高雄醫學大學 109 學年度學士後醫學系招生考試試題

科目:物理及化學　　考試時間: 100 分鐘

說明:一、選擇題用 2B 鉛筆在「答案卡」上作答，修正時應以橡皮擦擦拭，不得使用修正液(帶)，未遵照正確作答方法而致電腦無法判讀者，考生自行負責。
二、試題及答案卡必須繳回，不得攜出試場。

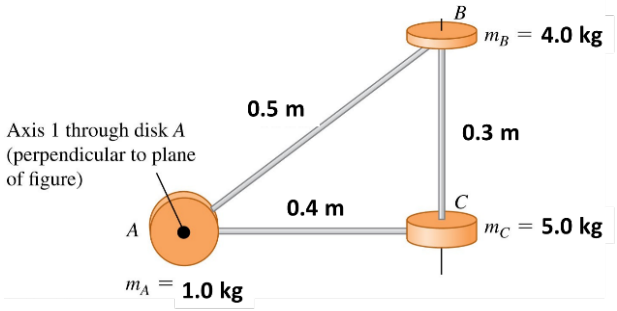
Choose one best answer for the following questions

【單選題】每題 1 分，共計 30 分，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
1~15 題為物理，16~30 題為化學。

1. Consider the block and spring system shown in the drawing. On the earth's surface the natural frequency is ω. The system is then transported into moon's surface (Gravitational acceleration: $g_{Moon} = g_{Earth}/6$). How will the natural frequency of the system change?

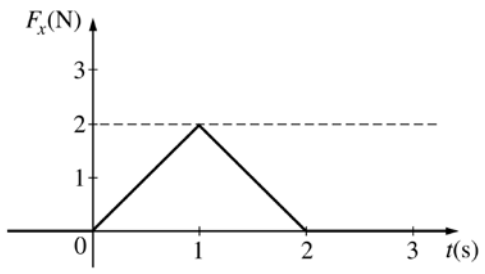
(A) 6ω　(B) $\sqrt{6}\,\omega$　(C) ω/6
(D) $\omega/\sqrt{6}$　(E) The frequency doesn't change.

2. What is this body's moment of inertia ***I*** about axis through disk *A*?



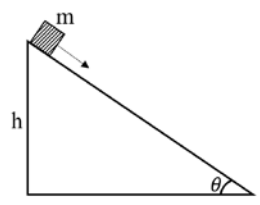
(A) 1.8 kg · m　(B) 1.8 kg · m^2　(C) 4.0 kg · m　(D) 4.0 kg · m^2　(E) 5.0 kg · m^2

3. The figure shows a plot of the time-dependent force $F_x(t)$ acting on a particle in motion along the x-axis. What is the total impulse delivered to the particle?



(A) 0 kg · m/s　(B) 1 kg · m/s　(C) 2 kg · m/s　(D) 3 kg · m/s　(E) 4 kg · m/s

4. A block of mass m sliding down an incline at constant speed is initially at a height h above the ground, as shown in the figure. The coefficient of kinetic friction between the mass and the incline is ***μ***. If the mass continues to slide down the incline at a constant speed, how much energy is dissipated by friction by the time the mass reaches the bottom of the incline?



(A) mgh/μ　(B) mgh　(C) μmgh/ sin θ　(D) mgh sin θ　(E) 0

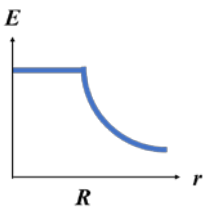
5. A baseball is thrown vertically upward and feels no air resistance. As it is rising
   (A) both its momentum and its mechanical energy are conserved.
   (B) both its momentum and its kinetic energy are conserved.
   (C) its kinetic energy is conserved, but its momentum is not conserved.
   (D) its momentum is not conserved, but its mechanical energy is conserved.
   (E) its gravitational potential energy is not conserved, buts its momentum is conserved.

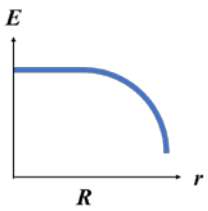
6. Which step is one of the Carnot cycle?
   (A) Isobaric compression (B) Isochoric compression (C) Isothermal compression
   (D) Isochoric expansion (E) Isobaric expansion

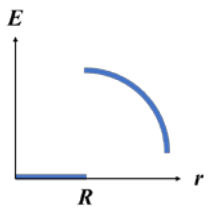
7. One surface is remained at temperature of 300 K and it's heat current in radiation is *H*. When it was heated to 600 K, what is the heat current in radiation of this surface comparing to that at 300 K?
   (A) 32*H* (B) 16*H* (C) 8*H* (D) 4*H* (E) 2*H*

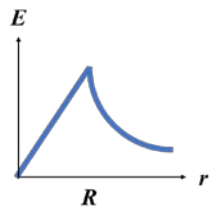
8. A conducting sphere is charged up such that the potential on its surface is 100 V (relative to infinity). If the sphere's radius were twice as large, but the charge on the sphere were the same, what would be the potential on the surface relative to infinity?
   (A) 25 V (B) 50 V (C) 100 V (D) 200 V (E) 400 V

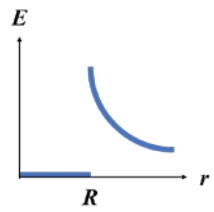
9. There is a solid insulating sphere with radius *R* and total charge *Q*. Which diagram is correct for electric field *E* at any point inside or outside the sphere?

(A) 

(B) 

(C) 

(D) 

(E) 

10. An object is placed at a distance 5.0 cm to the left of a concave mirror with a curvature radius 5.0 cm. Determine the location and magnification of the image formed by this image system.
   (A) The image is formed 2.5 cm to the right of the mirror and it has a magnification of –1/2.
   (B) The image is formed 5.0 cm to the right of the mirror and it has a magnification of –1.
   (C) The image is formed 2.5 cm to the left of the mirror and it has a magnification of 1.
   (D) The image is formed 5.0 cm to the left of the mirror and it has a magnification of –1.
   (E) The image is formed 1.25 cm to the left of the mirror and it has a magnification of –1/4.

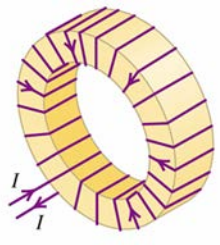
11. Soap bubble is colorful. What is the phenomenon of the colorful reflection appeared in the thin films?
   (A) Diffraction (B) Dispersion (C) Interference (D) Refraction (E) Total refraction

12. One rope with weight 2.0 kg and length 10.0 m is tied on a shelf and stretched taut by a 98 kg box at the bottom. What is the speed ***v*** of a transverse wave on the rope? (Gravitational acceleration g = 10 m/s^2)
   (A) 10.0 m/s (B) 10.7 m/s (C) 70.0 m/s (D) 70.7 m/s (E) 100.0 m/s

13. A 80 kg baseball player begins his slide into third base at speed of 5 m/s. The coefficient of friction between his clothes and ground is 0.8 to make him stopped when he reached the third base. How far does he slide?
   (A) 1.22 m (B) 1.32 m (C) 1.41 m (D) 1.50 m (E) 1.59 m

14. Given that the wavelengths of visible light range from 400 nm to 700 nm, what is the highest frequency of visible light? ($c = 3.0 \times 10^8$ m/s)
   (A) 3.1×10^8 Hz (B) 5.0×10^8 Hz (C) 4.3×10^{14} Hz (D) 7.5×10^{14} Hz (E) 2.3×10^{20} Hz

15. There is a doughnut-shaped toroidal solenoid with 200 turns of wires carrying current 0.02A. The inner radius of that is 1 m and outer radius is 5 m. What is the magnetic field ***B*** of this doughnut-shaped toroidal solenoid at the point with distance 0.5 m from center of that? (μ_0 is permeability constant)

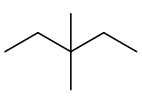
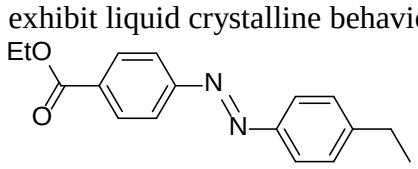


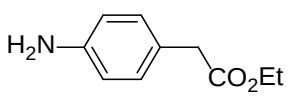
(A) 0 (B) $4\mu_0/\pi$ (C) $2\mu_0/\pi$ (D) $\mu_0/2\pi$ (E) $\mu_0/4\pi$

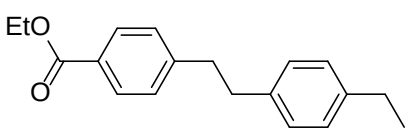
16. For 1.0 M of the following solution, which chemical gives the highest pH value?
(A) NaF (B) $Na_2S_2O_3$ (C) NH_4Cl (D) $Al(NO_3)_3$ (E) Ethanol

17. Which of the following complex is diamagnetic?
(A) $[Ni(CN)_6]^{4-}$ (B) $[Ti(CN)_6]^{3-}$ (C) $[Cr(CN)_6]^{3-}$ (D) $[Co(CN)_6]^{3-}$ (E) All of these

18. Which of the following molecule doesn't exhibit the behavior of *s*-*p* mixing of molecular orbitals?
(A) N_2 (B) B_2 (C) O_2 (D) NO (E) All of these

19. Which of the following substrate is most likely to exhibit liquid crystalline behavior?
(A) 
(B) 

(C) 

(D) 

(E) $C_{25}H_{51}OH$

20. What is the net number of tetrahedral holes contained in the close packing of spheres unit cell like face-center cubic?
(A) 8 (B) 4 (C) 12 (D) 6 (E) 3

21. Which of the following active ingredient is most commonly used in liquid bleaches (Sanitizers)?
(A) NaCl (B) NaClO (C) $NaClO_2$ (D) $NaClO_3$ (E) $NaClO_4$

22. Natural copper contains two isotopic forms. The most common isotope is ^{63}Cu (atomic mass 62.93 amu), which is 69.09% abundant. The average atomic mass of Cu is 63.55 amu. What is the mass of the other isotope?
(A) 61.90 amu (B) 63.10 amu (C) 64.93 amu (D) 65.90 amu (E) 67.10 amu

23. 0.2 g of $FeCl_3(s)$ is dissolved in 20 mL water. The pH of this aqueous solution at 25 ^oC will be
(A) pH > 7 (B) pH < 7 (C) pH = 7
(D) no effect on pH (E) this cannot be determined

24. Several possible combinations of ΔH and ΔS for a reaction are listed as below. Which of the following case is spontaneous for this reaction at all temperatures?
(A) ΔH is positive, ΔS is positive (B) ΔH is negative, ΔS is positive (C) ΔH is negative, ΔS is negative
(D) ΔH is positive, ΔS is negative (E) None of these

25. First-row transition metals play significant roles in biological system. Which of the following transition metal is a component of vitamin B_{12}?
(A) Cr (B) Zn (C) Fe (D) Cu (E) Co

26. What is the charge of NO molecule if the bond order is 2?
(A) +1 (B) –1 (C) 0 (D) +2 (E) –2

27. What is the range of wave number (cm^{-1}) for an organic molecule containing a carbonyl group in the infrared spectrum?
(A) 3610−3640 (B) 2850−3300 (C) 2100−2300 (D) 1690−1760 (E) 1080−1300

28. The complex *cis*-$Pt(NH_3)_2Cl_2$ showed high anti-tumor activity, but *trans*-$Pt(NH_3)_2Cl_2$ showed no effect on tumor therapy. These two complexes can be classified into which type of isomerism.
(A) linkage isomerism (B) optical isomerism (C) coordination isomerism
(D) ionization isomerism (E) geometric isomerism

29. The decay of strontium-90 follows a first-order process and the rate constant is 0.02406 $year^{-1}$. How much of 2 mg sample of strontium-90 remains after 144 years?
(A) 0.250 mg (B) 0.062 mg (C) 0.031 mg (D) 0.125 mg (E) 0.500 mg

30. Which compound yields the largest van't Hoff factor (*i*) when dissolved in water?
(A) NaCl (B) $MgCl_2$ (C) $MgSO_4$ (D) $FeCl_3$ (E) Glucose

【單選題】每題 2 分，共計 120 分，答錯 1 題倒扣 0.5 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。
31~60 題為物理，61~90 題為化學。

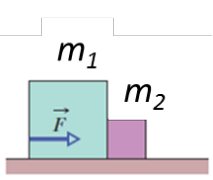
31. In a baseball game, the pitcher throw a ball (150 g) at a speed of 30.0 m/s. The batter hit it straight back with a speed of 40.0 m/s. What is the average force exerted by the bat if the bat-ball contact time is 0.005 sec?
(A) 300 N (B) 14000 N (C) 1200 N (D) 2100 N (E) 900 N

32. A bullet of mass m traveling at speed v strikes a block of mass M, initially at rest, and is embedded in it as shown below. How far will the block with the bullet embedded in it slide on a rough horizontal surface of coefficient of kinetic friction μ_k before it comes to rest?

(A) $\left(\frac{m+M}{m}\right)\left(\frac{v^2}{2\mu_k g}\right)$ (B) $\left(\frac{m+M}{M}\right)\left(\frac{v^2}{2\mu_k g}\right)$ (C) $\left(\frac{m+M}{M}\right)^2\left(\frac{v^2}{2\mu_k g}\right)$
(D) $\left(\frac{m}{m+M}\right)\left(\frac{v^2}{2\mu_k g}\right)$ (E) $\left(\frac{m}{m+M}\right)^2\left(\frac{v^2}{2\mu_k g}\right)$

33. An unusual spring has a restoring force of magnitude $F = (2.00\ \text{N/m})x + (1.00\ \text{N/m}^2)x^2$, where x is the stretch of the spring from its equilibrium length. A 3.00 kg object is attached to this spring and released from rest after stretching the spring 1.50 m. If the object slides over a frictionless horizontal surface, how fast is it moving when the spring returns to its equilibrium length?
(A) 5.84 m/s (B) 4.33 m/s (C) 2.06 m/s (D) 5.48 m/s (E) 1.50 m/s

34. Two blocks are in contact on a frictionless table. A horizontal force is applied to the larger block. F = 100 N, $m_1/m_2 = 2$. The force acting on the small block from the larger one is,

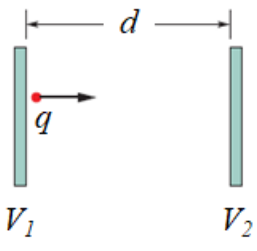


(A) 100/2 N (B) 100/3 N (C) 100/4 N (D) 100/6 N (E) 100/8 N

35. A uniform solid sphere of mass M and radius R rotates with an angular speed ω about an axis through its center. A uniform solid cylinder of mass M, radius R, and length $2R$ rotates through an axis running through the central axis of the cylinder. What must be the angular speed of the cylinder so it will have the same rotational kinetic energy as the sphere?
(A) $2\omega/5$ (B) $2\omega/\sqrt{5}$ (C) $\omega/\sqrt{5}$ (D) $\sqrt{2/5}\,\omega$ (E) $4\omega/5$

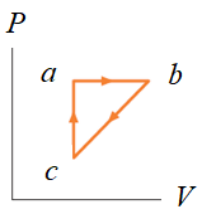
36. Two Earth satellites, A and B, of same mass m, are to be launched into circular orbits about Earth's center. Satellite A is to orbit at an altitude of Earth' radius, $h_A = R_E$. Satellite B is to orbit at an altitude of $2h_A$. The ratio of the total energy of satellite B to that of satellite A is,
(A) 1/2 (B) 2/3 (C) 2 (D) 3/2 (E) 1/4

37. A charged dust particle of mass m = 32 mg and charge value q =100 nC is releasing from plate 1 with zero speed, where V_1 = 130 V, and V_2 = –30 V. The dust particle velocity when reaching plate 2 is,



(A) 0.03 m/s (B) 0.05 m/s (C) 0.75 m/s (D) 1.00 m/s (E) 1.25 m/s

38. As a gas is held within a closed chamber, it passes through the cycle shown in the figure. Along path ab, the change in the internal energy is 3.0 J and the magnitude of the work done is 5.0 J. Along path ca, the energy transferred to the gas as heat is 2.5 J. How much the change in the internal energy along path bc?

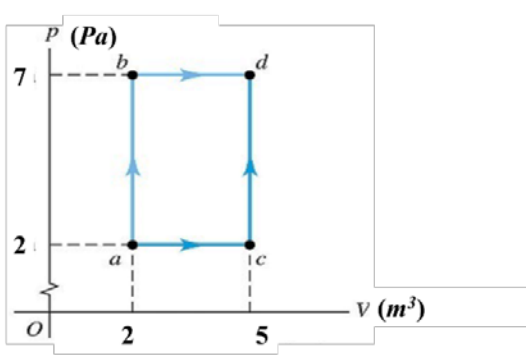


(A) +5.5 J (B) +10.5 J (C) –0.5 J (D) –10.5 J (E) –5.5 J

39. A 30.0 g bullet shoot into an ice at speed of 2.4×10^2 m/s and stay inside. Assume the kinetic energy is transfer to thermal energy, and absorbed by the ice, what is the change in entropy of the ice?

(A) 86.4 J/K (B) 27.0 J/K (C) 31.6 J/K (D) 2.7 J/K (E) 3.16 J/K

40. In process *ab*, 20 J of heat is added to the system. In process *bd*, 80 J of heat is added to the system. Find the internal energy change ΔU in process *acd*?

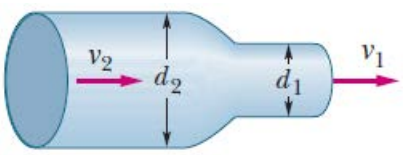


(A) 0 J (B) 20 J (C) 59 J (D) 79 J (E) 100 J

41. The density of wood, water and unknown liquid are 0.8 g/cm^3, 1.0 g/cm^3, and 1.2 g/cm^3, respectively. The volume ratio of the wood that can be seen in water and unknown liquid is

(A) 5/6 (B) 3/4 (C) 2/3 (D) 1/2 (E) 1/4

42. Water flows through a horizontal pipe and then out into the atmosphere, where $d_2/d_1 = 2$. The speed of the water at the output of the pipe is $v_1 = 10$ m/s. The desity of water is 1g/cm^3. What is the gauge pressure at the left section? (1 atm = 1.01×10^5 Pa)



(A) 4.6 atm (B) 4.8 atm (C) 5.0 atm (D) 5.2 atm (E) 5.4 atm

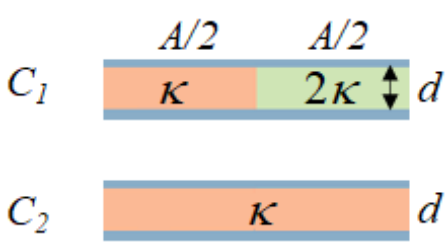
43. A patient need an intravenous drip contains a glucose solution. If the average pressure in the vein is 1.30 kPa, what is the minimum height to hang the bag in order to infuse glucose into the vein? Assume the specific gravity of the solution is 1.02.

(A) 0.13 m (B) 1.30 m (C) 0.26 m (D) 2.6 m (E) 0.52 m

44. A balloon is to be filled with helium and used to suspend a mass of 300 kg in air. If the mass of the balloon is neglected, which of the following gives the approximate volume of helium required? (The density of air is 1.29 kg/m^3 and the density of helium is 0.18 kg/m^3)

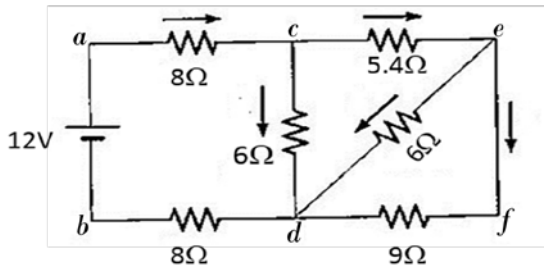
(A) 50 m^3 (B) 95 m^3 (C) 135 m^3 (D) 270 m^3 (E) 540 m^3

45. There are two parallel-plate capacitors with same plate area *A*. As the figure illustrated, C_1 is filled with two materials of dielectric constants κ and 2κ, while C_2 is filled with only one material. The capacitance ratio C_1 / C_2 is _____.



(A) 0.5 (B) 1.0 (C) 1.5 (D) 2.0 (E) 2.5

46. What is the equivalent resistance of the circuit in the figure?



(A) 8.6 Ω (B) 13.8 Ω (C) 3.6 Ω (D) 42.4 Ω (E) 19.6 Ω

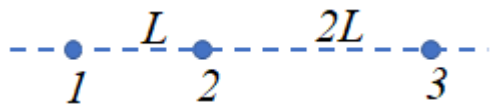
47. There is a straight current-carrying conductor with current I =10 A and length L = 2 m. What is the magnetic field $\boldsymbol{B}$ of this conductor at the distance 2 m from that? (μ_0 is permeability constant)

(A) $5\,\mu_0$ (B) $5\,\mu_0/\pi$ (C) $5\,\mu_0/2\pi$ (D) $\mu_0/2\pi$ (E) μ_0/π

48. If the displacement current in a parallel-plate capacitor (0.5 μF) is 4.0 A, at what rate is the potential difference varying across the plates?

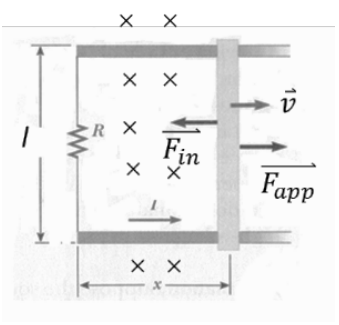
(A) 2.0×10^6 V/s (B) 8.0×10^6 V/s (C) 4.0×10^6 V/s
(D) 1.25×10^7 V/s (E) The potential difference is not varying

49. Three charge particles are situated as illustrated. Particle 1 and 2 are fixed, while particle 3 is free to move. If there is no net force on the particle 3, what is the charge ratio q_2/q_1?



(A) 2 (B) 2/3 (C) 3 (D) –2/3 (E) –2

50. The sliding bar has a length of 1.0 m, and moves at 3.0 m/s in a magnetic field of magnitude 0.5 T. This could induced motional emf. If the resistance in the circuit is 1.0 Ω, what is the power delivered to the resistor if the current goes counterclockwise around the loop?

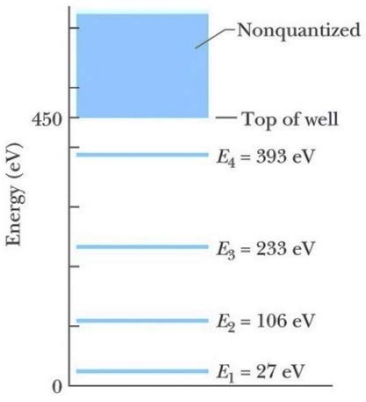


(A) 0.85 W (B) 1.35 W (C) 1.80 W (D) 2.25 W (E) 2.55 W

51. What is the critical angle when a ray passes from diamond into air? The index of refraction for air and diamond is 1.00 and 2.42, respectively.

(A) 0° (B) 24° (C) 30° (D) 36° (E) 66°

52. The figure shows the energy levels for an electron in a finite potential energy well. If the electron makes a transition from the n = 3 state to the ground state, what is the wavelength of the emitted photon?



(A) 2.3 nm (B) 3.0 nm (C) 5.3 nm (D) 5.7 nm (E) 6.0 nm

53. Light of wavelength 500 nm is incident upon a single slit with width 2×10^{-4} m. The diffraction pattern is observed on a screen positioned 4 m from the slit. Determine the distance of the second dark fringe from the central peak.

(A) 0.01 m (B) 0.02 m (C) 0.03 m (D) 0.04 m (E) 0.05 m

54. Unpolarized light can be polarized, either partially or totally, by reflection. What is the polarizing angle when a ray passes from diamond into air? The index of refraction for air and diamond is 1.00 and 2.42, respectively.
(A) 0° (B) 22° (C) 31° (D) 42° (E) 66°

55. Monochromatic light is normally incident on a diffraction grating that is 1 cm wide and has 12,500 slits. The first order line is deviated at a 30° angle. What is the wavelength of the incident light?
(A) 300 nm (B) 400 nm (C) 500 nm (D) 600 nm (E) 1000 nm

56. The work function for a certain sample is 2.3 eV. The stopping potential for electrons ejected from the sample by 6.0×10^{14} Hz electromagnetic radiation is ($c = 3.00 \times 10^8$ m/s):
(A) 0 V (B) 0.18 V (C) 0.36 V (D) 2.0 V (E) 3.6 V

57. A police car chases fugitives on the highway at 144 km/hr, its siren emitting sound at a frequency of 500 Hz. What frequency is heard by a passenger in a car traveling at 108 km/hr in the opposite direction as the police car and car approach each other? Assume the speed of sound in the air is 345 m/s.
(A) 420 Hz (B) 495 Hz (C) 545 Hz (D) 595 Hz (E) 625 Hz

58. Two cars are approaching to each other. Car A moves at speed v_A = 108.0 km/hr, and the car B at v_B = 72.0 km/hr. The car A sends out a horn sound traveling in air with speed of 343 m/s. The horn's sound frequency as detected by the car B is 1000 Hz. The horn's sound frequency that car A sends out is _____.
(A) 1212 Hz (B) 1154 Hz (C) 948 Hz (D) 862 Hz (E) 821 Hz

59. The wave function of the string wave is given by $y(x,t) = 0.2m \times h\left[\left(20m^{-1}\right)x + \left(10s^{-1}\right)t\right]$, where *h* denotes a general function. The speed of a wave is _____.
(A) 2 m/s (B) 1.5 m/s (C) 1 m/s (D) 0.5 m/s (E) 0.25 m/s

60. A standing sound wave pattern on a long string is described by $y(x,t) = 0.008 \times \sin(10\pi x)\cos(20\pi t)$ (all in SI unit). The distance between two nodes is _____.
(A) 0.1 m (B) 0.2 m (C) 0.3 m (D) 0.4 m (E) 0.5 m

61. Which is an incorrect statement for heat capacity of ideal gases?
(A) C_v is identical for monatomic ideal gases
(B) Molecular motion of monatomic ideal gas is zero
(C) C_v of polyatomic ideal gas is larger than C_v of monatomic ideal gas
(D) $C_p > C_v$ in all ideal gases
(E) $C_p = \frac{5}{2}R$ for monatomic ideal gas

62. $C_{diamond}\,(s) \rightarrow C_{graphite}\,(s) \quad \Delta G^o = -2.9$ kJ
Which of the following is an incorrect statement?
(A) The process is spontaneous
(B) It occurs very slowly at 25 °C and 1atm
(C) Smaller ΔS^o for diamond
(D) Smaller ΔH^o for diamond
(E) The process become reversible at high temperature and pressure

63. Determine the number of nodal surfaces for a 3*s* orbital.
(A) 3 (B) 2 (C) 1 (D) 0 (E) None of these

64. Which molecule has only one resonance structure that obeys the Octet rule?
(A) NO^+ (B) NO_2^- (C) NO_3^- (D) O_3 (E) CO_3^{2-}

65. What is the resonance frequency (MHz) for ^{13}C nuclei operated in a nuclear magnetic resonance spectrometer of 400 MHz? (gyromagnetic ratio of ^1H and ^{13}C is ~4)
(A) 100 (B) 200 (C) 400 (D) 800 (E) 1600

66. The color difference between $[CoCl_4]^{2-}$ and $[Co(H_2O)_6]^{2+}$ can be supported by which concept?
(A) Redox process
(B) Spectrochemical series
(C) Disproportionation reaction
(D) van't Hoff factor
(E) Hard-Soft Acid-Base

67. How many net numbers of spheres are occupied in a face-centered cubic (f.c.c.) unit cell?
(A) 1 (B) 2 (C) 4 (D) 6 (E) 8

68. For a reaction involving changes of reactant concentrations ([A]), what is the reaction order (*m*) when the correlation of ln [A] versus time (*t*) is a straight line?
(A) *m*=0 (B) *m*=1/2 (C) *m*=1 (D) *m*=2 (E) None of these

69. Consider the reaction $Fe^{3+}(aq) + SCN^{-}(aq) \rightleftharpoons FeSCN^{2+}(aq)$. Which one of the following statements is correct?
(A) The equilibrium position shifts to the right after water is added to double the volume
(B) The equilibrium position shifts to the right after $AgNO_3(aq)$ is added
(C) The equilibrium position shifts to the left after $NaOH(aq)$ is added
(D) The equilibrium position shifts to the left after $Fe(NO)_3(aq)$ is added
(E) None of the above is correct

70. Which "P" in the following compounds has the lowest oxidation state?
(A) Phosphoric acid (B) Phosphorous acid (C) Hypophosphorous acid
(D) Sodium phosphide (E) Black phosphorus

71. How many π electrons are delocalized in 1,4-diphenyl-1,3-butadiene?
(A) 4 (B) 8 (C) 16 (D) 24 (E) 32

72. Based on MO theory, which molecule is not paramagnetic?
(A) O_2^- (B) O_2^+ (C) O_2 (D) N_2 (E) N_2^+

73. Consider mixing equal volume of 0.1 M Na_2CO_3 solution and 0.1 M H_2SO_4 solution. Which statement is correct?
(A) $[H^+]$ is less than 0.05 M (B) $[H^+]$ is between 0.1 M and 0.05 M
(C) $[H^+]$ is 0.1 M (D) $[H^+]$ is 0.2 M
(E) pH > 7

74. Which is the major specie for a carbonate-containing solution at pH 8.5? ($K_{a1} = 4.3 \times 10^{-7}$, $K_{a2} = 4.8 \times 10^{-11}$ for carbonic acid)
(A) CO_2 (B) H_2CO_3 (C) HCO_3^- (D) CO_3^{2-} (E) $C_2O_4^{2-}$

75. What is the main contribution for the negative entropy value ($\Delta S^o_{soln} < 0$) when formation of $LiF(aq)$ in water?
(A) Random dispersal of water (B) Breaking ordered bonding of solids
(C) Interaction of Li^+ and F^- with water molecules (D) Dispersion of Li^+ and F^- into solution
(E) Fast equilibrium

76. The energy required to remove the electron from a hydrogen atom in its ground state is 2.178×10^{-18} J. What is the energy required to excite the electron in the He^+ ion from the n = 1 level to the n = 2 level?
(A) 1.634×10^{-18} J (B) 2.178×10^{-18} J (C) 3.268×10^{-18} J (D) 8.712×10^{-18} J (E) None of these

77. To increase the value of K for the endothermic reaction as mentioned below,
$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$
a chemist should _____.
(A) decrease the temperature (B) decrease the container volume (C) increase the total pressure
(D) increase the temperature (E) None of these

78. Two moles of an ideal gas undergo isothermal expansion from a volume of 1.0 L to a volume of 10.0 L against a constant external pressure of 1.0 atm. Calculate the changes of internal energy (ΔE). (1 L·atm = 101.3 J)
(A) 9.12×10^2 J (B) 1.82×10^3 J (C) -9.12×10^2 J (D) -1.82×10^3 J (E) 0 J

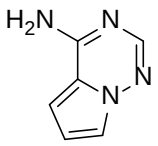
79. Which theory, phenomenon or equation can explain redox potential difference on ion concentrations?
(A) Disproportionation (B) Electrogenerated chemiluminescence (C) Galvanic displacement
(D) Henderson-Hassebalch equation (E) Nernst equation

80. Using the data below, calculate the normal boiling point of liquid Br_2 at 1 atm.
For the process, $Br_2(l) \rightarrow Br_2(g)$: $\Delta H° = 31.0$ kJ mol^{-1} and $\Delta S° = 93.0$ $JK^{-1}mol^{-1}$
(A) 300 K (B) 0.33 K (C) 0.30 K (D) 333 K (E) 433 K

81. Using the data shown as follows to calculate $\Delta G°$ for the reaction (1 F = 96,485 coulombs):
$2Fe^{3+}(aq) + Cu(s) \rightarrow 2Fe^{2+}(aq) + Cu^{2+}(aq)$
The reduction potentials for Fe^{3+} and Cu^{2+} are as follows:
$Fe^{3+} + e^- \rightarrow Fe^{2+}$ $\varepsilon° = 0.77$ V
$Cu^{2+} + 2e^- \rightarrow Cu$ $\varepsilon° = 0.34$ V
(A) -8.3×10^4 J (B) -1.2×10^5 J (C) -4.2×10^4 J (D) -6.0×10^4 J (E) -2.4×10^5 J

82. For corrosion of iron, which of the following statements is (are) true?
I. Anode reaction: $Fe \rightarrow Fe^{2+} + 2e^-$
II. Cathode reaction: $O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$
III. Moisture serving as a salt bridge
(A) I (B) III (C) I and II
(D) I, II, and III (E) None of the statement is true

83.



Above structure is the precursor of the Remdesivir (potential COVID−19 drug), which of the below statements are true?

I. It is an aromatic compound
II. It has 13 σ bond
III. It shows dipole moment
IV. It has 11 σ bond
V. It contains s*p* hybridization

Please choose one of the answer below,

(A) I and IV (B) II and IV (C) I, II, and III
(D) I, II, III, and V (E) None of these

84. What is the boiling-point change for a solution containing 18.0 g of glucose in 150.0 g of water at 1 atm? (K_b = 0.51 °C kg/mol for water)

(A) 2.2 °C (B) 0.06 °C (C) 0.34 °C (D) 4.3 °C (E) 1.8 °C

85. If the human eye has an osmotic pressure of 8.0 atm at 25˚C, the concentration of solution particles in water will be _____ mmol/L in order to provide an isotonic eyedrop solution, a solution with equal osmotic pressure.

(A) 620 (B) 4,110 (C) 0.62 (D) 327 (E) 79

86. The solubility of $CaCl_2$ in cold water is 74.5 g per 100.0 g water. Assuming i = 3.0 for $CaCl_2$, the freezing point for a saturated solution of $CaCl_2$ will be _____˚C. (K_f = 1.86 °C kg/mol for water)

(A) 0 (B) –0.32 (C) –13 (D) –32 (E) –37.4

87. Determine the value of K_c for the reaction

$$HX(aq) \rightleftharpoons H^+(aq) + X^-(aq) \quad K_c = 7.0 \times 10^{-4}$$
$$H_2C_2O_4(aq) \rightleftharpoons 2H^+(aq) + C_2O_4^{2-}(aq) \quad K_c = 4.0 \times 10^{-6}$$
$$2HX(aq) + C_2O_4^{2-}(aq) \rightleftharpoons 2X^-(aq) + H_2C_2O_4(aq) \quad K_c = ?$$

(A) 0.001 (B) 0.01 (C) 0.1 (D) 1.0 (E) 10

88. 2-deoxy-2-[^{18}F]fluoroglucose ([^{18}F]FDG) decays by _____ and [^{18}F] will yield stable _____.

(A) alpha emission, ^{18}O (B) beta emission, ^{19}F (C) positron emission, ^{18}O
(D) photon emission, ^{19}F (E) neutron capture, ^{19}O

89. For an unknown molecules A_2, if the dissociation energy is 1204 kJ/mol, what is the maximum wavelength of electromagnetic radiation required to rupture this bond? (Planck constant: 6×10^{-34} J.s, light of speed: 3×10^8 m/s)

(A) 90 nm (B) 120 nm (C) 150 nm (D) 180 nm (E) 210 nm

90. Calculate the ratio of the root-mean-square velocities (μ_{rms}) of H_2 to SO_2.

(A) 1.0 (B) 0.18 (C) 32 (D) 5.6 (E) 180