Question paper id : QP_1

Physics

Section A

1. **A particle moves along the x-axis according to the equation *x(t)=5t2−4t+1x(t) = 5t^2 - 4t + 1*x(t)=5t2−4t+1. What is the acceleration of the particle at *t=3t = 3*t=3 seconds?**

A) 10 m/s²

B) 6 m/s²

C) 10 m/s²

D) 2 m/s²

2. **A block of mass 2 kg is placed on a friction less inclined plane making an angle of 30° with the horizontal. What is the acceleration of the block down the plane? (Take *g=10g = 10*g=10 m/s²)**

A) 5 m/s²

B) 10 m/s²

C) 8.66 m/s²

D) 2.5 m/s²

3. **Which of the following statements is true for an object in uniform circular motion?**

A) The velocity is constant.

B) The acceleration is zero.

C) The speed is constant, but velocity changes.

D) Both speed and velocity are constant.

4. **A parallel plate capacitor is connected to a battery. If the plate separation is doubled while keeping the voltage constant, what happens to the capacitance?**

A) It doubles.

B) It halves.

C) It remains the same.

D) It quadruples.

5. **Light of wavelength 500 nm falls on a slit of width *1×10−61 ¥times 10^{-6}*1×10−6 m. What is the angular width of the central maximum in the diffraction pattern?**

A) 0.5 radians

B) 1 radian

C) 0.25 radians

D) 0.1 radians

6. **A current of 5 A flows through a conductor for 2 minutes. How much charge passes through the conductor?**

A) 600 C

B) 10 C

C) 150 C

D) 1000 C

7. **The dimensional formula for Planck's constant is:**

A) *[ML2T−1][ML^2T^{-1}]*[ML2T−1]

B) *[ML2T−2][ML^2T^{-2}]*[ML2T−2]

C) *[MLT−1][MLT^{-1}]*[MLT−1]

D) *[MT−2][MT^{-2}]*[MT−2]

8. **Two waves of frequencies 250 Hz and 255 Hz superimpose. What is the beat frequency?**

A) 5 Hz

B) 505 Hz

C) 2 Hz

D) 250 Hz

9. **The escape velocity from the surface of Earth is approximately 11.2 km/s. What would be the escape velocity from a planet having twice the mass and twice the radius of Earth?**

A) 11.2 km/s

B) 22.4 km/s

C) 15.8 km/s

D) 7.9 km/s

10. **In a thermodynamic process, the pressure of an ideal gas is inversely proportional to the square of volume. The work done when the volume changes from *V1V_1*V1 to *V2V_2*V2 is proportional to:**

A) *V2−V1V_2 - V_1*V2 −V1

B) *1V1−1V2¥dfrac{1}{V_1} - ¥dfrac{1}{V_2}*V1 1 −V2 1

C) *V12−V22V_1^2 - V_2^2*V12 −V22

D) *lnf(V2V1)¥ln ¥left(¥dfrac{V_2}{V_1} ¥right)*ln(V1 V2)

11. **A wire of length L and cross-sectional area A has a resistance R. If the length is doubled and cross-sectional area is halved, the new resistance will be:**

A) 2R

B) 4R

C) 8R

D) R

12. Which of the following materials is diamagnetic?

A) Copper

B) Aluminum

C) Iron

D) Nickel

13. In Young's double-slit experiment, if the wavelength of light is increased, the fringe width will:

A) Increase

B) Decrease

C) Remain the same

D) Become zero

14. The energy stored in a stretched spring is an example of:

A) Kinetic energy

B) Potential energy

C) Thermal energy

D) Chemical energy

15. According to Einstein's photoelectric equation, the kinetic energy of emitted electrons is directly proportional to:

A) Frequency of incident light

B) Intensity of incident light

C) Wavelength of incident light

D) Square of frequency of incident light

16. **A transformer has 500 turns in the primary coil and 10 turns in the secondary coil. If the input voltage is 240 V, the output voltage is:**

A) 12 V

B) 24 V

C) 4.8 V

D) 120 V

17. **The half-life of a radioactive substance is 10 days. After how many days will only one-eighth of the original sample remain?**

A) 30 days

B) 20 days

C) 40 days

D) 80 days

18. **Which law states that the total flux through a closed surface is equal to *1є0¥dfrac{1}{¥epsilon_0}*є0 1 times the charge enclosed?**

A) Coulomb's Law

B) Ampère's Law

C) Gauss's Law

D) Faraday's Law

19. **An object is placed between the pole and focus of a concave mirror. The image formed is:**

A) Real, inverted, and enlarged

B) Virtual, upright, and enlarged

C) Real, inverted, and diminished

D) Virtual, upright, and diminished

20. A gas expands from volume *V1V_1*V1 to *V2V_2*V2 at constant temperature T. The work done by the gas is:

A) *nRTln⁡(V2V1)nRT ¥ln ¥left(¥dfrac{V_2}{V_1} ¥right)*nRTln(V1 V2)

B) *nR(V2−V1)nR(V_2 - V_1)*nR(V2 −V1)

C) *12nR(T22−T12)¥dfrac{1}{2} nR(T_2^2 - T_1^2)*21 nR(T22 −T12)

D) Zero

21. Which of the following is a scalar quantity?

A) Electric field

B) Magnetic moment

C) Work

D) Torque

22. The fundamental frequency of an open organ pipe is 300 Hz. What is the frequency of the first overtone?

A) 600 Hz

B) 900 Hz

C) 300 Hz

D) 150 Hz

23. The potential energy of a system increases if work is done:

A) By the system against conservative forces

B) On the system by conservative forces

C) By the system against non-conservative forces

D) On the system by non-conservative forces

24. **A charged particle moves in a magnetic field in a circular path of radius r. The radius of the path increases if:**

A) The magnetic field increases

B) The charge of the particle increases

C) The velocity of the particle increases

D) The mass of the particle decreases

25. **Which phenomenon demonstrates the particle nature of light?**

A) Interference

B) Diffraction

C) Photoelectric effect

D) Polarization

26. **The moment of inertia of a solid sphere about an axis passing through its center is:**

A) *25MR2¥dfrac{2}{5} MR^2*52 MR2

B) *12MR2¥dfrac{1}{2} MR^2*21 MR2

C) *23MR2¥dfrac{2}{3} MR^2*32 MR2

D) *MR2MR^2*MR2

27. **Which of the following statements is true for stationary waves?**

A) Energy is propagated along the wave

B) All particles have the same amplitude

C) There are nodes and antinodes at fixed positions

D) The frequency varies along the medium

28. In a PN junction diode under reverse bias, the current is due to:

A) Majority carriers

B) Minority carriers

C) Both majority and minority carriers

D) Holes only

29. The de Broglie wavelength of a particle is inversely proportional to:

A) Its velocity

B) Its mass

C) Its momentum

D) The square of its velocity

30. Which of the following is NOT a property of electromagnetic waves?

A) They are transverse waves

B) They require a medium to propagate

C) They can exhibit interference and diffraction

D) Their speed in vacuum is *3×1083 ¥times 10^8*3×108 m/s

Chemistry

Section B

31. Which of the following elements has the highest first ionization energy?

A) Sodium

B) Magnesium

C) Aluminum

D) Phosphorus

32. What is the hybridization of the central atom in *SF6¥text{SF}_6*SF6 ?

A) sp^3

B) sp^3d

C) sp^3d^2

D) sp^2

33. In the reaction *2SO2+O2↔2SO3¥text{2SO}_2 + ¥text{O}_2 ¥leftrightarrow ¥text{2SO}_3*2SO2 +O2 ↔2SO3 , the equilibrium shifts to the right when:

A) Pressure is decreased

B) Temperature is increased

C) SO_3 is removed

D) An inert gas is added at constant volume

34. Which of the following is not a colligative property?

A) Boiling point elevation

B) Freezing point depression

C) Osmotic pressure

D) Viscosity

35. The IUPAC name of the compound CH_3-CH_2-C≡CH is:

A) But-1-yne

B) But-2-yne

C) Pent-1-yne

D) Propyne

36. Which of the following oxides is amphoteric?

A) Na_2O
B) Al_2O_3
C) SO_2
D) CO_2

37. What is the oxidation state of chromium in *K2Cr2O7¥text{K}_2¥text{Cr}_2¥text{O}_7*K2 Cr2 O7 ?

A) +3
B) +6
C) +2
D) +7

38. Which gas is released when zinc reacts with dilute hydrochloric acid?

A) Oxygen
B) Hydrogen
C) Nitrogen
D) Chlorine

39. The rate constant of a reaction depends on:

A) Temperature
B) Concentration
C) Pressure
D) Volume

40. Which of the following statements is true for ideal solutions?

A) They obey Raoult's Law over the entire range of concentration
B) They have positive deviations from Raoult's Law
C) They have negative deviations from Raoult's Law
D) Their enthalpy of mixing is not zero

41. Which of the following is a weak electrolyte?

A) NaCl
B) HCl
C) CH_3COOH
D) KOH

42. In the periodic table, the element with atomic number 17 belongs to:

A) Alkali metals
B) Alkaline earth metals
C) Halogens
D) Noble gases

43. Which of the following represents the correct order of decreasing atomic radius?

A) Na > K > Rb
B) Rb > K > Na
C) K > Rb > Na
D) Na > Rb > K

44. What is the geometry of *BF3¥text{BF}_3*BF3 molecule?

A) Tetrahedral
B) Trigonal planar
C) Linear
D) Pyramidal

45. The bond order of O_2 molecule is:

A) 1
B) 2
C) 3
D) 1.5

46. Which of the following compounds will have the highest boiling point?

A) CH_3OH
B) CH_4
C) C_2H_6
D) C_2H_5OH

47. In which of the following reactions is the entropy expected to decrease?

A) *N2(g)+3H2(g)→2NH3(g)¥text{N}_2(g) + 3¥text{H}_2(g) ¥rightarrow 2¥text{NH}_3(g)*N2 (g)+3H2 (g)→2NH3 (g)
B) *CaCO3(s)→CaO(s)+CO2(g)¥text{CaCO}_3(s) ¥rightarrow ¥text{CaO}(s) + ¥text{CO}_2(g)*CaCO3 (s)→CaO(s)+CO2 (g)
C) *H2O(s)→H2O(l)¥text{H}_2O(s) ¥rightarrow ¥text{H}_2O(l)*H2 O(s)→H2 O(l)
D) *C6H12O6(s)→2C2H5OH(l)+2CO2(g)¥text{C}_6¥text{H}_{12}O_6(s) ¥rightarrow 2¥text{C}_2¥text{H}_5¥text{OH}(l) + 2¥text{CO}_2(g)*C6 H12 O6 (s)→2C2 H5 OH(l)+2CO2 (g)

48. Which of the following is an example of homogeneous catalysis?

A) Hydrogenation of oils using finely divided nickel
B) Decomposition of hydrogen peroxide using manganese dioxide
C) Oxidation of sulfur dioxide in the presence of nitric oxide
D) Synthesis of ammonia using iron catalyst

49. Which of the following is not a greenhouse gas?

A) Carbon dioxide
B) Methane
C) Nitrous oxide
D) Nitrogen

50. The standard electrode potential of zinc is -0.76 V. This means that zinc:

A) Is a good oxidizing agent
B) Is a good reducing agent
C) Cannot be oxidized
D) Cannot be reduced

51. Which of the following statements is correct about d-block elements?

A) They show variable oxidation states
B) They are all non-metals
C) They do not form colored compounds
D) They are poor conductors of electricity

52. Which of the following is an example of a nucleophile?

A) *BF3¥text{BF}_3*BF3
B) *AlCl3¥text{AlCl}_3*AlCl3
C) *NH3¥text{NH}_3*NH3
D) *NO2+¥text{NO}_2^+*NO2+

53. Which compound gives a positive Tollen's test?

A) Acetone
B) Benzaldehyde
C) Ethanol
D) Acetic acid

54. Which of the following is an essential amino acid?

A) Glycine
B) Alanine
C) Valine
D) Serine

55. The main constituent of natural rubber is:

A) Isobutylene
B) Chloroprene
C) Isoprene
D) Styrene

56. Which of the following vitamins is water-soluble?

A) Vitamin A
B) Vitamin D
C) Vitamin C
D) Vitamin K

57. Which of the following is not a property of colloidal solutions?

A) Tyndall effect
B) Brownian movement
C) Electrostatic stabilization
D) High rate of diffusion

58. The order of a reaction can be determined by:

A) Balanced chemical equation
B) Rate law
C) Stoichiometry
D) Molecularity

59. Which of the following ions will show the maximum flocculation value for a negatively charged sol?

A) Al^{3+}
B) Na^{+}
C) Ba^{2+}
D) Mg^{2+}

60. Which of the following is a chain-growth polymer?

A) Nylon-6,6
B) Bakelite
C) Polyethylene
D) Starch

Mathematics

Section C

61. Evaluate *∫(2x3−3x2+x−5) dx¥int (2x^3 - 3x^2 + x - 5) ¥, dx*∫(2x3−3x2+x−5)dx.

A) *12x4−x3+12x2−5x+C¥dfrac{1}{2}x^4 - x^3 + ¥dfrac{1}{2}x^2 - 5x + C*21 x4−x3+21 x2−5x+C

B) *12x4−x3+x2−5x+C¥dfrac{1}{2}x^4 - x^3 + x^2 - 5x + C*21 x4−x3+x2−5x+C

C) *12x4−x2+x−5x+C¥dfrac{1}{2}x^4 - x^2 + x - 5x + C*21 x4−x2+x−5x+C

D) *2x4−3x3+x2−5x+C2x^4 - 3x^3 + x^2 - 5x + C*2x4−3x3+x2−5x+C

62. Find the value of *limf⁡x→0sinf⁡5xx¥lim_{x ¥to 0} ¥dfrac{¥sin 5x}{x}*limx→0 xsin5x .

A) 0

B) 1

C) 5

D) Does not exist

63. If the circles *x2+y2=r2x^2 + y^2 = r^2*x2+y2=r2 and *(x−a)2+y2=r2(x - a)^2 + y^2 = r^2*(x−a)2+y2=r2 touch externally, then the value of *aa*a is:

A) *2r2r*2r

B) *rrr*

C) *r2¥dfrac{r}{2}*2r

D) *2r¥sqrt{2}r*2 r

64. Find the sum of the first *nn*n terms of the series *2+5+8+11+…2 + 5 + 8 + 11 + ¥ldots*2+5+8+11+….

A) *n(3n+1)n(3n + 1)*n(3n+1)

B) *n2(4n−1)¥dfrac{n}{2}(4n - 1)*2n (4n−1)

C) *n2(3n+1)¥dfrac{n}{2}(3n + 1)*2n (3n+1)

D) *n(2n+1)n(2n + 1)*n(2n+1)

65. Solve the differential equation *dydx=ytanf(x)¥dfrac{dy}{dx} = y ¥tan x*dxdy =ytanx.

A) *y=Ccosf(x)y = C ¥cos x*y=Ccosx

B) *y=Csinf(x)y = C ¥sin x*y=Csinx

C) *y=Csecf(x)y = C ¥sec x*y=Csecx

D) *y=C⋅ secf(x)y = C ¥cdot ¥sec x*y=C⋅ secx

66. If the sum of the roots of the quadratic equation *ax2+bx+c=0ax^2 + bx + c = 0*ax2+bx+c=0 is equal to the sum of their squares, then:

A) *b=a+cb = a + c*b=a+c
B) *b2=4acb^2 = 4ac*b2=4ac
C) *b=−a−cb = -a - c*b=−a−c
D) *b=0b = 0*b=0

67. Determine the nature of the function *f(x)=e2xf(x) = e^{2x}*f(x)=e2x.

A) Increasing for all real x
B) Decreasing for all real x
C) Constant
D) None of the above

68. If *ϑ¥theta*θ is an acute angle and *sinf(θ)=35¥sin ¥theta = ¥dfrac{3}{5}*sinθ=53 , find *cosf(θ)¥cos ¥theta*cosθ.

A) *45¥dfrac{4}{5}*54
B) *35¥dfrac{3}{5}*53
C) *53¥dfrac{5}{3}*35
D) *54¥dfrac{5}{4}*45

69. **Calculate the distance between the points *(acosϑ,asinϑ)(a ¥cos ¥theta, a ¥sin ¥theta)*(acosθ,asinθ) and *(acosϕ,asinϕ)(a ¥cos ¥phi, a ¥sin ¥phi)*(acosϕ,asinϕ) on the circle *x2+y2=a2x^2 + y^2 = a^2*x2+y2=a2.**

A) *2asin(ϑ−ϕ2)2a ¥sin ¥left(¥dfrac{¥theta - ¥phi}{2} ¥right)*2asin(2θ−ϕ)
B) *2acos(ϑ−ϕ2)2a ¥cos ¥left(¥dfrac{¥theta - ¥phi}{2} ¥right)*2acos(2θ−ϕ)
C) *a(ϑ−ϕ)a (¥theta - ¥phi)*a(θ−ϕ)
D) *2asin(ϑ−ϕ)2a ¥sin (¥theta - ¥phi)*2asin(θ−ϕ)

70. **If the determinant of a 2×2 matrix *(abcd)¥begin{pmatrix} a & b ¥¥ c & d ¥end{pmatrix}*(ac bd) is zero, then:**

A) *ad=bcad = bc*ad=bc
B) *a=da = d*a=d
C) *b=cb = c*b=c
D) *a+d=0a + d = 0*a+d=0

71. **Evaluate *∫0πsinx dx¥int_{0}^{¥pi} ¥sin x ¥, dx*∫0π sinxdx.**

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

72. **Find the eccentricity of a parabola.**

A) 0
B) 1
C) Greater than 1
D) Less than 1

73. **If the lines *y=m1x+cy = m_1x + c*y=m1 x+c and *y=m2x+cy = m_2x + c*y=m2 x+c are perpendicular, then the product *m1m2m_1 m_2*m1 m2 is:**

A) 0
B) 1
C) -1
D) Undefined

74. Determine the number of ways to arrange the letters of the word "MATHEMATICS".

A) 11!
B) *11!2!2!2!¥dfrac{11!}{2!2!2!}*2!2!2!11!
C) *11!2!¥dfrac{11!}{2!}*2!11!
D) *11!2!2!¥dfrac{11!}{2!2!}*2!2!11!

75. Solve the inequality ｜*x–3*｜ *<5|x - 3| < 5* ｜x–3｜<5.

A) *−2<x<8-2 < x < 8*−2<x<8
B) *−8<x<2-8 < x < 2*−8<x<2
C) *−5<x<5-5 < x < 5*−5<x<5
D) *3<x<53 < x < 5*3<x<5

76. If *y=lnfx¥y = ¥ln x*y=lnx, find *dydx¥dfrac{dy}{dx}*dxdy .

A) *1x¥dfrac{1}{x}*x1
B) *xx*x
C) *exe^x*ex
D) *lnfx¥ln x*lnx

77. Identify which of the following sequences represents an arithmetic progression (AP).

A) 2, 4, 8, 16, ...
B) 3, 6, 9, 12, ...
C) 1, 2, 4, 7, ...
D) 2, 3, 5, 8, …

78. Express *cosf2θ¥cos 2¥theta*cos2θ in terms of *sinfθ¥sin ¥theta*sinθ.

A) *1−2sinf2θ1 - 2¥sin^2 ¥theta*1−2sin2θ
B) *2sinf2θ−12¥sin^2 ¥theta - 1*2sin2θ−1
C) *2sinfθcosfθ2¥sin ¥theta ¥cos ¥theta*2sinθcosθ
D) *1sinfθ¥dfrac{1}{¥sin ¥theta}*sinθ1

79. Write the equation of the circle with center at (h, k) and radius r.

A) *(x+h)2+(y+k)2=r2(x + h)^2 + (y + k)^2 = r^2*(x+h)2+(y+k)2=r2
B) *(x−h)2+(y−k)2=r2(x - h)^2 + (y - k)^2 = r^2*(x−h)2+(y−k)2=r2
C) *x2+y2=r2x^2 + y^2 = r^2*x2+y2=r2
D) *(x−h)2+(y+k)2=r2(x - h)^2 + (y + k)^2 = r^2*(x−h)2+(y+k)2=r2

80. If the mean of the numbers 2, 4, x, 8, 10 is 6, find x.

A) 6
B) 4
C) 8
D) 10

81. Find the minimum value of the function *f(x)=x2−4x+3f(x) = x^2 - 4x + 3*f(x)=x2−4x+3.

A) 0
B) -1
C) 1
D) 4

***82.* Calculate the sum of the infinite geometric series *3+2+43+89+…3 + 2 + ¥dfrac{4}{3} + ¥dfrac{8}{9} + ¥ldots*3+2+34 +98 +….**

A) 9
B) 8
C) 6
D) 15

83. If *log⁡ab=c¥log_a b = c*loga b=c, express b in terms of a and c.

A) *aca^c*ac
B) *cac^a*ca
C) *ac¥dfrac{a}{c}*ca
D) *log⁡ac¥log_a c*loga c

84. Find the derivative of *sin⁡−1x¥sin^{-1} x*sin−1x with respect to x.

A) *11−x2¥dfrac{1}{¥sqrt{1 - x^2}}*1−x2 1
B) *11+x2¥dfrac{1}{1 + x^2}*1+x21
C) *1−x2¥sqrt{1 - x^2}*1−x2
D) *1x¥dfrac{1}{x}*x1

85. Determine the area under the curve *y=xy = x*y=x from x = 0 to x = 2.

A) 1
B) 2
C) 2
D) 4

86. If the matrix *A=(1234)A = ¥begin{pmatrix} 1 & 2 ¥¥ 3 & 4 ¥end{pmatrix}*A=(13 24), find the transpose *ATA^T*AT.

A) *(1234)¥begin{pmatrix} 1 & 2 ¥¥ 3 & 4 ¥end{pmatrix}*(13 24)
B) *(1324)¥begin{pmatrix} 1 & 3 ¥¥ 2 & 4 ¥end{pmatrix}*(12 34)
C) *(4321)¥begin{pmatrix} 4 & 3 ¥¥ 2 & 1 ¥end{pmatrix}*(42 31)
D) *(2143)¥begin{pmatrix} 2 & 1 ¥¥ 4 & 3 ¥end{pmatrix}*(24 13)

87. Compute the value of *tanf⁡45∘ ¥tan 45^¥circ*tan45∘ .

A) 0
B) 1
C) *3¥sqrt{3}*3
D) Undefined

88. Find the x-coordinate where the function *f(x)=x3−3x+1f(x) = x^3 - 3x + 1*f(x)=x3−3x+1 has a local maximum.

A) 0
B) 1
C) -1
D) 3

89. Solve for x in the equation *e2x=7e^{2x} = 7*e2x=7.

A) *x=lnf⁡2x = ¥dfrac{¥ln 7}{2}*x=2ln7
B) *x=2lnf⁡x = 2¥ln 7*x=2ln7
C) *x=lnf⁡x = ¥ln 7*x=ln7
D) *x=72x = ¥dfrac{7}{2}*x=27

90. Evaluate *∫e3xdx¥int e^{3x} dx*∫e3xdx.

A) *3e3x+C3e^{3x} + C*3e3x+C
B) *13e3x+C¥dfrac{1}{3} e^{3x} + C*31 e3x+C
C) *e3x+Ce^{3x} + C*e3x+C
D) *ex+Ce^{x} + C*ex+C