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普通物理

- 功(work)的定義需要同時有力和位移，如同交異性朋友，光是送了一大堆禮物（有出力），如果對方一無所動（沒有位移），作的功還是零。但是在小學被老師罰過拿水桶的人一定知道，手臂明明水平伸直沒動（沒有位移），被罰的痛苦卻是千真萬確，那是因為(A)你的手臂在老師沒看到時有偷偷移動，如果真的挺直，應該就不會酸了，(B)罪惡感作祟，(C)功的定義只適用於普物課，(D)肌肉其實一直在抽筋，所以還是有做功，(E)以上皆非。
- 質點 m 的兩端分別用彈簧係數為 K_1 和 K_2 的彈簧固定在牆上，當質點偏離平衡位置時，它會作簡諧振動，請問角頻率多大？
(A) $\sqrt{\frac{m}{K_1 + K_2}}$, (B) $\sqrt{\frac{K_1 K_2}{m(K_1 + K_2)}}$, (C) $\sqrt{\frac{K_1 + K_2}{m}}$, (D) $\sqrt{\frac{K_1 K_2}{m}}$, (E) 以上皆非。
- Kepler 的第三定律中，是誰的三次方和週期平方的比值會不隨行星的種類而改變？(A)軌道的短軸，(B)長軸，(C)短軸和長軸的算術平均，(D)短軸和長軸的幾何平均，(E)以上皆非。
- 腳踏車在行進中比較容易平衡，原因是(A)角動能守恆，(B)有風，(C)動量守恆，(D)角動量守恆，(E)以上皆非。
- 在薩哈拉沙漠，有些土著的衣著和頭巾是黑色的，原因是(A)黑布在非洲比白布便宜許多，(B)黑布雖然容易吸熱，但是在布和身體之間的空氣在經過加熱後，對流加快，反而使人覺得涼快，(C)他們沒上過普物，(D)只要不中暑，熱到相當程度，反而會有涼的感覺，(E)以上皆非。
- 花式溜冰有一個令人昏炫的動作，當溜冰者藉著改變手腳的動作，可以在定點快速的旋轉。在這過程中，(A)動能守恆，(B)既然是在定點，嚴格來說，應該是角動能守恆，(C)角動量守恆，(D)以上皆是，(E)以上皆非。
- 如果考慮相對論效應，則在高速公路上，我會覺得正後方的砂石車逼近我的速度比古典的（即我的車速減去那輛惡劣的砂石車速度）(A)快，(B)慢，(C)要看砂石車在觀察的那一剎那有沒有加速，如果有的話，它不再是慣性座標，答案會不一定，(D)即使砂石車是等速前進，逼近的原因到底是我太慢、還是他太快，會給出相反的答案，(E)以上皆非。
- 地球表面的溫度為 $300^\circ K$ ，大氣游離層的溫度設為 $-50^\circ C$ ，如果利用此溫差來發電，則發電最大的效率為多少？(A) $\frac{300 + 50}{300}$, (B) $\frac{300 - 223}{300 + 223}$, (C) $\frac{300}{300 + 223}$, (D) $\frac{300 - 223}{300}$, (E) 以上皆非。
- 如果考慮單擺擺線的質量，則簡諧振動的週期會比 $2\pi\sqrt{\frac{\ell}{g}}$ （ ℓ 是擺長， g 是重力加速度）(A)長，(B)短，(C)不變，(D)要看單擺會不會彎曲變形？(E)以上皆非。
- 如果把大氣壓力視成是來自我們腦袋瓜正上頭的所有空氣的重量，則當我們進到室內，有天花板幫忙撐住絕大部份高空的空氣重量時，大氣壓力會(A)變小，(B)不變，因為天花板在微觀上還是有氣孔，所以其實沒有撐住高空空氣的重量，(C)變大，因為大樓的重量會藉由室內的空氣，轉注壓在我們可憐的頭上，(D)不變，因為空氣有溫度，透過熱運動的碰撞，可以補足原本的大氣壓力，(E)以上皆非。

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普通化學

11. Nowadays, nano materials are very important for developing nano electronics. What is the size of nano materials? (A) $1\sim 100 \times 10^{-15} \text{ m}$ (B) $1\sim 100 \times 10^{-12} \text{ m}$ (C) $1\sim 100 \times 10^{-9} \text{ m}$ (D) $1\sim 100 \times 10^{-3} \text{ m}$ (E) none of the above.
12. Of the following, the reagent frequently used in gas analysis to absorb carbon monoxide is: (A) cuprous chloride (B) calcium chloride (C) pyrogallic acid (D) sodium peroxide (E) cupric chloride.
13. The most common way to protect the surface of aluminum from corrosion by the environment is (A) Painting (B) galvanizing (C) cathodic protection (D) an oxide coating produced naturally on the aluminum surface (E) none of the above.
14. What volume of hydrogen at STP is liberated when a current of 3.0 amperes is passed through a dilute aqueous solution of sulfuric acid for a period of 2.5 hrs? (A) 6.4 L (B) 4.5 L (C) 3.8 L (D) 3.2 L (E) none of the above.
15. Which of the following causes its aqueous solution to be acidic? (A) AgNO_3 (B) CaCl_2 (C) KF (D) AlCl_3 (E) none of the above.
16. The name for a model which explains how enzymes function is the (A) glove model (B) catalytic model (C) active reaction model (D) induced-fit model (E) none of the above.
17. The largest source of radiation for human is (A) ^{40}K (B) emissions from nuclear power plants (C) radon gas (D) cosmic rays (E) none of the above.
18. Which of the following is false? (A) Addition polymers are formed from simple molecules called monomers. (B) The empirical formula of an addition polymer is that of the monomer. (C) The presence of end groups causes the empirical formula of an addition polymer to differ substantially from that of the monomer. (D) The names of addition polymers are derived by adding poly to the monomer name as a prefix. (E) none of the above.
19. Which of the following is not a CFC? (A) CCl_3F (B) $\text{CCl}_2\text{FCCl}_2\text{F}$ (C) CCl_2F_2 (D) CH_4 (E) none of the above.
20. An unknown compound which contains carbon, hydrogen, and oxygen is found to be 40.0% carbon and 6.7% hydrogen. What is the empirical formula of the compound? (A) CHO (B) C_2HO (C) CH_2O (D) CHO_2 (E) none of the above.

工程數學

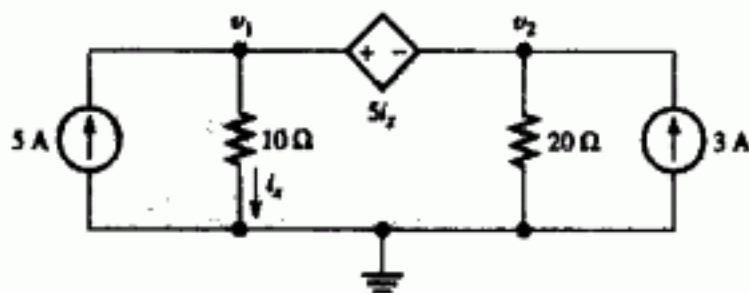
21. Which one of the following functions is a general solution of the differential equation: $y''' - y'' = 0$ (A) $A + Be^x$, (B) $A + Be^{-x}$, (C) $A + Bx + Ce^{-x}$, (D) $A + Bx + Ce^x$, (E) none of the above.
22. Which one of the following functions is a general solution of the differential equation: $y''' - y'' = 1$ (A) $A + Bx + Ce^x$, (B) $A + Bx + Ce^{-x}$ (C) $A + Bx + Cx^2 + De^{-x}$ (D) $A + Bx + Cx^2 + De^x$, (E) none of the above.
23. For the following differential equation: $x^2y''' + xy' + x^2y = 0$, $0 < x < \infty$; if we are seeking a power series solution which centers at $x = 1$, what is the radius of convergence of the power series solution. (A) 2, (B) 1/2, (C) 0, (D) ∞ , (E) none of the above.

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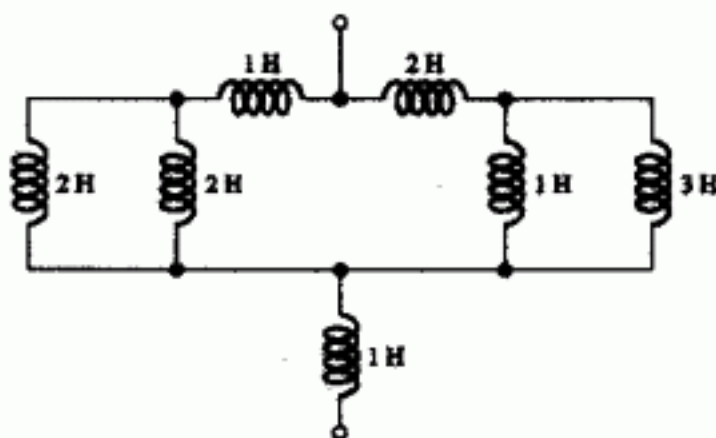
- 24 What is the inverse of the given Laplace transform: $\frac{3}{s(s+8)}$?
 (A) $\frac{3}{8} e^{-8t}$, (B) $\frac{3}{8} e^{+8t}$, (C) $\frac{3}{8} (1-e^{-8t})$, (D) $\frac{3}{8} (1+e^{-8t})$, (E) none of the above.
- 25 What is the inverse of the Laplace transform: $(s-8)e^{-s}$. (A) e^{8t} , (B) $H(t-8)e^{8t}$, (C) $H(t-1)e^{8(t-1)}$, (D) $H(t-8)e^{t-8}$, (E) none of the above. Where $H(t)$ is the Heaviside step function.
- 26 What is the Laplace transform of $t^n e^{at}$? ($n = \text{integer}$)
 (A) $\frac{n!}{s^{n+1}}$, (B) $\frac{n!}{(s-a)^n}$, (C) $\frac{n!}{(s-a)^{n+1}}$, (D) $\frac{n!}{(s+a)^n}$, (E) none of the above.
- 27 The solution of the following equation:
$$\begin{bmatrix} 1 & 2 & 0 \\ 2 & 4 & 0 \\ -1 & -2 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$
 is (A) unique, (B) 1-parameter, (C) 2-parameter, (D) 3-parameter, (E) none of the above.
- 28 Which set of vectors is a basis for \mathbb{R}^3 ? (A) $(1,1,0), (1,0,1), (0,1,1)$, (B) $(1,0,0), (1,0,1), (0,0,1)$, (C) $(-1,0,0), (1,0,1), (0,0,1)$, (D) all of the above (E) none of the above.
- 29 What is the rank of the matrix $\begin{bmatrix} 6 & 5 & 2 & 0 \\ 0 & 2 & 3 & 0 \\ 0 & 0 & 0 & 6 \end{bmatrix}$? (A) 1, (B) 2, (C) 3, (D) 4, (E) none of the above.
- 30 What is the nullity of the matrix in the previous question? (A) 0, (B) 1, (C) 2, (D) 3, (E) 4.

應用電子學

- 31 Find the value of i_x . (A) 6.4A (B) 7.4A (C) 8.4A (D) 9.4A (E) 10.4A.

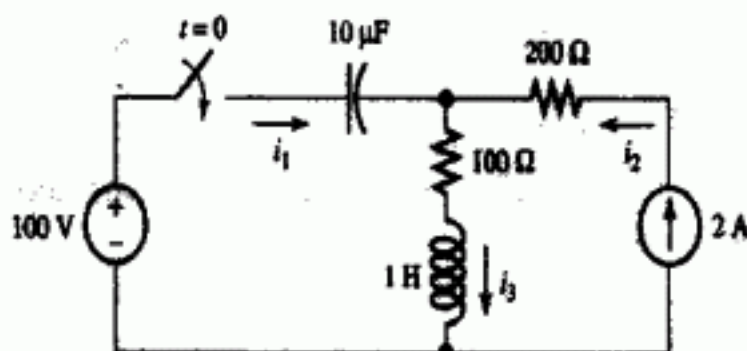


- 32 Find the equivalent inductance for the series-parallel combinations shown in below. (A) 1.158H (B) 2.158H (C) 3.158H (D) 4.158H (E) 5.158H.

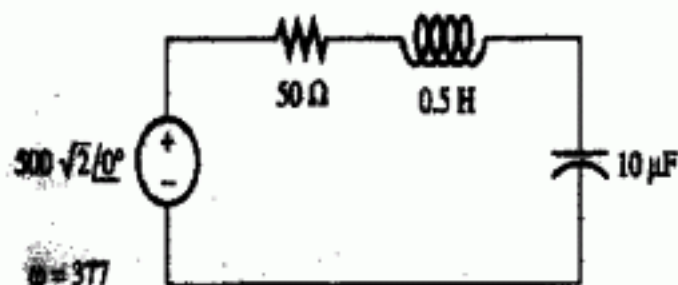


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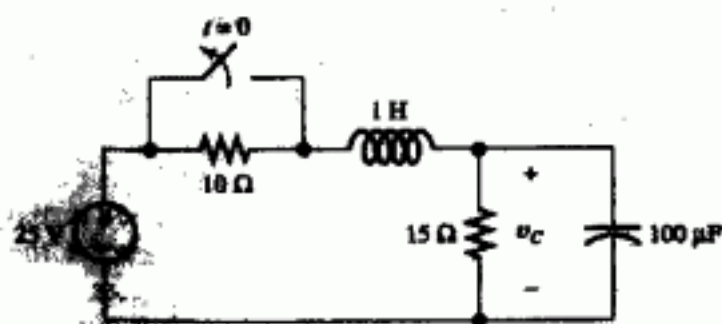
- 33 Find the steady-state value of i_3 for the circuit shown in below. (A) 1A (B) 2A (C) 3A (D) 4A (E) 5A.



- 34 Find the reactive power delivered by the source shown in below. (A) -1186VAR (B) 1186VAR (C) 2286VAR (D) -2286VAR (E) 3286VAR.



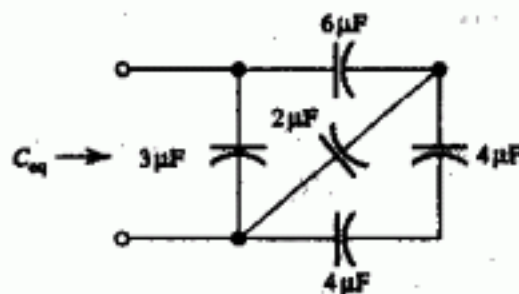
- 35 Repeat the problem 34. Find the apparent power delivered by the source. (A) 2628VA (B) 2728VA (C) 2828VA (D) 2928VA (E) 3028VA.
- 36 A parallel resonant circuit has $R = 5K\Omega$, $L = 50\mu H$, and $C = 200pF$. Determine the resonant frequency. (A) $5.592\mu Hz$ (B) $4.592\mu Hz$ (C) $3.592\mu Hz$ (D) $2.592\mu Hz$ (E) $1.592\mu Hz$.
- 37 A parallel resonant circuit has $R = 5K\Omega$, $L = 50\mu H$, and $C = 200pF$. Determine the quality factor. (A) 10 (B) 9 (C) 8 (D) 7 (E) 6.
- 38 A 200-turn coil is wound on a core having a reluctance of 5×10^5 ampere-turns/Wb. Determine the inductance of the coil. (A) 60mHz (B) 70mHz (C) 80mHz (D) 90mHz (E) 100mHz.
- 39 The circuit shown in below has been set up for a long time prior to $t = 0$ with the switch closed. Find the steady-state value of v_c after the switch has been opened for a long time. (A) 15V (B) 20V (C) 25V (D) 30V (E) 35V.



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40 Find the equivalent capacitance for the circuits shown in below.

- (A) $1.4 \mu\text{F}$ (B) $2.4 \mu\text{F}$ (C) $3.4 \mu\text{F}$ (D) $5.4 \mu\text{F}$ (E) $7.4 \mu\text{F}$.



熱力學

- 41 Assume that w is a function of variables x, y, z . Which of the following expressions shows that w is not a state function? (A) $w=x^3$, (B) $w=1/(xy+yz)$, (C) $dw=z^2 dx+x^2 dy+x^2 dz$, (D) $w=(x-a)/(y-b)$, (E) $dw=yz dx+xz dy+xy dz$.
- 42 About the monatomic ideal gas, which of the following description is correct. (A) $(\partial U/\partial V)_T < 0$, (B) $(\partial T/\partial P)_H = 0$, (C) $\alpha=(1/V)(\partial V/\partial T)_P=1/273$, (D) $S=C_V/R$, (E) $C_P=3R/2$.
- 43 One mole of perfect gas with molar heat capacity $C_V=2R$ undergoes a reversible adiabatic process to change its state from (P_i, V_i, T_i) to (P_f, V_f, T_f) . Assume that $T_f/T_i=4$, then (A) $V_f/V_i=1/2$, (B) $V_f/V_i=1/4$, (C) $V_f/V_i=1/8$, (D) $V_f/V_i=1/16$, (E) $V_f/V_i=1/32$.
- 44 One mole of perfect gas undergoes an isothermal process to change its state from (P_i, V_i, T) to (P_f, V_f, T) . Then (A) $w=P_f(V_i-V_f)$, (B) $\Delta S=P_f(V_i-V_f)/T$, (C) $\Delta H=(P_f V_f-P_i V_i)$, (D) $\Delta U=P_f(V_f-V_i)$, (E) none of above statements is correct.
- 45 In the free expansion of ideal gas, which of the following statements is correct? (A) $\Delta G < 0$, (B) $\Delta H > 0$, (C) $\Delta S < 0$, (D) $\Delta U > 0$, (E) none of them is correct.
- 46 A heat engine operated between T_2 and T_1 ($T_2 > T_1$). Then (A) the efficiency of the engine increases as T_1 increases, (B) the efficiency changes as the working substance varies if it is operated with Carnot cycle. (C) the maximum efficiency is the same for all reversible cyclic processes, (D) the efficiency is the same as long as (T_2-T_1) holds constant, (E) none of above is correct.
- 47 At a pressure of 1 atm the equilibrium melting point of a compound MX is 600 K, and, at this temperature, the latent heat of melting of MX is 3300 J/mole. Assume that the heat capacity is also the same for MX liquid and solid. When 1 mole of supercooled MX liquid spontaneously freezes at 550 K, then the entropy change of MX (in J/K) is (A) 0, (B) -5.5, (C) -6, (D) 5.5, (E) 6.
- 48 A rigid container is divided into two compartments of equal volume with a partition. One compartment contains 2 moles, and the other contains 2 moles of the same ideal gas. When the partition is removed, the entropy change is (A) 0, (B) $R(\ln 4)$, (C) $R(\ln 8)$, (D) $R(\ln 16)$, (E) $R(\ln 32)$.

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- 49 One mole of ideal gas undergoes a thermal process that changes its state from (P_i, V_i, T_i) to (P_f, V_f, T_f) . Which of the following statement is correct
 (A) $T_i = T_f$, if the process does not change the volume,
 (B) $T_i = T_f$, if the process does not involve work,
 (C) $T_i = T_f$, if the process is performed isothermally,
 (D) $T_i = T_f$, if the process does not involve heat,
 (E) none of above is correct.
- 50 One mole of ideal gas undergoes a thermal process that changes its state from (S_i, V_i, T_i) to (S_f, V_f, T_f) . Which of the following statement is correct
 (A) $S_i = S_f$, if the process is isothermal and reversible,
 (B) $S_i = S_f$, if the process is adiabatic and reversible,
 (C) $S_i = S_f$, if the process is isobaric and reversible,
 (D) $S_i = S_f$, if the process is isometric and reversible,
 (E) none of above is correct.

物理冶金

- 51 On a stereographic projection, the great circle lines represent (A) directions (B) planes (C) surface normal of planes (D) directions that lie in a plane (E) none of the above.
- 52 When energetic electron beams interact with a sample, secondary electron is one of the products of the process. The energy of the secondary electrons in on the order of (A) ~ 10 eV (B) ~ 100 eV (C) ~ 500 eV (D) ~ 1000 eV (E) ~ 5000 eV.
- 53 In a pair of inert gas atoms separated by a distance r , which of the following statement is correct? (A) The energy of the dipole-dipole interaction is approximately $\propto r^{-6}$ (B) The force on the induced dipole due to the field of the other dipole is approximately $\propto r^{-6}$ (C) The energy of the dipole-dipole interaction is approximately $\propto r^{-2}$ (D) The force on the induced dipole due to the field of the other dipole is approximately $\propto r^{-2}$ (E) none of the above
- 54 Which of the following statements about edge dislocation is incorrect? (A) the dislocation line is perpendicular to Burgers vector (B) dislocation moves in the direction of Burgers vector (C) The slip plane contains the dislocation (D) The slip plane contains the Burgers vector (E) none of the above.
- 55 For a BCC crystal, which of the following statements is correct? (A) The slip system always includes the close-packed plane (B) The slip system always includes the loose-packed plane (C) The slip system always includes the close-packed direction (D) The slip system always includes the $\langle 111 \rangle$ plane (E) none of the above.
- 56 In the dislocation model for a low angle boundary, the boundary is considered as an array of equally spaced (spacing h) edge dislocations (Burgers vector b). The angle of tilt (θ) can be expressed as (A) $\theta = 2b/h$ (B) $\theta = h/b$ (C) $\theta = b/2h$ (D) $\sin(\theta/2) = b/2h$ (E) none of the above.

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- 57 In an extended dislocation system, the partial dislocation $\frac{1}{6}[\bar{2}11]$ cross slipped from plane (111) to (11 $\bar{1}$) will create one stair-rod dislocation (with Burgers vector A) and one Shockley partial dislocation (with Burgers vector B). Which of the following combination of A and B is possible? (A) $A = \frac{1}{6}[\bar{1}\bar{1}0]$; $B = \frac{1}{6}[\bar{1}2\bar{1}]$ (B) $A = \frac{1}{6}[\bar{1}0\bar{1}]$; $B = \frac{1}{6}[\bar{1}12]$ (C) $A = \frac{1}{6}[0\bar{1}\bar{1}]$; $B = \frac{1}{3}[\bar{1}11]$ (D) $A = \frac{1}{6}[\bar{1}10]$; $B = \frac{1}{6}[\bar{1}21]$ (E) none of the above.
- 58 In a FCC crystal, a total dislocation (with Burgers vector b_1) could dissociate into two partial dislocations (with burgers vector b_2 and b_3) separated with certain distance. Which of the following parameters is irrelevant to the process? (A) $b_1^2 < b_2^2 + b_3^2$ (B) the stacking fault energy (C) the repulsive force between two partial dislocations (D) the shear modulus in the slip plane (E) none of the above.
- 59 The simplest grain growth law assumes that the rate of growth of the cell is proportional to _____. (A) temperature of the cell (B) area of the cell wall (C) curvature of the cell wall (D) diameter of the cell (E) none of the above.
- 60 In a BCC crystal, assume a system contains N atoms in the lattice site and n interstitial atoms. What is the entropy of mixing (A) $k \cdot \ln \frac{N!}{n!(N-n)!}$ (B) $k \cdot \ln \frac{3N!}{n!(3N-n)!}$ (C) $k \cdot \ln \frac{n!}{N!(N-n)!}$ (D) $k \cdot \ln \frac{2N!}{n!(2N-n)!}$ (E) none of the above. k is the Boltzman constant.

近代物理

- 61 Assume a particle is moving with a velocity v , its matter wave is described by a wave function ϕ . Which of the following descriptions about the matter wave is true? (A) the phase velocity of the matter wave can not exceed light speed (B) the particle is moving and releasing an electromagnetic wave with a wavelength of h/mv (C) the group velocity of the matter wave can exceed light speed (D) $|\phi|^2$ is an experimentally interpretable quantity (E) the group velocity of the matter wave always equals to the phase velocity.
- 62 Which of the following statements about fermions is false? (A) the spin quantum number is a half-integer (B) satisfy Pauli exclusion principle (C) electron is fermion (D) α -particle is fermion (E) neutron is fermion.
- 63 The characteristic x-ray spectrum L_{α} is resulting from electrons transition (A) K shell \rightarrow L shell (B) L shell \rightarrow M shell (C) M shell \rightarrow L shell (D) N shell \rightarrow L shell (E) N shell \rightarrow M shell.
- 64 What is the approximate intensity ratio of characteristic x-ray $K_{\alpha 1}$ and $K_{\alpha 2}$? (A) 1:1 (B) 2:1 (C) 3:1 (D) 4:1 (E) 5:1.
- 65 The total energy of a molecule can be viewed as the sum of its electronic energy, its vibrational energy and its rotational energy. The corresponding emission or absorption spectra of the above energy modes are λ_{elec} , λ_{vib} and λ_{rot} . Which of the following relations is true? (A) $\lambda_{elec} > \lambda_{vib} > \lambda_{rot}$ (B) $\lambda_{rot} > \lambda_{elec} > \lambda_{vib}$ (C) $\lambda_{elec} > \lambda_{rot} > \lambda_{vib}$ (D) $\lambda_{vib} > \lambda_{rot} > \lambda_{elec}$ (E) $\lambda_{rot} > \lambda_{vib} > \lambda_{elec}$.

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- 66 The interaction between electron orbital angular momentum and external magnetic field can be described by (A) Photoelectric effect (B) Zeeman effect (C) Pauli exclusion principle (D) spin-orbit coupling (E) hyperfine structure.
- 67 A metal plate emits photoelectrons when it is illuminated with yellow light but not when the light's color is red. The metal plate will not emit photoelectrons when illuminated with (A) green light (B) UV light (C) Infrared light (D) blue light (E) violet light.
- 68 Which of the following descriptions about fluorescence and phosphorescence effects is false? (A) $\lambda_{\text{emitted}} > \lambda_{\text{absorbed}}$ for fluorescence emission (B) $\lambda_{\text{emitted}} < \lambda_{\text{absorbed}}$ for phosphorescence emission (C) phosphorescent materials continue to glow after turning off incident radiation (D) the total spin of the molecule is conserved in fluorescence transitions (E) the excited state is generally have a total spin different from that of the ground state.
- 69 Two successive rotational spectral lines of HCL molecules are 103.7 cm^{-1} and 124.3 cm^{-1} . What is the spectral line next to the line 124.3 cm^{-1} ? (A) 144.9 cm^{-1} (B) 165.6 cm^{-1} (C) 114 cm^{-1} (D) 155.3 cm^{-1} (E) 175.9 cm^{-1} .
- 70 Considering the atomic spectra of Na element ($3p_{3/2} \rightarrow 3s_{1/2}$), how many spectral lines can be observed under weak magnetic field? (A) 3 (B) 5 (C) 2 (D) 4 (E) 6.

有機化學

- 71 Which of the following statements about p molecular orbitals is/are correct? (A) p molecular orbitals are cylindrically symmetric. (B) Most of the electron density in a p molecular orbital is centered above and below the internuclear axis. (C) When two atoms are connected by a double bond, both of these bonds are p bonds. (D) Both statements b and c are correct. (E) Statements a, b, and c are all correct.
- 72 What is the major constituent of natural gas? (A) methane (B) ethane (C) propane (D) n-octane (E) isooctane.
- 73 Which of the following statements correctly pertains to a pair of enantiomers? (A) They rotate the plane of polarized light by exactly the same amount and in opposite directions. (B) They rotate the plane of polarized light by differing amounts and in opposite directions. (C) They rotate the plane of polarized light by differing amounts and in the same direction. (D) They have different melting points. (E) They have the same melting point, but they have different boiling points.
- 74 Which of the following alkyl halides is most likely to undergo rearrangement in an SN1 reaction? (A) 3-bromopentane (B) 3-chloropentane (C) 2-chloro-3,3-dimethylpentane (D) bromocyclohexane (E) 1-bromo-4-methylcyclohexane.
- 75 What two atomic orbitals or hybrid atomic orbitals overlap to form the C-H bond in ethylene? (A) C $sp^3 + H s$ (B) C $sp^2 + H s$ (C) C $sp + H s$ (D) C $p + H s$ (E) none of the above.
- 76 Treatment of cyclopentene with peroxybenzoic acid _____ (A) results in oxidative cleavage of the ring to produce an acyclic compound (B) yields a meso epoxide (C) yields an equimolar mixture of enantiomeric epoxides (D) gives the same product as treatment of cyclopentene with OsO4 (E) none of the above.

單選題，以 2B 鉛筆劃在答案卡上；答對一題得 1 分，答錯一題倒扣 0.25 分，未答不計分。

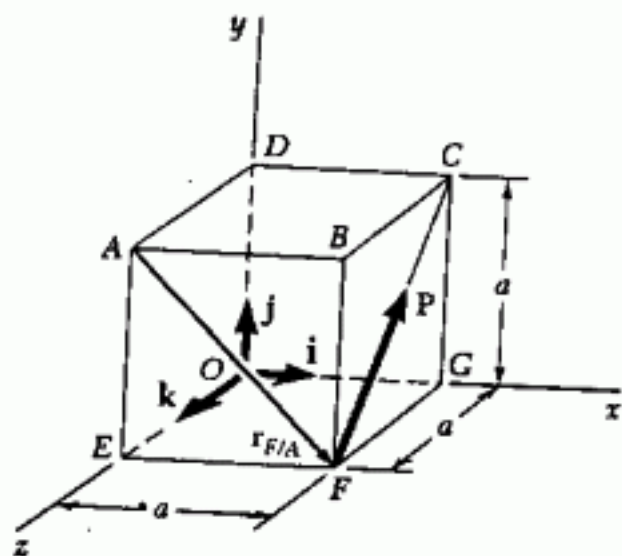
- 77 Which of the following alkyl halides would be suitable to use when forming a Grignard reagent?
 (A) $\text{H}_2\text{NCH}_2\text{CH}_2\text{Br}$ (B) $(\text{CH}_3)_2\text{NCH}_2\text{CH}_2\text{Br}$ (C) $\text{CH}_3\text{COCH}_2\text{CH}_2\text{Br}$ (D) $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{CN}$
 (E) all of the above.
- 78 Which compound would be expected to show intense IR absorption at $3363, 3185, 1660 \text{ cm}^{-1}$?
 (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ (B) $(\text{CH}_3)_2\text{CHNH}_2$ (C) $\text{CH}_3\text{CH}_2\text{CONH}_2$ (D) 1-butene (E) 2-propanol.
- 79 What multiplicities are observed for the signals in the off-resonance decoupled ^{13}C spectrum of 2-chloropropene? (A) 3 singlets (B) 2 singlets and a doublet (C) a singlet and 2 doublets (D) a singlet, a doublet and a triplet (E) a singlet, a triplet, and a quartet.
- 80 In the addition of hydrogen bromide to alkynes in the absence of peroxides, which of the following species is believed to be an intermediate? (A) vinyl anion (B) vinyl cation (C) vinyl radical (D) carbene (E) none of the above.

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- 81 Choose the wrong one from the following statements. In order to have uniform tension or compression in a prismatic bar (A) the axial force must act through the centroid of the cross-sectional area, (B) the axial force must within the proportional limit, (C) homogeneous in composition of the bar, (D) no sharp change in dimension of the bar, (E) linear relationship between stress and strain.

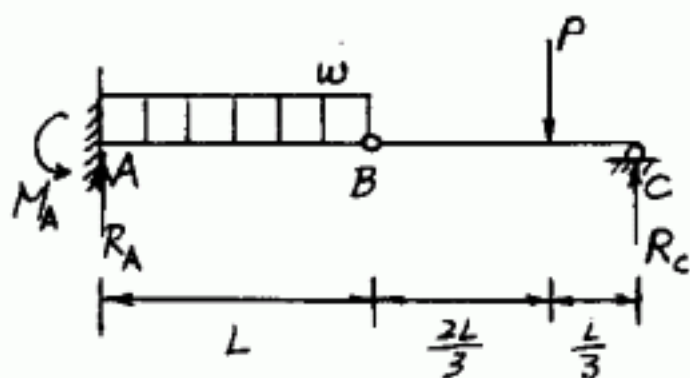
A cubic of side a is acted upon by a force P as shown.

- 82 The moment of P about point A is (A) $0.5 a P (i + j + k)$
 (B) $0.577 a P (i + j + k)$ (C) $0.707 a P (i + j + k)$
 (D) $a P (i + j + k)$ (E) $2 a P (i + j + k)$.
- 83 The moment of P about axis AB is
 (A) $0.5 a P$ (B) $0.577 a P$ (C) $0.707 a P$
 (D) $a P$ (E) $2 a P$.
- 84 The moment of P about axis AG is (A) $-0.25 a P$
 (B) $-0.408 a P$ (C) $-0.5 a P$ (D) $-0.577 a P$
 (E) $-0.707 a P$.



A compound beam ABC is loaded by distributed load ω over AB and a concentrated load P at point D

- 85 The reaction R_A is (A) $P/3 + \omega L/2$ (B) $P/3 + \omega L$
 (C) $P/2 + \omega L/2$ (D) $P/2 + \omega L$ (E) $2P/3 + \omega L/2$.
- 86 The reaction R_C is (A) $P/3 + \omega L/2$ (B) $2P/3 + \omega L/2$
 (C) $P/3$ (D) $P/2$ (E) $2P/3$.
- 87 The moment M_A is (A) $PL/3 + \omega L^2/2$ (B) $PL/3 + \omega L^2/3$
 (C) $PL/2 + \omega L^2/2$ (D) $PL/2 + \omega L^2/3$ (E) $PL + \omega L^2/2$.



單選題，以 2B 鉛筆劃在答案卡上；答對一題得 1 分，答錯一題倒扣 0.25 分，未答不計分。

A compound truss is loaded by two concentrated loads as shown

88 How many zero-force-member in the truss?

(A) 6 (B) 7 (C) 8 (D) 9 (E) 10.

89 The force in member DE is (A) 10 kN

(B) 12 kN (C) 15 kN (D) 18 kN (E) 20 kN.

90 The force in member GH is (A) - 14.14 kN

(B) - 16.97 kN (C) - 21.21 kN (D) - 25.46 kN

(E) - 28.28 kN

