國　立　清　華　大　學　命　題　紙

九十三學年度 材料科學工程 系（所） 組碩士班入學考試

科目 理工學力測驗一 科號 1301 共 14 頁第 1 頁 *請在試卷【答案卷】內作答

普通物理

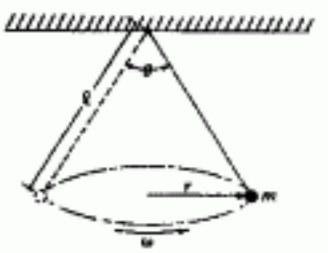
1. 地球對某點質量的引力強度可表示成 $F(r)$，其中 r 表示地球中心到這點質量的距離。假設地球質量均勻分布，且地球半徑可以表示成 R，那麼 $F(R)/F(\frac{1}{3}R)$ 的比值是多少: (a) 9　(b) 3　(c) 1　(d) 1/3　(e) 1/9

2. 兩個泥球 A 與 B，質量分別是 M 與 $3M$，各以繩長 L 懸掛在天花板上。假設球 A 被舉到高度 h_0 然後放掉，接著與球 B 碰撞並黏在一起。請問碰撞後兩球最大的擺盪高度是: (a) $\frac{1}{16}h_0$　(b) $\frac{1}{8}h_0$　(c) $\frac{1}{4}h_0$　(d) $\frac{1}{2}h_0$　(e) h_0

3. 對理想氣體來說，定壓比熱 Cp 比定容比熱 Cv 要來的高。下列何者爲是: (a) 當溫度增加時，定壓條件下氣體可以作功　(b) 當溫度增加時，定容條件下氣體會作功　(c) 溫度升高 1°C 時，定容比定壓條件需要更多的熱能　(d) 溫度升高 1°C 時，定壓時的內能變化比定容時多　(e)以上皆非

4. 假設有一彈簧其延伸距離與力的關係是 $F = -kx^3$，其中 k 是比例常數。請問彈簧儲存的彈性位能 U 是: (a) $-3kx^2$　(b) $3kx^2$　(c) $\frac{1}{4}kx^4$　(d) $4kx^4$　(e) $-\frac{1}{4}kx^4$

5. 一質量 m 掛在一段長度爲 ℓ 的繩子上。如果此一質量以半徑 r 做等速度的水平迴旋且其角頻率 ω，如右圖。則繩子上所受到的張力爲: (a) $mg(\frac{r}{\ell})$　(b) $m\omega^2 r$　(c) $m(\omega^2 r^2 + g^2)^{1/2}$　(d) $m(\omega^4 r^2 + g^2)^{1/2}$　(e) mg



6. 一均勻木棒長度 L 質量 M 躺在水平無磨擦的桌面上。現在有一質量 m 的小球以速度 v 撞上這木棒的一端，碰撞後小球靜止不動。假設這是一個完全彈性碰撞，請問碰撞後木棒的質心速度 V 是: (a) $\frac{m}{M}v$　(b) $\frac{m}{M+m}v$　(c) $\sqrt{\frac{m}{M}}v$　(d) $\frac{3m}{M}v$　(e) $\frac{Mm}{M+m}v$

7. 對一個粒子數固定的系統，凱式溫度(T: Kelvin)的倒數可以用下列甚麼方式來表示(令 P 表溫度、V 表體積、S 表 Entropy、U 表內能): (a) $\left(\frac{\partial P}{\partial V}\right)_S$　(b) $\left(\frac{\partial P}{\partial S}\right)_V$　(c) $\left(\frac{\partial V}{\partial P}\right)_U$　(d) $\left(\frac{\partial S}{\partial U}\right)_V$　(e) $\left(\frac{\partial V}{\partial S}\right)_P$

8. 雙原子理想氣體的定容比熱(C_v)定壓比熱(C_p)的比值 C_v/C_p 約爲: (a)1.67 (b) 1.40 (c)1.33 (d)0.7 (e)0.6

9. 一南極浮冰密度 920 kg/m^3 漂浮在海水中，海水密度 1025 kg/m^3。請問浮在海面上的冰山一角佔整個浮冰體積比例是多少: (a)920/1025 (b)1025/920 (c)105/1025 (d)105/920 (e)210/(920+1025)

10. 火星的半徑只有地球的 1/2，質量是地球的 1/10，火星上重力場強度是地球的: (a)5 (b)1/5 (c)2/5 (d)5/2 (e)一樣

普通化學

11. In the following reaction, which species is the reducing agent?

$3Cu + 6H^+ + 2HNO_3 \rightarrow 3Cu^{2+} + 2NO + 4H_2O$

(a) H^+ (b) Cu (c) N in NO (d) Cu^{2+} (e) N in HNO_3

12. Given a cylinder of fixed volume filled with 1 mole of argon (Ar) gas, which of the following in correct? (Assume all gases obey the ideal gas law.)

(a) If the temperature of the cylinder is changed from 25 ˚C to 50 ˚C, the pressure inside the cylinder will double.

(b) If a second mole of argon is added to the cylinder, the ratio T/R would remain constant.

(c) A cylinder of identical volume filled with the same *pressure* of helium (He) must contain more atoms of gas because He has a smaller atomic radius than argon.

(d) Two of the above.

(e) None of the above.

13. For the following reaction $PCl_5 \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$

ΔH = -89 kJ. How can the equilibrium be shifted to the right?

(a) Add more PCl_5

(b) Decrease the pressure by changing the volume

(c) Remove PCl_3

(d) Remove Cl_2

(e) All of the above

14. For which process is ΔS negative?

(a) Evaporation of 1 mole of CCl_4(l)

(b) Mixing 5 mL ethanol with 20 mL water

(c) Compressing 1 mole Ne at constant temperature from 1.5 atm to 0.5 atm

(d) Grinding a large crystal of KCl to powder

(e) Raising the temperature of 100 g Cu from 275 K to 295K

15. Place the elements S, Cl, and F in order of increasing ionization energy.

(a) S, Cl, F (b) Cl, F, S (c) F, S, Cl (d) F, Cl, S (e) S, F, Cl

16. Which compound does not contain both polar covalent and ionic bonds?

(a) NaOH (b) NH_4NO_3 (c) $KC_2H_3O_2$ (d) CH_3OH (e) All of the above contain both polar covalent and ionic bonds.

17. The molecular XCl_5^- has a square pyramid shape. Which of the following atoms could be X?

(a) O (b) Xe (c) S (d) P (e) Two of the above atoms could be X.

18. The fact that O_2 is paramagnetic can be explained by

(a) the Lewis structure of O_2
(b) the molecular orbital diagram for O_2
(c) resonance
(d) hybridization of atomic orbitals in O_2
(e) a violation of the octet rule

19. What is the rate law for the following reaction, given the data below?

$2NO + H_2 \rightarrow N_2O + H_2O$

Experiment	Initial [NO] (mol/L)	Initial [H_2] (mol/L)	Initial Rate of Disappearance of NO (mol/L • s)
1	6.4×10^{-3}	2.2×10^{-3}	2.6×10^{-5}
2	12.8×10^{-3}	2.2×10^{-3}	1.0×10^{-4}
3	6.4×10^{-3}	4.5×10^{-3}	5.1×10^{-5}

(a) Rate = $k[NO]^2[H_2]$ (b) Rate = $k[NO]^2$ (c) Rate = $k[NO]^2[H_2]^2$ (d) Rate = $k[NO][H_2]$
(e) Rate = $k[NO][H_2]^2$

20. Sodium oxide (Na_2O) crystallizes in a structure in which the O^{2-} ions are in a face-centered cubic lattice and the Na^+ ions are in tetrahedral holes. The number of Na^+ ions in the unit cell is: (a) 2 (b) 4 (c) 6 (d) 8 (e) none of the above

工程數學

21. The general solution of $y'' - y = 0$ is (a) $Ae^x + Be^{-x}$, (b) $A\sin x + B\cos x$, (c) $Ae^x + Be^{ix}$, (d) $Ae^{ix} + Be^{-ix}$,

(e) none of the above.

22. The general solution of $y'' - y = 1$ is (a) $Ae^x + Be^{-x} + C$, (b) $A\sin x + B\cos x + C$, (c) $Ae^x + Be^{ix} + C$,

(d) $Ae^{ix} + Be^{-ix} + C$, (e) none of the above.

23. The general solution of the equation: $x^2y'' - 2xy' - 10y = 0$ is $y(x) =$ (a) $Ax^2 + Bx^5$, (b) $Ax^2 + Bx^{-5}$,

(c) $Ax^{-2} + Bx^5$ (d) $Ae^{-2x} + Be^{5x}$, (e) none of the above.

24. The general solution of the equation: $x^3y' + x^2y = 1, (x > 0)$ is $y(x) =$ (a) $\frac{C}{x} - \frac{\ln x}{x}$, (b) $\frac{C}{x} - \frac{1}{x}$, (c) $\frac{C}{x} - \frac{1}{x^2}$, (d) $\frac{C}{x} - \frac{1}{x^3}$, (e) none of the above.

25. The series $\sum_0^\infty \frac{1}{5^n}x^n$ converges in (a) $|x| < 5$, (b) $|x| > 5$, (c) $|x| < \sqrt{5}$, (d) $|x| > \sqrt{5}$, (e) none of the above.

26. Solve $(x+1)y'' + y' + 2(x-1)y = 0$ by the power series method $y(x) = \sum_0^\infty a_n(x-4)^n$. The radius of convergence R of the power series solution is (a) 1, (b) 3, (c) 5, (d) ∞, (e) none of the above.

27. Solve $(1-x^2)y'' - 2xy' + 6y = 0$ by a power series solution $y(x) = \sum_0^\infty a_n(x-1)^n$. The radius of convergence R of the power series solution is (a) 1, (b) 3, (c) 5, (d) ∞, (e) none of the above.

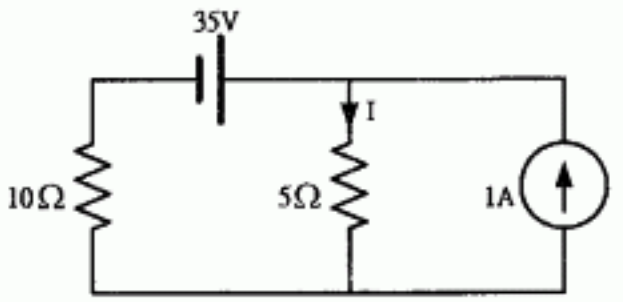
28. The Laplace transform of the unit step function H(t) is (a) e^{-s}, (b) e^s, (c)1, (d)$\frac{1}{s}$, (e) none of the above.

29. The Laplace transform of the function $t\sin t$ is (a)$\frac{1}{s^2+1}$, (b)$\frac{1}{s^2-1}$,(c)$\frac{2s}{s^2+1}$, (d)$\frac{2s}{s^2-1}$, (e) none of the above.

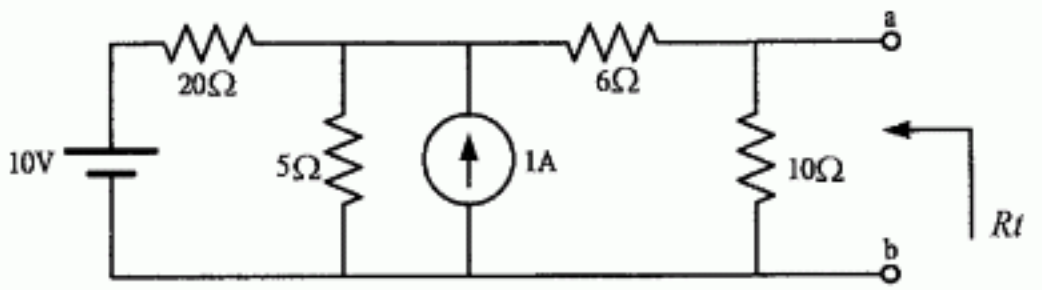
30. If the inverse Laplace transform of $\frac{2s+1}{s^2+2s+4}$ is f(t), then f(0) is (a) 0, (b)$\frac{1}{2}$, (c) 1, (d) 2, (e) none of the above.

應用電子學

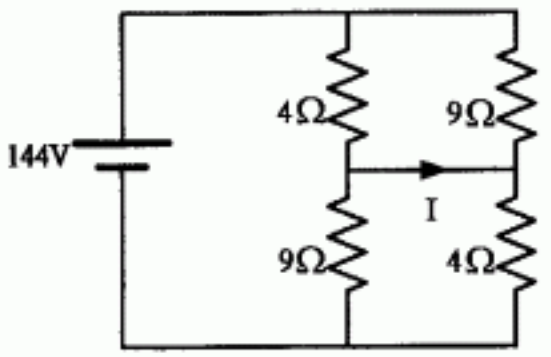
31. Find I for the following circuit. I = (a) 1A (b) 2A (c) 3A (d) 4A (e)5A.



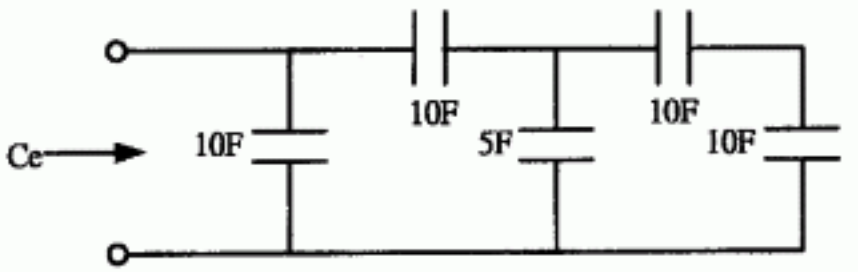
32. Find the Th'evenin resistance looking into terminals a,b for the circuit shown below. Rt= (a) 3Ω (b) 4Ω (c) 5Ω (d) 6Ω (e)7Ω.



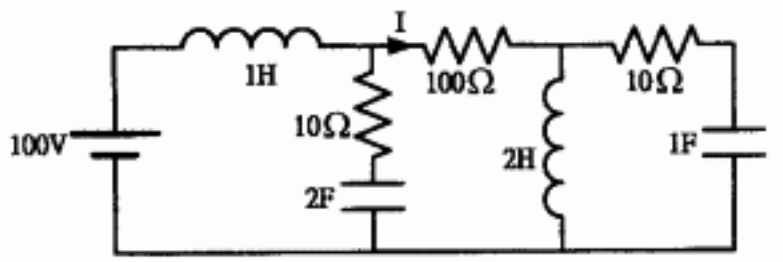
33. Find current I in the following circuit. I= (a) 8A (b) 9A (c) 10A (d) 11A (e) 12A.



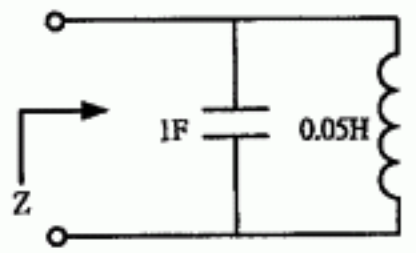
34. Find the equivalent capacitance "Ce" of the following circuit with zero initial voltage for all capacitors.
Ce= (a) 10F (b) 12F (c) 13F (d) 14F (e) 15F.



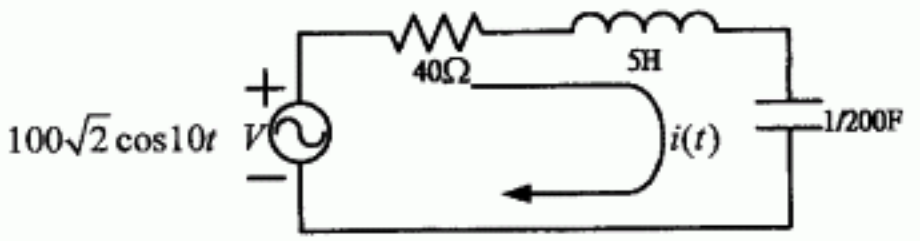
35. Find the steady state value of I in the following circuit. I = (A) 1A (B) 2A (C) 3A (D) 4A (E)5A.



36. Find the complex impedance "Z" of the following network for $w = 10$ rad/sec.
Z= (a) –j10Ω (b) –j8Ω (c) 0Ω (d) j8Ω (e) j10Ω.



37. Given the following circuit under sinusoidal steady state.



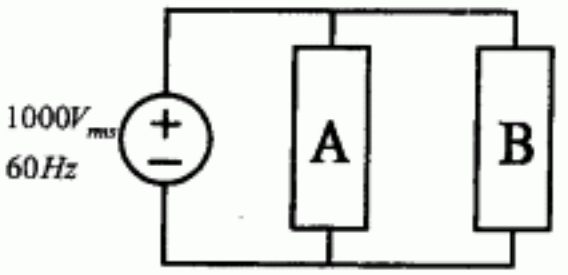
Find the root mean square(RMS) value" I " of current $i(t)$.

I= (a) 1A (b) 2A (c) 3A (d) 4A (e) 5A.

38. Repeat the previous problem , find the reactive power "Q" delivered by the voltage source.
(a)–120 vars (b) –60 vars (c) 60 vars(d) 120 vars (e)150 vars.

39. Repeat the previous problem , calculate the power factor of the series RLC load.
(a)1.0 (b) 0.9 (c) 0.8 (d) 0.7 (e)0.6.

40. Two loads A and B are connected as follows across a 1KV rms , 60Hz voltage source. Load A consumes 10KW with a 0.90 lagging power factor. Load B has an apparent power of 15KVA with an 0.80 lagging power factor. Find the real power delivered by the voltage source.
(a) 10KW (b) 14KW (c) 18KW (d) 22KW (e)26KW.



熱力學

41. In the case of ideal gas (PV = nRT; n = 1) the relationship between the heat capacity at constant volume (C_v) and at constant pressure (C_p) is $C_p = C_v + A$, what the R stands for?
(a) $A = dV/dT$
(b) $A = \alpha^2VT/\beta$; α = thermal expansion coefficient, β = compressibility
(c) $A = 1/V(\partial P/\partial T)$
(d) $A = P + \partial V/\partial T$
(e) $A = \alpha^2/\beta$

42. In the P-V diagram, the Carnot cycle efficiency is expressed as
(a) $w/q \times 100\%$; $w = V_2\text{-}V_1$, q: heat input to the system
(b) $w/q \times 100\ \%$; $w = P_2\text{-}P_1$, q: work done to the surrounding
(c) $w/q \times 100\%$; w = work done onto the system, q: heat input to the system
(d) $R = \partial P/\partial T + \partial V/\partial T$
(e) $R = DQ - PdV$

43. Which of following is correct description?
(a) The temperature of plastic materials within an isobaric condition remains unchanged when a load is applied---*thermoelastic effect*.
(b) The partial pressure of a component gas is the product of its mole fraction and the total pressure of the gas mixture----*Dalton's law of partial pressures*.
(c)The heat and work constitute the entropy----*the second law of thermodynamics*.
(d)At the transition temperature the reaction of $\Delta G = 1$---*First order phase transition*.
(e)The thermal expansion coefficient α is equal to $1/V\ (\partial V/\partial P)$.

44. For a change of state from A to B the first law of thermodynamics gives an expression of

(a) $U = (q_A - q_B) - w$

(b) $U = q - (w_A - w_B)$

(c) $\Delta U = q - w$; $\Delta U = U_A - U_B$

(d) $\Delta U = q - (w_A - w_B)$

(e) $U = (q_A - q_B) - (w_A - w_B)$

45. which of following is incorrect for the entropy definition

(a) A measure of system disordering

(b) A measure of the multiplicity of a system

(c) A time arrow

(d) The heat energy Q is adsorbed when a state changes at temperature T in a reversible condition, $\Delta S = Q/T$

(e) A state changes naturally from high to low values of entropy.

46. The *Gibbs phase rule* is used to describe which of following

(a) Energy requirement for the phase separation in a binary system

(b) Degree of freedom

(c) The energy requirement for the state change from solid to liquid

(d) The energy requirement for maintaining an equilibrium between liquid-liquid phase.

(e) The energy requirement for maintaining an equilibrium between solid-liquid phase.

47. A heat transfer from a hot body (A) to cold body (B) and eventually both reaching a same temperature level are

(a) When the heat is transferring from A to B is a reversible process and both reaching the same temperature is an irreversible process.

(b) Both processes are irreversible process.

(c) Both processes are reversible.

(d) Both processes increase the total value of entropy ΔS.

(e) When the heat is transferring from A to B is an irreversible process and both reaching the same temperature is a reversible process.

48. Which of following is not Maxwell's equations

(a) $(\partial U/\partial P)_v = (\partial H/\partial T)_p$

(b) $(\partial T/\partial V)_s = -(\partial P/\partial S)_v$

(c) $(\partial T/\partial P)_s = (\partial V/\partial S)_p$

(d) $(\partial S/\partial V)_T = (\partial P/T\partial)_v$

(e) $(\partial S/\partial P)_T = -(\partial V/\partial T)_p$

49. The pressure (P) and volume (V) of the ideal gas in a reversible adiabatic process is:

(a) PV^{γ} = variables; $\gamma = C_p/C_v$

(b) PV^{γ} = constant; $\gamma = C_p/C_v$.

(c) $\partial P/\partial T = \partial V/\partial T = \Delta U$

(d) $\partial P/\partial T = \partial V/\partial T = \Delta S$

(e) $P^{\gamma}V$ = constant; $\gamma = C_p/C_v$.

50. In a binary solution

(a) The solute and solvent obey the *Raoult*' and *Henry*'s laws respectively.

(b) The solute and solvent obey the *first law of thermodynamics*.

(c) The solute and solvent obey the *Henry*' and *Raoult*'s laws respectively.

(d) Both solute and solvent obey *Raoult*'s law at zero temperature.

(e) Both solute and solvent obey *Henry*'s law at room temperature

物理冶金

51. The contrast shown in scanning electron microscopy represents the (a) depth difference (b) composition (c) surface inclination (d) phase (e) structure of the sample.

52. What physical parameter could the Bragg law be used to determine? (a) thickness of a solid (b) structure of a crystal (c) order of an amorphous (d) composition of a solid (e) none of the above.

53. Which phenomenon is not related to the interaction between a beam of electrons, with energy of several tens of KeV, and materials? (a) emission of secondary electrons (b) emission of characteristic X-ray (c) elastically backscattered electron (d) emission of ion (e) emission of Auger electrons.

54. The dislocation energy is proportional to n^{th} power of the Burgers vector. n = (a) 1/2 (b) 1 (c) 3/2 (d) 2 (e) 3.

55. When considering whether a dislocation could dissociate into partial dislocations in FCC crystal, beside the sum of the two partial dislocations should be smaller than the original dislocation, another energy need to be considered is the (a) stacking fault energy (b) binding energy (c) crystallization energy (d) thermal energy (e) none of the above.

56. Slip system for a crystal consists of slip direction and slip plane. Which of the following statement is wrong? (a) The major slip direction for a FCC crystal is in the <110> direction (b) The major slip direction of a BCC crystal is in the <111> direction (c) The major slip plane for a hexagonal crystal with c/a ratio smaller than 1.63 is the basal plane (d) The major slip plane for a FCC crystal is the {111} plane. (e) In BCC crystal, the slip direction is more important than the slip plane.

57. In FCC crystals, the dynamic recovery is much easier to occur for a crystal (a) with small stacking fault energy (b) with high surface energy (c) with small dislocation density (d) with dislocations that are easier to do cross-slip (e) none of the above..

58. The discontinuous nature of dislocation movement implies that the dislocation is (a) a partial dislocation (b) blocked by obstacles (c) moving slowly (d) cross slipped (e) none of the above.

59. Orowan Equation is simply related the applied strain rate to (a) the elastic modulus (b) binding energy (c) the crystallization speed (d) the temperature (e) the dislocation velocity of the crystal

60. In derivation of the equilibrium vacancy concentration in a crystal, the energy consideration includes two terms, one is the enthalpy increase due to the vacancies and the other is (a) entropy of mixing (b) entropy of vibration (c) internal energy (d) Gibbs free energy (e) none of the above

近代物理

61. Which statement for orbital quantum number ℓ or magnetic quantum number m_ℓ is **not** correct? (a) ℓ is smaller than the principal quantum number (b) Electron angular momentum is proportional to $\ell^{1/2}$ (c)space quantization of the orbital angular momentum is associated with ℓ (d) The maximum m_ℓ is ℓ (e) the letter corresponding to the electron angular-momentum state of ℓ=3 is *f*.

62. A sample of a certain element is placed in a 0.6 T magnetic field and suitably excited. How far apart are the Zeeman components of the 450-nm spectra line of the element? (the charge of electron=1.6×10^{-19}C and its mass=9.1×10^{-31}kg)
(a)0.00283nm (b)0.00566 nm (c) 0.00142 nm (d)0.00425 nm (e)0.00708 nm.

63. Which answer is **not** the possible values of the total angular-momentum quantum number J under LS coupling of two atomic electrons whose orbital quantum number are ℓ_1=1 and ℓ_2=2. (a)0 (b)1 (c)2 (d)4 (e)5

64. The term symbol of the first excited state of Na is $3^2P_{1/2}$. Which one is **not** possible quantum numbers of the outer electron. (1) n=3 (b) ℓ=1 (c) j=1/2 (d) j=5/2 (e) m_j= -1/2.

65. The J=0 ⟶ J=1 rotational absorption line occurs at 1.153×10^{11} Hz in $^{12}CO^{16}$ and at 1.102×10^{11} Hz in $^{?}C^{16}O$. What is the mass number of the unknown carbon isotope ? (a) 13 (b) 12 (c) 14(d) 15 (e) 11.

66. The hydrogen isotope deuterium has an atomic mass approximately twice that of ordinary hydrogen. Which statement is **not** correct for HD and H_2? (a) HD has the greater reduced mass (b)HD has smaller frequency of vibration energy (c) HD has smaller zero-point energy (d) HD has smaller binding energy (e) the zero-point energy of HD can contribute less energy to the splitting of the molecule.

67. What is the average molecular energy of an ideal-gas molecule at room temperature (a) 0.04 eV (b) 0.1 eV (c) 0.25 eV (d) 0.7 eV (e) 0.07 eV.

68. Which statement is **not** correct? (a) molecules of a gas obey Maxwell-Boltzmann distribution (b) phonons in a solid obey Boes-Einstein distribution. (c) Fermions have integral spins. (d) Bosons have no limits to numbers of particles per state. (e)Fermions have never more than 1 particle per state.

69. Which statement is **not** correct? (a) Cv~3R for most solids at room temperature. (b) electrons in metals have almost no contribution to Cv at roomperature (c) Lead has higher Cv than carbon at 100 K. (d) electrons in metal can contribute Cv of 3R/2. (e) At temperature lower than 100 K, the Cv of lead increases with temperature.

70. The Fermi energy of Al is 11.8 eV. What is the average electron energy at T=0 k. (a)11.8 eV (b)7.08 eV (C) 5.9 eV (d) 4.72 eV (e) 23.6 eV.

有機化學

71. An ylide is a molecule that can be described as a:
    (a) carbanion bound to a negatively charged heteroatom.
    (b) carbocation bound to a negatively charged heteroatom.
    (c) carbocation bound to a carbanion.
    (d) carbocation bound to a diazonium ion.
    (e) carbanion bound to a positively charged heteroatom.

72. Which of the following reagents will quantitatively convert an enolizable ketone to its enolate salt?
    (a) lithium hydroxide
    (b) lithium diisopropylamide
    (c) methyllithium
    (d) diethylamine
    (e) pyridine

73. When a high energy electron impacts molecule M in the ionization chamber, what type of species is initially produced?
    (a) anion
    (b) cation
    (c) radical
    (d) radical anion
    (e) radical cation

74. Absorption of what type electromagnetic radiation results in transitions among allowed vibrational motions?.
    (a) X-rays
    (b) radio waves
    (c) microwaves
    (d) ultraviolet light
    (e) infrared light

75. The Diels-Alder reaction is a concerted reaction; this means:

(a) a mixture of endo and exo products are formed.

(b) all bond making and bond breaking occurs simultaneously.

(c) the products contain rings.

(d) the reaction follows Markovnikov's rule.

(e) the reaction is highly endothermic.

76. Which of the following compounds has the lowest boiling point?

(a) 1,2,3-trichlorobenzene

(b) 1,2,4-trichlorobenzene

(c) o-dichlorobenzene

(d) m-dichlorobenzene

(e) p-dichlorobenzene

77. What intermediate occurs when a ketone undergoes a Wolff-Kishner reduction?

(a) a hydrazone

(b) a hydrated aldehyde

(c) a carboxylate

(d) an amalgam

(e) a cyanohydrin

78. Which of the following is also known as a Schiff base?

(a) an imine

(b) a cyanohydrin

(c) a hydrate

(d) sodium hydroxide

(e) an aldehyde

79. Which of the following compounds is the strongest acid?

(a) p-nitrobenzoic acid

(b) p-bromobenzoic acid

(c) m-methylbenzoic acid

(d) m-methoxybenzoic acid

(e) water

80. Which of the statements below correctly describes an achiral molecule?

(a) The molecule has a nonsuperimposable mirror image.

(b) The molecule exhibits optical activity when it interacts with plane-polarized light.

(c) The molecule has an enantiomer.

(d) The molecule might be a meso form.

(e) None of the above

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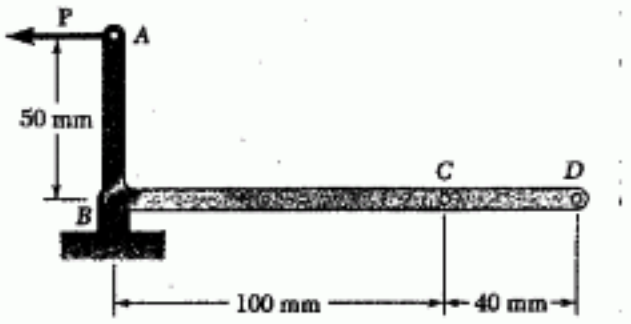
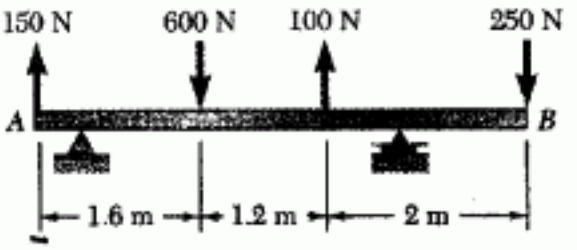
81. The 100-N horizontal force P acts on a bell crank as shown. Replace P with an equivalent force-couple system at B.



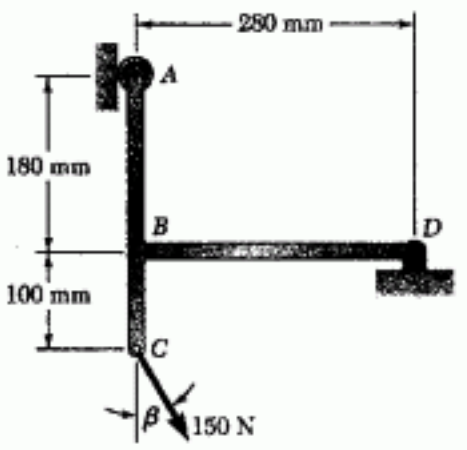
(a) F = 100 N→; M= 5 N· m counterclockwise
(b) F = 100 N←; M= 5 N· m counterclockwise
(c) F = 50 N→; M= 5 N· m clockwise
(d) F = 50 N←; M= 5 N· m counterclockwise
(e) F = 100 N←; M= 5 N· m counterclockwise

82. A 4.8-m-long beam is subjected to the forces shown. Reduce the given system of forces to an equivalent force-couple system at the center point of the beam.



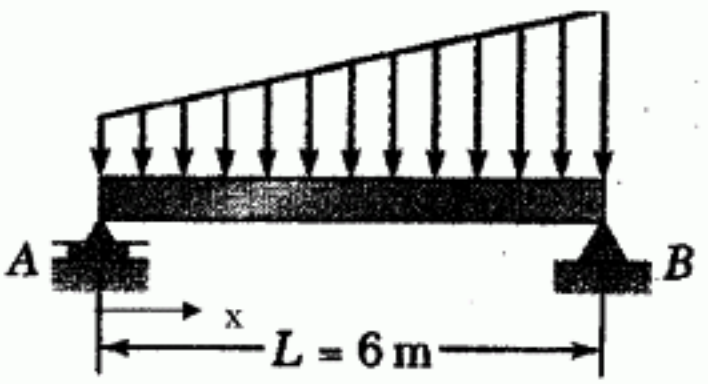
(a) F = 600 N ↓ ; M = 540 clockwise
(b) F = 600 N ↓ ; M = 540 counterclockwise
(c) F = 600 N ↑ ; M = 540 clockwise
(d) F = 600 N ↑ ; M = 540 counterclockwise
(e) F = 750 N ↑ ; M = 450 counterclockwise

83. For the frame and loading shown. Determine the reaction R at A when $\beta = 45^0$.



(a) 244 N ←; (b) 244 N →; (c) 224 N ←; (d) 224 N → ; (e) 244 N ↑

84.~85. A beam supports a distributed load F(x) as shown, The load equation F(x) = 2000 + 600 x (N/m). Where x is the distance from A.



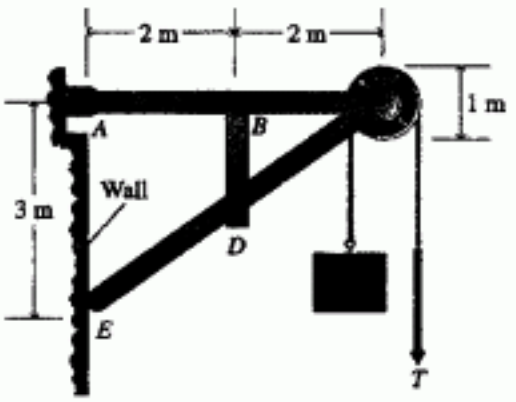
84. Determine the equivalent concentrated load.

(a) 20.8 kN ↓ , located 3.47 m to the right of A;
(b) 22.8 kN ↓ , located 3.47 m to the right of A;
(c) 20.8 kN ↓ , located 4.37 m to the right of A;
(d) 22.8 kN ↓ , located 4.37 m to the right of A;
(e) 22.8 kN ↓ , located 4.37 m to the right of A;

85. Determine the reactions at the supports B.

(a) 13.2 kN ↓ ; (b) 12.3 kN ↑ ; (c) 13.2 kN ↑ ; (d) 12.3 kN ↓ ; (e) None of the above

86.~88. The hoist frame is used to lift the weight W. As shown, the pulley balances the weight W. For W = 6 kN.



86. The reaction at point E is

(a) 10.67 kN; (b) 4 kN; (c) 8 kN; (d) 16 kN; (e) None of the above

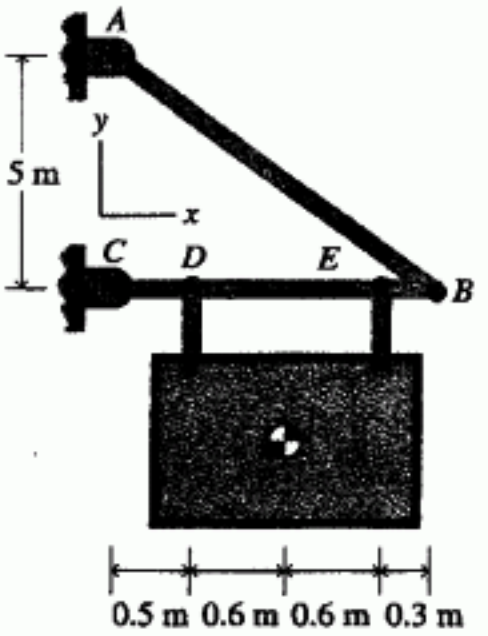
87. The vertical component of reaction at point A is

(a) 10.67 kN; (b) 4 kN; (c) 8 kN; (d) 16 kN; (e) None of the above

88. The force in member BD is

(a) 10.67 kN; (b) 4 kN; (c) 8 kN; (d) 16 kN; (e) None of the above

89.~90.A heavy sign that weight = 9.0 kN is hung from a structure mechanism, as shown. All the pins are frictionless.



89. The force in bar AB is

(a) 8.25 kN; (b) 9.0 kN; (c) 6.6 kN; (d) 4.05 kN; (e) Nono of the above

90. The reaction at point A is

(a) 8.25 kN; (b) 9.0 kN; (c) 6.6 kN; (d) 4.05 kN; (e) Nono of the above