(\sqrt{x} - \frac{3}{x^3}\right)^7$ , the constant term is

- A) 21
- B) -21
- C) 14
- D) -14
- E) 7

**Correct Answer :** Option B

**92.**  $23\left({}^{50}C_{23}\right) =$

- A)  $50\left({}^{49}C_{27}\right)$
- B)  ${}^{49}C_{23}$
- C)  ${}^{50}C_{22}$
- D)  $27\left({}^{50}C_{23}\right)$
- E)  ${}^{49}C_{27}$

**Correct Answer :** Option A

**93.** Let  $p(x) = (1+x+x^2+\dots+x^{10})(1-x+x^2-x^3+\dots+x^{10})$ . Then the sum of all coefficients of  $p(x)$  is equal to

- A) 121
- B) 66
- C) 11
- D) 10
- E) 0

Correct Answer : Option C

94. Let  $A = \begin{pmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{pmatrix}$  and  $B = \begin{pmatrix} a_1 & 2b_1 & 4c_1 \\ 2a_2 & 4b_2 & 8c_2 \\ 4a_3 & 8b_3 & 16c_3 \end{pmatrix}$ . If  $|B| = 16$ , then the value of  $|A|$  is

equal to

- A) 4
- B)  $\frac{1}{4}$
- C) 8
- D)  $\frac{1}{8}$
- E) 16

Correct Answer : Option B

95. If  $A$  is an invertible matrix and satisfies the equation  $5A^2 - 4A - 7I = 0$ , where  $I$  is the identity matrix and  $0$  is the zero matrix, then  $7A^{-1} =$

- A)  $5A - 4I$
- B)  $4A - 7I$
- C)  $7A - 5I$
- D)  $4A - 5I$
- E)  $5A - 7I$

Correct Answer : Option A

96. Let  $A$  be a  $3 \times 3$  matrix with  $|A| = 7$ . If  $B = 3A$ , then the value of  $\frac{|\text{adj } A|}{|B|}$  is equal to

- A)  $\frac{7}{3}$
- B)  $\frac{7}{9}$
- C)  $\frac{49}{9}$
- D)  $\frac{7}{27}$
- E)  $\frac{49}{27}$

Correct Answer : Option D

97. If  $A = \begin{pmatrix} -7 & 3 \\ 3 & -1 \end{pmatrix}$ , then  $\det(A^5)$  is equal to

- A) 81
- B) -81
- C) 243
- D) -243
- E) -32

Correct Answer : Option E

98. The means of two samples of size 30 and 40 are 35 and 42 respectively. Then the mean of the combined sample of size 70 is

- A) 36
- B) 37
- C) 38
- D) 39
- E) 40

Correct Answer : Option D

99. The standard deviation of a data set  $x_1, x_2, \dots, x_9$  ( $x_i > 0$ ) is 2. If  $\sum_{i=1}^9 x_i^2 = 360$ , then the mean of the data set is

- A) 4
- B) 6
- C) 8
- D) 10
- E) 12

Correct Answer : Option B

100. If two dice are rolled simultaneously, then the probability that the difference of the numbers on the two dice equals to zero is

- A)  $\frac{1}{12}$
- B)  $\frac{1}{9}$
- C)  $\frac{5}{36}$
- D)  $\frac{7}{36}$
- E)  $\frac{1}{6}$



Correct Answer : Option E

101. Let  $A$  and  $B$  be two events. If  $P(A) = 0.49$ ,  $P(B) = 0.3$  and  $P(A|B') = 0.4$ , then

$P(A|B)$  is equal to

- A) 0.45
- B) 0.28
- C) 0.4
- D) 0.7
- E) 0.3

Correct Answer : Option D

102.  $\tan x - \cot x + \operatorname{cosec} x \sec x =$

- A)  $2 \tan x$
- B)  $2 \operatorname{cosec} x \sec x$
- C)  $2 \tan x \sec x$
- D)  $2 \cot x$
- E)  $2 \cot x \operatorname{cosec} x$

Correct Answer : Option A

103. The value of  $\tan\left(\cos^{-1}\left(\frac{-24}{25}\right)\right)$  is equal to

- A)  $\frac{7}{24}$
- B)  $\frac{-7}{24}$
- C)  $\frac{-7}{25}$
- D)  $\frac{-24}{7}$
- E)  $\frac{24}{7}$

Correct Answer : Option B

104. If  $\sin t + \cos t = \sqrt{2}$ , then  $\tan t + \cot t$  is equal to

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

D)  $\frac{5}{2}$

E) 2

Correct Answer : Option E

105.  $\operatorname{cosec} x + \cot x =$

A)  $\tan\left(\frac{x}{2}\right)$

B)  $\sec\left(\frac{x}{2}\right)$

C)  $\cot\left(\frac{x}{2}\right)$

D)  $\cos\left(\frac{x}{2}\right)$

E)  $\sin\left(\frac{x}{2}\right)$

Correct Answer : Option C

106. The value of  $\sin\left(2\cos^{-1}\left(\frac{5}{12}\right) + \sin^{-1}\left(\frac{5}{12}\right)\right)$  is equal to

A)  $\frac{5}{12}$

B)  $\frac{12}{13}$

C)  $\frac{5}{13}$

D)  $\frac{10}{13}$

E)  $\frac{5}{6}$

Correct Answer : Option A

107.  $\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{2}{3}\right) + \cot^{-1}\left(\frac{9}{7}\right) =$

A)  $\frac{\pi}{6}$

B)  $\frac{\pi}{4}$

- C)  $\frac{\pi}{3}$
- D)  $\frac{\pi}{2}$
- E) 0

Correct Answer : Option D

108. Let  $\sum_{k=1}^{15} \sin(t_k) = 0$  and  $\sum_{k=1}^{15} \sin(3t_k) = \frac{-24}{5}$ , where  $t_1, t_2, t_3, \dots$  are real numbers. Then the value of the sum  $\sum_{k=1}^{15} \sin^3(t_k)$  is equal to

- A)  $\frac{4}{5}$
- B)  $\frac{6}{5}$
- C)  $\frac{3}{10}$
- D)  $\frac{24}{5}$
- E)  $\frac{96}{5}$

Correct Answer : Option B

109. If  $7 \cos^2 x + 3 \sin^2 x = 6$ , then the value of  $\cos 2x$  is equal to

- A)  $\frac{1}{2}$
- B)  $\frac{3}{2}$
- C)  $\frac{5}{2}$
- D) 1
- E) 2

Correct Answer : Option A

110.  $\frac{\operatorname{cosec}^2(\theta) - 1}{\operatorname{cosec}^2(\theta)} - \frac{\sec^2(\theta) - 1}{\sec^2(\theta)} =$

- A)  $2 \cos^2 \theta$
- B)  $2 \cos \theta$
- C)  $2 \sin^2 \theta$
- D)  $\cos 2\theta$

E)  $2 \sin \theta$

Correct Answer : Option D

111. The equation of the line perpendicular to the line  $7x - 5y = 11$  and passing through  $(7, -9)$  is

A)  $5x + 7y + 28 = 0$

B)  $5x + 7y - 28 = 0$

C)  $5x + 7y + 38 = 0$

D)  $5x + 7y - 38 = 0$

E)  $5x - 7y + 28 = 0$

Correct Answer : Option A

112. The values of  $\alpha$  for which the circle  $x^2 + y^2 + \alpha x - 8y + 56 = 0$  has radius 3 are

A) 7,-7

B) 9,-9

C) 12,-12

D) 18,-18

E) 14,-14

Correct Answer : Option E

113. The coordinates of the vertex of the parabola  $y = 2x^2 - 12x + 26$  are

A) (6,13)

B) (3,-8)

C) (3,8)

D) (6,-13)

E) (3,11)

Correct Answer : Option C

114. The equation of the parabola with focus at (3, 1) and vertex at (5, 1) is

A)  $(y-1)^2 = -8(x-5)$

B)  $(y-1)^2 = 8(x-5)$

C)  $(y-1)^2 = 8(x-3)$

D)  $(y-1)^2 = -8(x-3)$

E)  $(y-1)^2 = -4(x-5)$

Correct Answer : Option A

115. The eccentricity of the ellipse  $px^2 + 5y^2 = 80$ , where  $p > 5$ , is  $\frac{\sqrt{3}}{2}$ . Then the value of  $p$  is equal to
- A)  $\frac{5}{8}$
  - B) 16
  - C)  $\frac{5}{4}$
  - D) 20
  - E) 25

Correct Answer : Option D

116. For an ellipse the foci are  $F(3,0)$  and  $F'(-3,0)$ . If the length of the minor axis is 8, then the length of the major axis is equal to
- A) 16
  - B) 15
  - C) 14
  - D) 12
  - E) 10

Correct Answer : Option E

117. If  $(a, -6)$  lies on the perpendicular bisector of the line segment joining  $(-2, -1)$  and  $(4, -13)$ , then the value of  $a$  is equal to
- A) 1
  - B) -2
  - C) 2
  - D) -3
  - E) 3

Correct Answer : Option E

118. If  $(3, 2)$  and  $(5, 6)$  are end points of a diameter of a circle, then the equation of the circle is
- A)  $x^2 + y^2 - 6x + 4y + 3 = 0$
  - B)  $x^2 + y^2 - 8x - 4y + 3 = 0$
  - C)  $x^2 + y^2 - 8x - 4y - 3 = 0$
  - D)  $x^2 + y^2 - 6x + 4y + 17 = 0$
  - E)  $x^2 + y^2 - 8x - 4y - 17 = 0$

Correct Answer : Option B

Let  $\alpha, \beta, \gamma$  be the direction cosines of a vector  $\vec{a} = x\hat{i} + y\hat{j} + z\hat{k}$ , where  $z < 0$ . If  $\alpha = \frac{-4}{\sqrt{105}}$

119.

and  $\beta = \frac{\sqrt{5}}{\sqrt{21}}$ , then  $\gamma$  is equal to

- A)  $\frac{-8}{\sqrt{105}}$
- B)  $\frac{-\sqrt{8}}{\sqrt{105}}$
- C)  $\frac{-5}{\sqrt{105}}$
- D)  $\frac{-5}{\sqrt{21}}$
- E)  $\frac{-8}{\sqrt{21}}$

Correct Answer : Option A

120. Let  $A(0, 3, -3)$ ,  $B(1, 1, 1)$  and  $C(2, 0, 3)$  be three points in space. Then the projection of  $\overline{AB}$  on  $\overline{AC}$  is equal to

- A)  $\frac{26}{7}$
- B)  $\frac{32}{7}$
- C)  $\frac{34}{7}$
- D)  $\frac{24}{7}$
- E)  $\frac{20}{7}$

Correct Answer : Option B

121. If  $\vec{a} = 5\hat{i} - 7\hat{j} + 9\hat{k}$  and  $\vec{b} = -5\hat{i} + 7\hat{j} - 9\hat{k}$ , then  $\vec{a} \cdot (\vec{a} \times \vec{b}) + (\vec{a} + \vec{b}) \cdot \hat{b}$  is equal to

- A) 50
- B) -50
- C) 49
- D) -49
- E) 0

Correct Answer : Option E

122. The line joining the points (2, 2, 2) and (6, 6, 6) meets the line  $\frac{x-1}{3} = \frac{y-2}{2} = \frac{z-5}{-1}$  at the point
- A) (1,1,1)  
 B) (2,2,2)  
 C) (3,3,3)  
 D) (4,4,4)  
 E) (6,6,6)

Correct Answer : Option D

123. The angle between the vectors  $\vec{a}$  and  $\vec{b}$  is  $\frac{\pi}{3}$ . If  $|\vec{a} \cdot \vec{b}| = 15$ , then  $|\vec{a} \times \vec{b}|^2$  is equal to
- A) 5  
 B)  $15\sqrt{3}$   
 C)  $\frac{15}{\sqrt{3}}$   
 D)  $5\sqrt{3}$   
 E) 45

Correct Answer : Option E

124. The symmetric equation of the straight line passing through the points (-1, 4, 2) and (-3, 0, 5) is
- A)  $\frac{x-1}{-2} = \frac{y+4}{-4} = \frac{z+2}{3}$   
 B)  $\frac{x+1}{2} = \frac{y-4}{4} = \frac{z-2}{5}$   
 C)  $\frac{x+1}{-2} = \frac{y-4}{-4} = \frac{z-2}{3}$   
 D)  $\frac{x-3}{-2} = \frac{y}{-4} = \frac{z+5}{3}$   
 E)  $\frac{x+1}{4} = \frac{y-4}{-4} = \frac{z-2}{3}$

Correct Answer : Option C

125. The angle between the lines  $\frac{x-1}{2} = \frac{2y+3}{4} = \frac{z+5}{-2}$  and  $\frac{x-3}{4} = \frac{y+1}{-4} = \frac{z+3}{-4}$  is equal to
- A)  $\cos^{-1}\left(\frac{1}{8}\right)$   
 B)  $\cos^{-1}\left(\frac{1}{3}\right)$

- C)  $\cos^{-1}\left(\frac{1}{4}\right)$
- D)  $\cos^{-1}\left(\frac{1}{12}\right)$
- E)  $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

**Correct Answer :** Option B

**126.** If the function  $f(x) = \begin{cases} x^2, & \text{for } x < 4 \\ 5x - k, & \text{for } x \geq 4 \end{cases}$  is continuous at  $x = 4$ , then the value of  $k$  is equal to

- A) 2
- B) 3
- C) 4
- D) 5
- E) 6

**Correct Answer :** Option C

**127.** If  $f(x) = \sqrt[3]{x^2} + \sqrt{x}$ , then the value of  $f'(64)$  is equal to

- A)  $\frac{11}{48}$
- B)  $\frac{9}{48}$
- C)  $\frac{7}{48}$
- D)  $\frac{5}{48}$
- E)  $\frac{1}{16}$

**Correct Answer :** Option A

**128.** Ice is coated uniformly around a sphere of radius 15cm. If ice is melting at the rate of  $80 \text{ cm}^3 / \text{min}$  when the thickness is 5cm, then the rate of change of thickness of ice is

- A)  $\frac{1}{10\pi} \text{ cm / min}$
- B)  $\frac{1}{50\pi} \text{ cm / min}$
- C)  $\frac{1}{80\pi} \text{ cm / min}$



D)  $\frac{1}{40\pi}$  cm / min

E)  $\frac{1}{20\pi}$  cm / min

Correct Answer : Option E

129.  $\int \frac{e^x}{2^x} dx =$

A)  $\frac{e^x}{(\log_e 2)2^x} + C$

B)  $\frac{e^x}{2(2^x)} + C$

C)  $\frac{2}{e} \left( \frac{e}{2} \right)^{x-1} + C$

D)  $\frac{e^x}{(1 - \log_e 2)2^x} + C$

E)  $\frac{e^x}{2^x} + C$

Correct Answer : Option D

130. The area bounded by the parabola  $y = x^2 + 4$  and the straight line passing through the points  $(-1, 2)$  and  $(1, 6)$  is (in square units)

A)  $\frac{20}{3}$

B)  $\frac{4}{3}$

C)  $\frac{8}{3}$

D)  $\frac{16}{3}$

E)  $\frac{14}{3}$

Correct Answer : Option B

131. Let  $g(x) = 4x + 3$  and  $f(g(x)) = x^2 + 9$ . Then the value of  $f(7)$  is equal to

A) 7

B) 9

C) 10

D) 12

E) 14

Correct Answer : Option C

132. The range of the function  $f(x) = 7 \cos(10x + 4\pi)$  is

- A)  $[-1, 1]$
- B)  $[-4\pi, 4\pi]$
- C)  $[-10, 10]$
- D)  $[-7, 7]$
- E)  $[-2\pi, 2\pi]$

Correct Answer : Option D

133. Let  $f(x) = \log_e \left( \frac{x^2 + 30}{11x} \right)$ ,  $x \in [5, 6]$ . Then the point  $c \in (5, 6)$  at which  $f'(c) = 0$  is

- A)  $\sqrt{30}$
- B)  $4\sqrt{2}$
- C)  $2\sqrt{7}$
- D)  $\sqrt{35}$
- E)  $\sqrt{26}$

Correct Answer : Option A

134. Let  $f(x) = ax^3 + bx^2 + cx + d$ . If  $f$  has a local maximum value 21 at  $x = -1$  and a local minimum value 7 at  $x = 1$ , then  $f(0)$  is equal to

- A) 10
- B) 11
- C) 12
- D) 13
- E) 14

Correct Answer : Option E

135. The value of  $\int_{-2}^2 x|x| dx$  is equal to

- A)  $\frac{1}{8}$
- B)  $\frac{1}{4}$

C)  $\frac{-1}{4}$

D)  $\frac{-1}{8}$

E) 0

Correct Answer : Option E

136.  $\int x^5 e^{x^3} dx =$

A)  $\frac{e^{x^3}}{3}(x^3 - 1) + C$

B)  $\frac{e^{x^3}}{5}(x^5 - 1) + C$

C)  $\frac{e^{x^3}}{4}(x^4 - 1) + C$

D)  $\frac{e^{x^3}}{3}(x^5 - 1) + C$

E)  $\frac{x^3 e^{x^3}}{3} + C$

Correct Answer : Option A

137.  $\lim_{x \rightarrow 6} \frac{\sqrt{x^2 + 13} - 7}{x^2 - 36} =$

A)  $\frac{1}{7}$

B)  $\frac{1}{13}$

C)  $\frac{13}{36}$

D)  $\frac{1}{14}$

E)  $\frac{1}{36}$

Correct Answer : Option D

138. If  $x^4 + 2\sqrt{y+1} = 3$ , then  $\frac{dy}{dx}$  at (1, 0) is equal to

A) 4

B) 2

- C) -4
- D) -2
- E)  $\frac{-1}{8}$

Correct Answer : Option C

139. If  $\lim_{x \rightarrow 9} f(x) = 6$  and  $\lim_{x \rightarrow 9} g(x) = 3$ , then  $\lim_{x \rightarrow 9} \frac{f(x) - 2g(x)}{g(x)} =$

- A) 2
- B) -2
- C)  $\frac{1}{3}$
- D)  $\frac{-1}{3}$
- E) 0

Correct Answer : Option E

140. For the curve  $y = \alpha x^2 + \cos y + \beta$ , the value of  $\frac{dy}{dx}$  at (1, 0) is 2. Then the value of  $\alpha\beta$  is equal to

- A) 1
- B) -1
- C) 2
- D) -2
- E) 0

Correct Answer : Option D

141.  $\lim_{x \rightarrow 4} \left( \frac{1}{x-4} - \frac{5}{x^2 - 3x - 4} \right) =$

- A)  $\frac{1}{4}$
- B)  $\frac{1}{5}$
- C)  $\frac{1}{3}$
- D)  $\frac{1}{2}$
- E) 1

Correct Answer : Option B

142. If  $y = \log_e \left( \frac{1+2x^2}{1-3x^2} \right)$ , then  $\frac{dy}{dx} =$

- A)  $\frac{10x}{1-x^2-6x^4}$
- B)  $\frac{12x^3}{1-x^2-6x^4}$
- C)  $\frac{10x}{1-6x^4}$
- D)  $\frac{-10x}{1-x^2-6x^4}$
- E)  $\frac{-12x^3}{1-x^2-6x^4}$

Correct Answer : Option A

143. Let  $\alpha$  and  $\beta$  be real numbers such that  $f(x) = \begin{cases} 2x^2 + 4x + \alpha, & \text{if } x < 1 \\ \beta x^2 + 5, & \text{if } x \geq 1 \end{cases}$  is differentiable

at  $x=1$ . Then  $\alpha + \beta$  is equal to

- A) 5
- B) 6
- C) 7
- D) 8
- E) 9

Correct Answer : Option C

144. If  $f(x) = x^2 + 2xf'(1) + f''(2)$  for all  $x$ , then  $f(0)$  is equal to

- A) 4
- B) 3
- C) 2
- D) 1
- E) 0

Correct Answer : Option C

145. The function  $f(x) = 6x^4 - 3x^2 - 5$  is increasing in the set

- A)  $\left( -\infty, \frac{-1}{2} \right) \cup \left( \frac{1}{2}, 1 \right)$
- B)  $\left( \frac{-1}{2}, 0 \right) \cup \left( \frac{1}{2}, \infty \right)$

- C)  $\left(\frac{-1}{2}, \frac{1}{2}\right)$
- D)  $\left(-\infty, \frac{1}{2}\right)$
- E)  $\left(-\infty, \frac{-1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$

Correct Answer : Option B

146. The general solution of the differential equation  $2y \tan x + \frac{dy}{dx} = 5 \sin x$  is

- A)  $y = 5 \sec x + C \sec^2 x$
- B)  $y = 5 + C \cos x$
- C)  $y = 5 \cos x + C$
- D)  $y = 5 \cos x + C \cos^2 x$
- E)  $y = 5 \sec^2 x + C \sec x$

Correct Answer : Option D

147.  $\int \frac{\sin \theta \sin 2\theta}{1 - \cos 2\theta} d\theta =$

- A)  $1 + \cos \theta + C$
- B)  $1 + \sin \theta + C$
- C)  $\sin \theta + C$
- D)  $1 + \cos 2\theta + C$
- E)  $1 + \sin 2\theta + C$

Correct Answer : Option C

148.  $\int \frac{6x^3 + 9x^2}{x^4 + 3x^3 - 9x^2} dx =$

- A)  $3x \log|x^2 + 3x - 9| + C$
- B)  $6x \log|x^2 + 3x - 9| + C$
- C)  $6 \log|x^2 + 3x - 9| + C$
- D)  $x \log|x^2 + 3x - 9| + C$
- E)  $3 \log|x^2 + 3x - 9| + C$

Correct Answer : Option E

149. The value of  $\int_0^3 |x-2| dx$  is equal to

- A)  $\frac{2}{3}$
- B)  $\frac{3}{2}$
- C)  $\frac{5}{2}$
- D)  $\frac{2}{5}$
- E)  $\frac{9}{2}$

Correct Answer : Option C

The integrating factor of the differential equation  $(3 \sin x \cos x) dy = (1 + 3y \sin^2 x) dx$ , where

150.  $0 < x < \frac{\pi}{2}$ , is

- A)  $\sec x$
- B)  $\sin x$
- C)  $\tan x$
- D)  $\cos x$
- E)  $\cot x$

Correct Answer : Option D