113學年度 學士後醫學系招生考試

物理及化學試題封面

考試開始鈴響前，請勿翻閱本試題！

★考試開始鈴響前，請注意：

一、除准考證、應考文具及一般手錶外；行動電話、穿戴式裝置及其他物品均須放在臨時置物區。

二、請務必確認行動電話已取出電池或關機，行動電話及手錶的鬧鈴功能必須關閉。

三、就座後，不可擅自離開座位或與其他考生交談。

四、坐定後，雙手離開桌面，確認座位號碼、答案卡號碼與准考證號碼相同，以及抽屜中、桌椅下或座位旁均無非考試必需用品。如有任何問題，請立即舉手反應。

五、考試開始鈴響前，不得翻閱試題本或作答。

六、考試全程不得吃東西、喝水及嚼食口香糖。

七、違反上述規定，依「筆試規則及違規處理辦法」議處。

★作答說明：

一、考試時間：100 分鐘。

二、本試題（含封面）共 **15** 頁，如有缺頁或毀損，應立即舉手請監試人員補發。

三、本試題共 90 題，皆為單選題，共計 150 分；每題答錯倒扣，不作答不計分。

四、答題依題號順序劃記在答案卡上，寫在試題本上無效；答案卡限用 2B 鉛筆劃記，若未按規定劃記，致電腦無法讀取者，考生自行負責。

五、試題本必須與答案卡一併繳回，不得攜出試場。

113 學年度學士後醫學系招生考試
物理及化學試題

Choose one best answer for the following questions

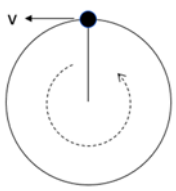
【單選題】每題 1 分，共計 30 分，答錯 1 題倒扣 0.25 分，倒扣至本大題零分為止，未作答，不給分亦不扣分。1~15 題為物理，16~30 題為化學。

1. A 10 g object connected to one end of a massless spring undergoes 50 oscillations in 5 seconds. What is the spring constant?
   (A) 5 N/m (B) 10 N/m (C) 20 N/m (D) 30 N/m (E) 40 N/m

2. If a simple pendulum oscillates with small amplitude and its length is doubled, what happens to the frequency of its motion?
   (A) It doubles.
   (B) It becomes $\sqrt{2}$ times as large.
   (C) It becomes half as large.
   (D) It becomes $1/\sqrt{2}$ times as large.
   (E) It remains the same.

3. A certain spring that obeys Hooke's law is stretched by an external agent. The work done in stretching the spring by 10 cm is 4 J. How much additional work is required to stretch the spring an additional 10 cm?
   (A) 2 J (B) 4 J (C) 8 J (D) 10 J (E) 12 J

4. A child plays a string of length = 20 cm connected with a ball of mass m = 1 kg, and starts to rotate it vertically. Find the minimum speed of the ball at the top that is needed to rotate it vertically in circular fashion?
   (Gravitational acceleration g = 10 m/s^2)



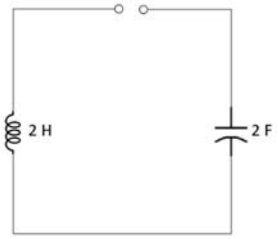
   (A) 0.7 m/s (B) 1.4 m/s (C) 2.2 m/s (D) 3.3 m/s (E) 4.2 m/s

5. A grindstone increases in angular speed from 4 rad/s to 12 rad/s in 4 s. Through what angle does it turn during that time interval if the angular acceleration is constant?
   (A) 8 rad (B) 12 rad (C) 16 rad (D) 32 rad (E) 64 rad

6. Determine the force per unit length between two infinitely long parallel conducting wires carrying currents I_1 and I_2 in opposite directions. The wires are separated by a distance d. Will the two wires be attracted to each other or repulsed?
   (A) $F = \frac{\mu_0 I_1 I_2}{2\pi d}$, attracted (B) $F = \frac{\mu_0 I_1 I_2}{2\pi d}$, repulsed (C) $F = \frac{\mu_0 I_1 I_2}{\pi d}$, attracted
   (D) $F = \frac{\mu_0 I_1 I_2}{\pi d}$, repulsed (E) $F = 0$

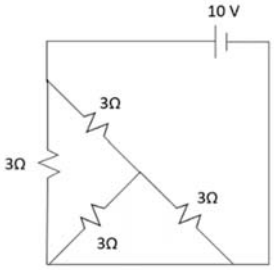
7. How many 1 μF capacitors must be connected in parallel to store a charge of 1 C with a potential of 110 V across the capacitors?
   (A) 7.1×10^3 (B) 8.4×10^3 (C) 9.1×10^3 (D) 10.2×10^3 (E) 12.4×10^3

8. Find the resonance frequency of the following LC circuit?



(A) 0.02 Hz (B) 0.04 Hz (C) 0.06 Hz (D) 0.08 Hz (E) 0.10 Hz

9. Find the current of the following circuit.



(A) 3.3 A (B) 4.4 A (C) 5.6 A (D) 6.7 A (E) 7.8 A

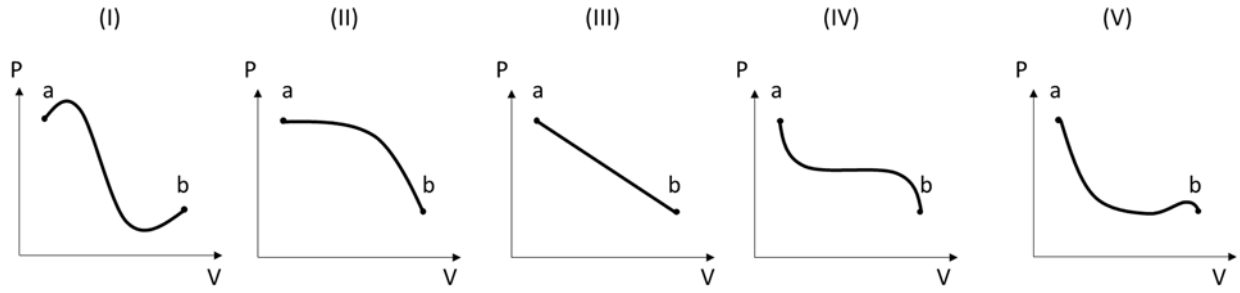
10. In the ^{4}He atom, when the 3rd orbital electron jumps to the 1st orbit, what is the photon energy being emitted?

(A) 44.2 eV (B) 48.4 eV (C) 52.3 eV (D) 54.1 eV (E) 60.6 eV

11. An engine does 15 kJ of work while exhausting 37 kJ to a cold reservoir. What is the efficiency of the engine?

(A) 0.15 (B) 0.29 (C) 0.33 (D) 0.45 (E) 1.20

12. A gas undergoing a series of pressure and volume changes from a state (a) to state (b) by the following five paths. Which of the following paths requires the highest work for the changing?



(A) I (B) II (C) III (D) IV (E) V

13. The speed of a transverse wave on a string is 170 m/s when the string tension is 120 N. To what value must the tension be changed to raise the wave speed to 180 m/s?

(A) 120 N (B) 125 N (C) 130 N (D) 135 N (E) 140 N

14. Which of the following aberrations is related to the wavelength of light?
(A) spherical aberration (B) chromatic aberration (C) coma
(D) astigmatism (E) distortion

15. An ideal fluid flows through a horizontal pipe whose diameter varies along its length. Measurements would indicate that the sum of the kinetic energy per unit volume and pressure at different sections of the pipe would _____.
(A) decrease as the pipe diameter increases
(B) increase as the pipe diameter increases
(C) increase as the pipe diameter decreases
(D) decrease as the pipe diameter decreases
(E) remain the same as the pipe diameter changes

16. A point in the wave function where the amplitude is zero defines _____.
(A) the node (B) the excited state
(C) the amplitude of the wave function (D) the frequency of radiation
(E) none of the above

17. For a heterogeneous catalyzed reaction, the reaction can be divided into four processes:
I. Escape or desorption of the products.
II. Reaction of the adsorbed reactants.
III. Migration of the adsorbed reactants on the surface of the catalyst.
IV. Adsorption and activation of the reactants.
What is the **correct** order of the process?
(A) I → II → III → IV (B) IV → III → II → I (C) I → IV → II → III
(D) IV → II → III → I (E) III → II → I → IV

18. The band gap of the semiconductor aluminum phosphide (AlP) is 2.5 eV. What color of light is emitted by AlP diode? (1 eV = 1.6×10^{-19} J; Planck's constant: 6.626×10^{-34} J · s = 4.136×10^{-15} eV · s)
(A) red (B) orange (C) yellow (D) green (E) blue

19. Which radiation is applied in nuclear magnetic resonance (NMR) technique?
(A) X-ray (B) ultraviolet (C) infrared (D) visible (E) radio wave

20. Which of the following reactions is a disproportionation reaction?
(A) $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$
(B) $Cl_{2(aq)} + 2I^-_{(aq)} \rightarrow I_{2(aq)} + 2Cl^-_{(aq)}$
(C) $CaSiO_{3(s)} + 8HF_{(aq)} \rightarrow H_2SiF_{6(aq)} + CaF_{2(aq)} + 3H_2O_{(l)}$
(D) $AgNO_{3(aq)} + NaCl_{(aq)} \rightarrow AgCl_{(aq)} + NaNO_{3(aq)}$
(E) $Cl_{2(aq)} + 2NaOH_{(aq)} \rightarrow NaClO_{(aq)} + NaCl_{(aq)} + H_2O_{(l)}$

21. Specify the number of unpaired electrons in CoF_6^{3-} (F^- ion is a weak field ligand).
(A) 0 (B) 1 (C) 2 (D) 4 (E) 5

22. The MnO_4^- ion is often used to analyze the Fe^{2+} concentration in an aqueous solution, based on the reaction in acidic condition as follows: ($MnO_4^- + Fe^{2+} \longrightarrow Fe^{3+} + Mn^{2+}$) A 50.00 mL sample of a solution containing Fe^{2+} requires 40.00 mL of a 0.025 M $KMnO_4$ solution for complete reaction. What is the concentration of the Fe^{2+} in the original solution?
(A) 1.0×10^{-1} M (B) 1.8×10^{-2} M (C) 4.5×10^{-3} M
(D) 1.8×10^{-3} M (E) 9.1×10^{-4} M

23. What is the number of lone pairs of electrons in the NO_2^- ion?
(A) 4 (B) 5 (C) 6 (D) 7 (E) 8

24. If you add 0.10 M silver nitrate dropwise to a solution consisting of 0.10 M Cl^- and 0.10 M CrO_4^{2-}, the precipitates are obtained. Given the K_{sp} for Ag_2CrO_4 is 9.0×10^{-12} and that for AgCl is 1.6×10^{-10}. Which of the followings will precipitate first?
(A) silver chloride
(B) silver chromate
(C) silver nitrate
(D) It cannot be determined by the information given.
(E) silver metal

25. When the Pd-106 nucleus is struck with an alpha particle, a proton is produced along with a new element. What is this new element?
(A) Cd-112 (B) Cd-109 (C) Ag-108 (D) Ag-109 (E) Ag-110

26. How many unpaired electrons are present in the F_2^{2+} ion? The order of the molecular orbitals is $(\sigma_{2s})(\sigma_{2s}^*)(\sigma_{2p})(\pi_{2p})(\pi_{2p}^*)(\sigma_{2p}^*)$.
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

27. You are holding four identical balloons each containing 10.0 g of a different gas. The balloon containing which gas is the **largest** balloon?
(A) H_2 (B) He (C) Ne
(D) O_2 (E) All balloons have the same volume.

28. What is the **simplest** formula of a solid containing three types of atoms in a cubic lattice in which the A, B, and C atoms respectively occupy the corners, the body-center, and the faces-centers of the unit cell?
(A) ABC (B) ABC_3 (C) ABC_6 (D) A_8BC_6 (E) A_4BC_3

29. Among the following covalent bonds, which one has the **smallest** bond energy?
(A) C–C (B) C–O (C) C–S (D) C–Cl (E) C–F

30. Which of the following changes shifts the equilibrium position toward product side in the endothermic decomposition reaction as follows: $C_5H_6O_{3(g)} \leftrightarrows C_2H_{4(g)} + 3CO_{(g)}$
(A) addition of $He_{(g)}$ (B) removal of $C_5H_6O_{3(g)}$ (C) addition of $C_2H_{4(g)}$
(D) increase in temperature (E) decrease in container volume

【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。

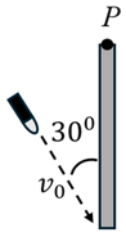
31. What average power is generated by a 70 kg mountain climber who climbs a summit of height 325 m in 95 min? (Gravitational acceleration g = 10 m/s^2)
(A) 25 W (B) 40 W (C) 55 W (D) 65 W (E) 80 W

32. A baseball flies from the ground to a roof with a height h = 3 m and falls at a 45-degree angle, taking 3 seconds, what is the horizontal displacement of the baseball during this time?
(Gravitational acceleration g = 10 m/s^2)
(A) 14 m (B) 28 m (C) 42 m (D) 56 m (E) 70 m

33. A child uses a horizontal rope to pull a toy box weighing 100 N on a table. Given that the coefficient of kinetic friction between the box and the table is 0.05, what is the work done by the child to move the box 50 cm at a constant speed?
(A) 0.25 J (B) 0.50 J (C) 2.5 J (D) 5.0 J (E) 10 J

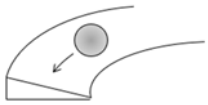
34. A vertically hanging 16 kg block is connected to a cord wrapped around the rim of a flywheel with a diameter of 0.5 m. The flywheel's rotational inertia is 1.0 kg · m^2. Upon releasing the block and allowing the cord to unwind, what is the acceleration of the block?
(Gravitational acceleration g = 10 m/s^2)
(A) 2 m/s^2 (B) 3 m/s^2 (C) 4 m/s^2 (D) 5 m/s^2 (E) 6 m/s^2

35. A bullet weighing 100 g is diagonally fired into the end of a 0.5 m long stick with a speed of v_0. The stick is suspended at point P. The rotational inertia of the stick relative to point P is 0.05 kg · m^2. When the bullet first enters the stick, the stick's angular velocity is 5.0 rad/s. What is the initial velocity of the bullet?



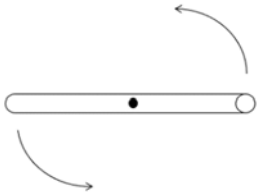
(A) 7 m/s (B) 10 m/s (C) 15 m/s (D) 30 m/s (E) 40 m/s

36. A frictionless curve of radius 500 m is banked with a banking angle θ = 30°. A ball of mass m = 10 kg and radius r = 50 cm is moving on it. What angular velocity is needed for the ball moving on the curve without need of frictional force?
(Gravitational acceleration g = 10 m/s^2) (tan 30° = 0.577)



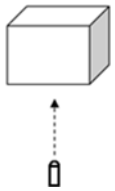
(A) 53.7 rad/s (B) 107.4 rad/s (C) 214.8 rad/s
(D) 332.2 rad/s (E) 429.6 rad/s

37. A thin rod of length 100 cm and mass 6 kg with the rotation axis through its center. The rod rotates and accelerates to an angular velocity of 100 rad/s uniformly from rest over a 10 seconds interval. Find the torque to the rod (kg · m^2/s^2)?



(A) 5 (B) 10 (C) 15 (D) 20 (E) 25

38. A gun fired vertically and hits a wooden block and stops inside. The bullet and block have a mass of 0.1 and 0.5 kg, respectively. The velocity of bullet is 100 m/s. How high will the wooden block be raised?
(Gravitational acceleration g = 10 m/s^2)



(A) 8 m (B) 10 m (C) 12 m (D) 14 m (E) 16 m

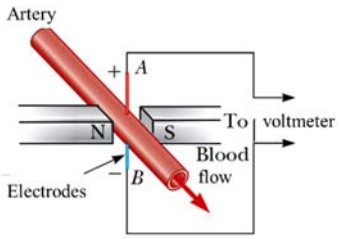
39. One particle of mass M = 0.5 × 10^{-9} kg and velocity V = 4 × 10^5 m/s directly hits the other particle of mass m = 0.1 × 10^{-9} kg and velocity v = 0 m/s. Find the maximum energy transfer from one particle to the other?
(A) 15 J (B) 22 J (C) 29 J (D) 36 J (E) 43 J

40. If two springs with spring constants k and 3k respectively are connected in series and attached to an object with mass m, what is the oscillation frequency of the springs?
(A) $\sqrt{k/m}$ (B) $\sqrt{3k/4m}$ (C) $\sqrt{3k/m}/2\pi$
(D) $\sqrt{k/m}/2\pi$ (E) $\sqrt{3k/4m}/2\pi$

41. An electronics technician wishes to construct a parallel plate capacitor using rutile (κ = 100) as the dielectric. The area of the plates is 1.0 cm^2. What is the capacitance if the rutile thickness is 1.0 mm? (permeability constant μ_0 = 8.85×10^{-12} C^2/N · m^2)
(A) 88.5 pF (B) 177 pF (C) 8.85 μF (D) 35.4 μF (E) 100 μF

42. Two conducting wires A and B of the same length and radius are connected across the same potential difference. Conductor A has twice the resistivity of conductor B. What is the ratio of the power delivered to A to the power delivered to B?
(A) 2 (B) $\sqrt{2}$ (C) 1 (D) $1/\sqrt{2}$ (E) $\frac{1}{2}$

43. A heart surgeon monitors the flow rate of blood through an artery using an electromagnetic flowmeter as shown in the figure. Electrodes *A* and *B* make contact with the outer surface of the blood vessel, which has a diameter of 3.0 mm. For a magnetic field magnitude of 0.04 T, an *emf* of 160 μV appears between the electrodes. Calculate the speed of the blood.

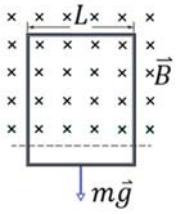


(A) 1.33 m/s (B) 2.33 m/s (C) 3.66 m/s (D) 4.66 m/s (E) 6.66 m/s

44. A rectangular coil with 1000 turns has a length and width of 10 cm and 20 cm respectively and carries a counterclockwise current of 10 A. When the magnetic dipole moment makes an angle of 60° with a magnetic field of 0.5 T, what is its potential energy?

(A) -50 J (B) -87 J (C) -100 J (D) 50 J (E) 100 J

45. A rectangular conductor coil has width L = 10 cm, resistance R = 0.3 Ω, and mass m = 100 g. Ignoring the air drag, when the coil falls in a uniform magnetic field B = 10 T, the final terminal velocity value of the coil is:
(Gravitational acceleration g = 10 m/s^2)



(A) 0.3 m/s (B) 0.5 m/s (C) 0.7 m/s (D) 3.0 m/s (E) 5.0 m/s

46. A 5 μF capacitor is linked to an electromotive force experiencing uniform increment at a rate of 100 V/s over time. The displacement current between the plates is:

(A) 0 (B) 5 A (C) 5×10^{-2} A (D) 5×10^{-4} A (E) 5×10^{-6} A

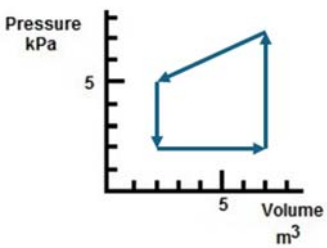
47. In a certain cyclotron a proton moves in a circle of radius 0.50 m. The magnitude of the magnetic field is 1.20 T. What is the oscillator frequency? (The mass of proton $m_p = 1.67\times10^{-27}$ kg)

(A) 1.83×10^7 Hz (B) 2.53×10^7 Hz (C) 3.62×10^7 Hz
(D) 4.71×10^7 Hz (E) 5.83×10^7 Hz

48. A gas is at 200 K. If we wish to double the root mean square speed (v_{rms}) of the molecules of the gas, to what value must we raise its temperature?

(A) 283 K (B) 400 K (C) 500 K (D) 600 K (E) 800 K

49. In the figure, a gas enclosed within a sealed chamber follows a closed path as illustrated. What is the total amount of work performed by the gas?

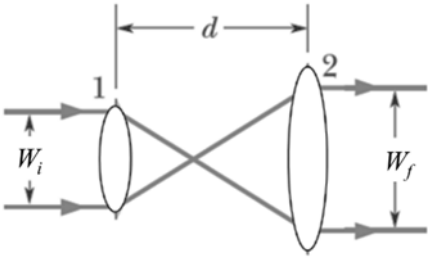


(A) +40 J (B) +20 J (C) 0 J (D) -20 J (E) -40 J

50. When a fixed pressure of one atmosphere is maintained, an ideal gas receives 25 J of energy in the form of heat. During this process, the gas's volume expands from 20 cm³ to 40 cm³. What is the molar specific heat of this ideal gas?
(The universal gas constant R = 8.31 J/mol · K, 1 atm = 1.01×10^5 Pa)
(A) 80 J/mol · K (B) 85 J/mol · K (C) 90 J/mol · K (D) 95 J/mol · K (E) 100 J/mol · K

51. Two objects with temperatures T1 and T2 (T2 = 2T1) are isolated from their surroundings. A small amount of heat Q is transferred without changing their temperatures. What is the total entropy change of the two objects?
(A) (1/2) · (Q/T1) (B) (3/2) · (Q/T1) (C) (1/3) · (Q/T2)
(D) (2/3) · (Q/T2) (E) (1/4) · (Q/T2)

52. The figure shows the configuration of a beam-expander (5x) formed by two positive lenses with focal lengthes f_1 and f_2. The distance between two lens is 12 cm. W_i and W_f denote the input and output laser beam diameters, respectively. What is the laser focal point in the system?



(A) 2.0 cm away from the input lens (B) 4.0 cm away from the input lens
(C) 6.0 cm away from the input lens (D) 8.0 cm away from the input lens
(E) 10.0 cm away from the input lens

53. A police car with a 500 Hz siren is moving at 20 m/s. What is the total frequency change when the police car is approaching and then leaving the listener? (sound speed in the air is 344 m/s)
(A) 32 Hz (B) 36 Hz (C) 48 Hz (D) 52 Hz (E) 58 Hz

54. A doppler flow meter transmit ultrasound of 10 MHz to measure the blood flow. If the reflected sound of 9.9 MHz is recorded by the same probe, find the speed of the blood flow. (sound speed in the tissue is 1500 m/s)
(A) 5.5 m/s (B) 6.5 m/s (C) 7.5 m/s (D) 8.5 m/s (E) 9.5 m/s

55. Thin film coating is a technique for anti-reflection. How thick a thin film with the refractive index of 1.25 should be coated on a glass surface (n=1.5) to eliminate the reflection for the wavelength of 600 nm? Only consider normal incidence.
(A) 120 nm (B) 150 nm (C) 300 nm (D) 500 nm (E) 600 nm

56. An acrylic cube with a volume of 8 cm³ registers a weight of 40 g on a spring scale calibrated in grams. If the same object is weighed while submerged in a liquid with a density of 4 g/cm³, what reading will the scale display?
(A) 8 g (B) 16 g (C) 24 g (D) 32 g (E) 40 g

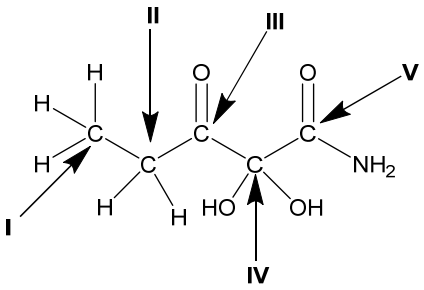
57. The net nuclear fusion reaction inside the Sun can be written as $4\,^1\mathrm{H} \rightarrow {}^4\mathrm{He} + E$. The rest energy of each hydrogen atom is 938.8 MeV, and the rest energy of the helium-4 atom is 3728.4 MeV. Calculate the percentage of the starting mass that is transformed to other forms of energy.
(A) 0.11 % (B) 0.31 % (C) 0.51 % (D) 0.71 % (E) 0.91 %

58. In Bohr's hydrogen theorem, find the ratio of the longest wavelength between Balmer's and Paschen's series? (Balmer/Paschen)
(A) 0.35 (B) 0.40 (C) 0.45 (D) 0.50 (E) 0.55

59. How fast is needed for an $\boldsymbol{O}_2^+$ ion to move in a circular orbit of radius 5 m in a magnetic field of 0.5 Tesla? (1 u = 1.66 × 10^{-27} kg)
(A) 3.8 × 10^5 m/s (B) 4.1 × 10^5 m/s (C) 5.2 × 10^5 m/s
(D) 7.5 × 10^6 m/s (E) 8.9 × 10^6 m/s

60. A spacecraft is flying towards Earth at a speed of 0.7 c. When it is 8 light-years away from Earth, it sends a message to Earth at a speed of 0.5 c (relative to the spacecraft). How long will it take for Earth to receive this message?
(A) 5 years (B) 6 years (C) 7 years (D) 8 years (E) 9 years

61. Which of the following carbon atoms exhibits an oxidation state of +3?



(A) I (B) II (C) III (D) IV (E) V

62. Given the electron configuration of an element X is [Ar]$3d^{10}4s^24p^3$. What is the formula for the chloride of X most likely to be?
(A) XCl (B) XCl_2 (C) XCl_3 (D) XCl_4 (E) XCl_6

63. How much energy is needed to convert 100 g of ice at 0°C to water at 50°C?
specific heat capacity (ice) = 2.10 J/g · °C;
specific heat capacity (water) = 4.18 J/g · °C;
heat of fusion = 333 J/g;
heat of vaporization = 2258 J/g
(A) 10.1 kJ (B) 20.7 kJ (C) 31.4 kJ (D) 54.2 kJ (E) 65.8 kJ

64. What concentration of glucose in water is needed to produce an aqueous solution isotomic with blood? Give the osmotic pressure of blood at 25ºC is 7.70 atm. (R = 0.082 atm · L/mol · K)
(A) 0.158 M (B) 0.315 M (C) 0.630 M (D) 1.580 M (E) 3.15 M

65. Which of the followings is **not** necessary for protein synthesis at the stage of peptide bonds formation?
(A) amino acids (B) mRNA (C) DNA
(D) tRNA (E) ribosomes

66. Give the effusion time of 250 mL of methane through a small hole is 48 s. How long will it require for same volume of helium to pass through the same hole? (CH_4=16 g/mol; He=4 g/mol)
(A) 12 s (B) 24 s (C) 48 s (D) 96 s (E) 192 s

67. Given the second half-life for a second order reaction is 60 seconds. How much time is required for 87.5% reactant to be consumed in this reaction?
(A) 30 seconds (B) 60 seconds (C) 90 seconds (D) 120 seconds (E) 210 seconds

68. Which of the following trends is **incorrect**?
(A) atom size: Li < Na < K < Cs
(B) ion size: $Ca^{2+} < K^+ < Cl^- < S^{2-}$
(C) electronegativity: I < Br < Cl < F
(D) boiling point: $H_2O < H_2S < H_2Se < H_2Te$
(E) bond angle: $SbF_3 < AsF_3 < PF_3 < NF_3$

69. At 27ºC, an ideal gas with a mass of 0.4 g in 100 mL has a pressure of 0.3 atm. What is the molecular weight of this gas molecule? (R = 0.082 atm·L/mol·K)
(A) 328 (B) 246 (C) 133 (D) 120 (E) 30

70. The rate constant for a reaction increases from 10.0 s^{-1} to 100.0 s^{-1} when the temperature is increased from 300 K to 400 K. What is the activation energy for this reaction in kJ/mol? (*R* = 8.31 J/mol·K; ln10 = 2.30)
(A) 45.6 (B) 23.0 (C) 18.3 (D) 12.7 (E) 5.0

71. Below reaction was studied at –10ºC and the following results were obtained.
$2NO_{(g)} + Cl_{2(g)} \rightarrow 2NOCl_{(g)}$

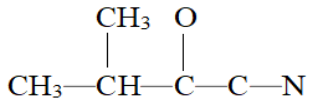
$[NO]_0$ (mol/L)	$[Cl_2]_0$ (mol/L)	Initial Rate (mol/L·min)
0.10	0.10	0.18
0.10	0.20	0.36
0.20	0.20	1.45

Considering the rate law of this reaction, what's the unit of the rate constant?
(A) $(mol/L)^2 \cdot min^{-1}$ (B) $(mol/L)^1 \cdot min^{-1}$ (C) $(mol/L)^0 \cdot min^{-1}$
(D) $(mol/L)^{-1} \cdot min^{-1}$ (E) $(mol/L)^{-2} \cdot min^{-1}$

72. Which of the following statements is **correct**?
(A) Arrhenius postulated that an acid is a proton (H^+) donor, and a base is a proton acceptor.
(B) A buffer with a large capacity contains large volumes of the buffering components.
(C) For the titrations of weak acids with strong bases, the greater pH value at the equivalence point is obtained when the stronger acid is used.
(D) For a particular buffering system, all solutions that have the same ratio of $[A^-]/[HA]$ have the same pH value.
(E) An acid-base indicator can be used to determine the equivalence point of an acid-base titration because of its ability to mark the half-equivalence point of a titration by changing color.

73. At a certain temperature, placing one mole of ammonia gas into a sealed container results in 40% ammonia decomposition at equilibrium. What is the equilibrium constant K_C for ammonia decomposition at that temperature? (ammonia decomposition: $2NH_{3(g)} \rightarrow N_{2(g)} + 3H_{2(g)}$)
(A) 0.043 (B) 0.12 (C) 0.80 (D) 8.33 (E) 17

74. Complete the Lewis structure for the molecular formula (C_5H_7ON) below.

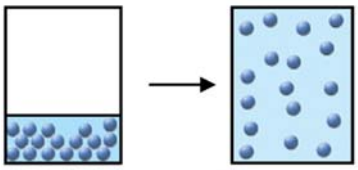


This molecule has _____ single bonds, _____ multiple bonds and ____ sp^2 hybridized atoms.
(A) 4, 2, 2 (B) 4, 2, 4 (C) 11, 2, 2 (D) 11, 2, 4 (E) 11, 5, 4

75. A product is electroplated by copper from $CuSO_4$ solution. A constant current of 9.65 amp is applied by an external power supply. How long will it take to deposit 6.35×10^2 g of Cu onto the surface of product? (Cu = 63.5 g/mol) (1F = 96485 C/mol)
(A) 14.22 s (B) 8.9 min (C) 2.54 h (D) 55.5 h (E) 1.37 days

76. An unknown compound is cooled at 1 atm, and it freezes at 50.0 K to form Solid I. At a lower temperature, Solid I rearranges to Solid II, which has a different crystal structure. Thermal measurements show that ΔH an ΔS for the I → II phase transition are –700.0 J/mol and –20.0 J/K mol, respectively. What is the temperature of Solids I and II in equilibrium?
(A) 13.6 K (B) 19.8 K (C) 35.0 K (D) 59.8 K (E) 98.2 K

77. What are the signs (+, –, or 0) of ΔH, ΔS, and ΔG for the spontaneous vaporization of a liquid to a vapor?



(A) $(\Delta H, \Delta S, \Delta G) = (+, +, +)$ (B) $(\Delta H, \Delta S, \Delta G) = (+, –, +)$
(C) $(\Delta H, \Delta S, \Delta G) = (0, 0, 0)$ (D) $(\Delta H, \Delta S, \Delta G) = (+, +, –)$
(E) $(\Delta H, \Delta S, \Delta G) = (–, – , –)$

78. The reduction potentials for Au^{3+} and Cr^{3+} are as follows:
$Au^{3+} + 3e^- \rightarrow Au$, $\varepsilon° = +1.50$ V
$Cr^{3+} + e^- \rightarrow Cr^{2+}$, $\varepsilon° = –0.50$ V
Calculate $\Delta G°$ (at 25°C) for the reaction:
$Au^{3+} + 3Cr^{2+} \rightarrow 3Cr^{3+} + Au$
(A) $–7.37 \times 10^2$ kJ (B) $–5.79 \times 10^2$ kJ (C) $–1.6 \times 10^2$ kJ
(D) 7.37×10^2 kJ (E) 10×10^2 kJ

79. How many different structures do $SeCl_4$, CBr_4, KrF_4, CH_4, and TeF_4 have?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

80. A weak acid HA is dissolved in enough water to prepare an acidic solution. The pH value and osmotic pressure of resulting solution at 27ºC are 6 and 0.246 atm, respectively. What is the Ka of HA? (R = 0.082 L·atm/K·mol; assuming Van't Hoff factor = 1)
(A) 1.00×10^{-10} (B) 2.30×10^{-10} (C) 1.10×10^{-9} (D) 6.10×10^{-9} (E) 5.80×10^{-8}

81. The pH of a bottle of vinegar is 2.75 at 25ºC. What is the mass percentage concentration (w/w) of acetic acid in this vinegar, assuming no other acid is presented?
(K_a of acetic acid: 1.8×10^{-5}; pK_a of acetic acid: 4.74; $10^{-2.75} = 0.0018$; $10^{2.75} = 562.3$; assuming the density of vinegar = 1 g/cm^3; CH_3COOH=60 g/mol)
(A) 5.0% (B) 4.0% (C) 3.0% (D) 2.0% (E) 1.0%

82. Which of the following complexes can exhibit optical isomerism? (en = $H_2N–CH_2–CH_2–NH_2$)
(A) *cis*–$Co(NH_3)_4Cl_2$ (B) *trans*–$Co(en)_2Br_2$ (C) *cis*–$Co(en)_2Cl_2$
(D) $Co(NH_3)_3Cl_3$ (E) none of these

83. A compound has a formula of $[Pt(PPh_3)_2(NCS)_2]$. How many isomers does this compound have?
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

84. Aluminum (Al) metal crystallizes in a face-centered cubic structure. The relationship between the radius *r* of an Al atom and the length of an edge *E* of the unit cell is _____.

(A) $r = 0.354E$ (B) $r = 0.433E$ (C) $r = 0.5E$ (D) $r = 2E$ (E) $r = 4E$

85. Which of the following statements correctly describes the signs of q (heat) and w (work) for the following exothermic process at P = 1 atm and T = 370 K? $H_2O_{(g)} \longrightarrow H_2O_{(l)}$

(A) The q and w are both negative.
(B) The q is positive, but the w is negative.
(C) The q and w are both positive.
(D) The q is negative, but the w is positive.
(E) The q and w are both zero.

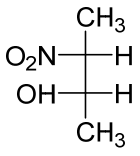
86. Carminic acid, a naturally occurring red pigment extracted from the cochineal insect, contains 53.66% C, 4.09% H and 42.25% O by mass. A titration required 10.00 mL of 0.5 M NaOH to neutralize 2.46 g carminic acid. Assuming there is only one acidic hydrogen per molecule, what is the empirical formula and molecular formula of carminic acid? (Na = 23.0 g/mole)

(A) empirical formula: $C_{22}H_{20}O_{13}$; molecular formula: $C_{44}H_{40}O_{26}$
(B) empirical formula: $C_{22}H_{20}O_{13}$; molecular formula: $C_{22}H_{20}O_{13}$
(C) empirical formula: $C_{44}H_{40}O_{26}$; molecular formula: $C_{22}H_{20}O_{13}$
(D) empirical formula: $C_{26}H_{20}O_{10}$; molecular formula: $C_{26}H_{20}O_{10}$
(E) empirical formula: $C_{26}H_{20}O_{10}$; molecular formula: $C_{52}H_{40}O_{20}$

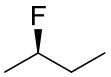
87. Biphenyl ($C_{12}H_{10}$) is an organic molecule formed by connecting two benzene rings via single bond. Which of the following statements about biphenyl molecules is **incorrect**?

(A) Benzene is an aromatic compound.
(B) The molecular structure has twelve carbon atoms in a coplanar fashion.
(C) The molecular structure has five hydrogen atoms in a coplanar fashion.
(D) The molecule has a total of six double bonds.
(E) The molecular hybridization in this molecule are the same as graphite.

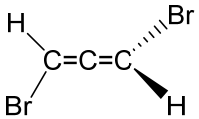
88. Which of the following molecules is achiral?



I



II



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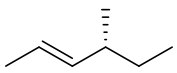

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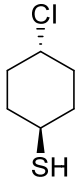
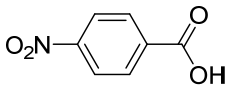


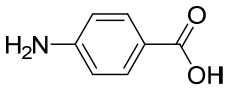
V

(A) I (B) II (C) III (D) IV (E) V

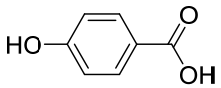
89. Which of the following molecules possesses the strongest acidity?



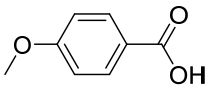
I



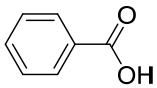
II



III



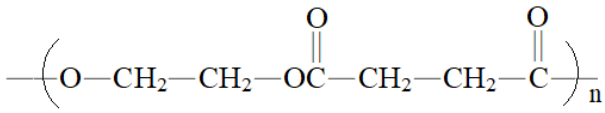
IV



V

(A) I (B) II (C) III (D) IV (E) V

90. What monomer(s) is/are needed to synthesize the polymer shown below?



I. $HOCH_2CH_2OH$ II. $HOOCCH_2CH_2COOH$ III. $HOCH_2CH_2COOH$
IV. HOCH=CHOH V. HOOCCH=CHCOOH

(A) II (B) III (C) I and II (D) IV and V (E) II and III

後醫-英文

題號	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
答案	A	E	E	D	D	E	B	E	E	B	D	A	C	D	E	E	E	B	C	A
題號	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
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題號	41	42	43	44	45	46	47	48	49	50										
答案	A	D	C	A	B	A	B	C	D	A										

後醫-物理及化學

題號	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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答案	D	A	C	A	D	C	A	B	C	D	B	C	C	D	C	B	A	D	B	E
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題號	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
答案	E	C	D	B	C	B	E	D	A	B	E	D	B	C	D	C	D	B	C	A
題號	81	82	83	84	85	86	87	88	89	90										
答案	E	C	E	A	D	B	B	E	A	C										

後醫-普通生物及生化概論

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題號	81	82	83	84	85	86	87	88	89	90										
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後醫-計算機概論與程式設計

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