九十二學年度材料科學工程學系碩士班研究生招生考試

科目 理工學力測驗二 科號 1102 共 11 頁第 1 頁

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。

普通物理

1. 大雄上普物實驗時，記錄繩波上某一點的垂直位移爲 $y(t)=(5\text{cm})\cos(4t+\pi/4)$。請問當位移爲 3 cm 時其速率爲_____cm/s。

   (A)9　(B)12　(C)16　(D)18　(E)4

2. 在一次太空任務中，宜靜與大雄在地面上以 1 GHz 頻道通訊。大雄登上太空梭，遠離宜靜所在的塔台時，發現要將頻率調低成 0.5GHz 才能聽到宜靜的甜美聲音。那麼塔台裏的宜靜要將頻道調整爲_____GHz 才能收到大雄的訊號。

   (A)2　(B)3/2　(C)2/3　(D)1/2　(E)1

3. 大雄在試車時發現車子引擎自靜止到 15 轉／sec 共繞了 600 轉。若用同樣的角加速度，從 15 轉／sec 到 60 轉／sec 要花_____秒的時間。

   (A)240　(B)200　(C)180　(D)120　(E)90

4. 小叮噹在喝可樂時，注意到浮在上面的冰塊其實在作小振幅的簡諧運動。隨著冰塊逐漸化掉，其振盪週期會

   (A)變長　(B)變短　(C)不變　(D)先變長然後慢慢又縮短　(E)和喝那種品牌的可樂有關(因爲密度不同)

5. 宜靜和大雄在斜面上玩。假設宜靜所在高度比大雄高 h，她如果把一個呼拉圈滾下去給大雄，等大雄接到時，呼拉圈的質心速度爲_____$\times\sqrt{gh}$

   (A)$\sqrt{4/3}$　(B)$\sqrt{2}$　(C)1　(D)$\sqrt{3/4}$　(E)$\sqrt{1/2}$

6. 電量爲 q、$2q$ 及 $3q$ 的點電荷分別固定於座標（2,0,0）、（0,2,0）及（0,0,2）。他們在原點位置所產生的電場大小是多少？（ε_0 爲 permittivity constant。）

   (A)$\frac{q}{4\pi\varepsilon_0}\sqrt{3.500}$　(B)$\frac{q}{4\pi\varepsilon_0}\sqrt{2.250}$　(C)$\frac{q}{4\pi\varepsilon_0}\sqrt{0.8750}$　(D)$\frac{q}{4\pi\varepsilon_0}\sqrt{0.5625}$　(E)$\frac{q}{4\pi\varepsilon_0}\sqrt{0.4375}$

7. 半徑爲 1m 的帶電球狀絕緣體之總電量爲 q，其電荷分佈有如下的關係式：$\rho = kr^2$（ρ爲電荷密度，k 爲常數，r 爲與球心的距離）。請計算離球心 0.5m 處的電場大小？

   (A)$\frac{1}{4\pi\varepsilon_0}\frac{q}{2}$　(B)$\frac{1}{4\pi\varepsilon_0}\frac{q}{4}$　(C)$\frac{1}{4\pi\varepsilon_0}\frac{q}{8}$　(D)$\frac{1}{4\pi\varepsilon_0}\frac{q}{16}$　(E)$\frac{1}{4\pi\varepsilon_0}\frac{q}{32}$

8. 二個點電荷分別帶 4C 及 8C 的正電。前者固定於原點，將後者由無限遠處移至距離原點 2m 的位置，移動過程需要作功多少？

   (A)$\frac{16}{4\pi\varepsilon_0}$J　(B)$\frac{8}{4\pi\varepsilon_0}$J　(C)$\frac{4}{4\pi\varepsilon_0}$J　(D)$\frac{2}{4\pi\varepsilon_0}$J　(E)$\frac{1}{4\pi\varepsilon_0}$J

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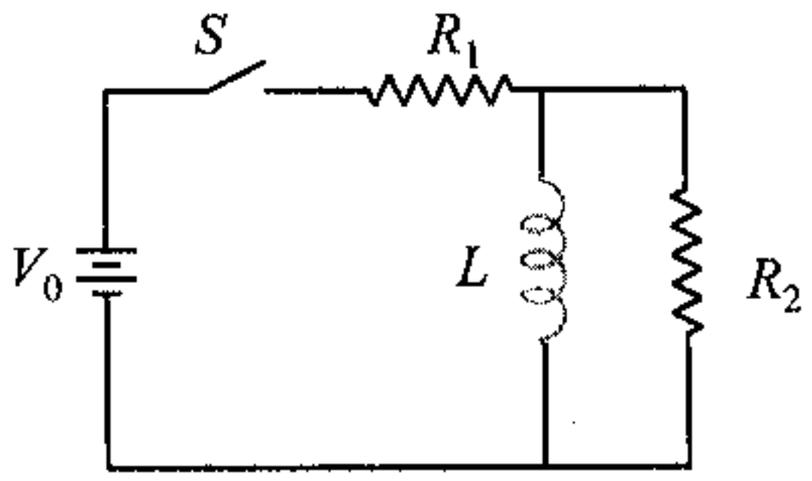
9. 右圖所示的電路中，V_0 爲 15V 的直流電壓源，R_1 和 R_2 分別爲 5Ω 及 10Ω 電阻，L 爲 0.2H 的電感器。在開關 S 關上前，整個電路無任何電流。請問當 S 關上後的瞬間，流過 5Ω 電阻的電流大小？
(A) 0 (B) 1A (C) 2A (D) 3A (E) 4A



10. 續前題，將 S 關上足夠久之後，整個電路達到穩定狀態，流過 10Ω 電阻的電流大小？
(A) 0 (B) 1A (C) 2A (D) 3A (E) 4A

普通化學

11. Draw the lewis structure for hydrogen cyanide, HCN. How many unshared electron pairs are present?
(A) 1 (B) 2 (C) 3 (D) 4 (E) none of the above.

12. The shape of water molecule is (A) angular (B) planar triangular (C) linear (D) tetrahedral (E) none of the above.

13. The hybrid orbitals used by the beryllium atom when the $BeBr_2$ molecule is formed are
(A) sp (B) sp^2 (C) sp^3 (D) sp^4 (E) none of the above.

14. The number of subshells in the n= 4 levels of any atom is
(A) 2 (B) 3 (C) 4 (D) 5 (E) none of the above.

15. The VSEPR model predicts the shape of carbon tetrafluoride molecule, CF_4, to be
(A) tetrahedral (B) planar triangular (C) linear (D) triangular pyramidal (E) none of the above.

16. For which of the following transitions does the emitted light have the longest wavelength?
(A) $n = 4$ to $n = 3$ (B) $n = 4$ to $n = 2$ (C) $n = 4$ to $n = 1$ (D) $n = 3$ to $n = 2$ (E) $n = 2$ to $n = 1$

17. Which electron configuration is correct?
(A) Ga $[Kr]3d^{10}4s^24p^1$ (B) Mo $[Kr]5s^24d^6$ (C) Ca $[Ar]4s^13d^{10}$ (D) Br $[Kr]3d^{10}4s^24p^7$
(E) Bi $[Xe]6s^24f^{14}5d^{10}6p^3$

18.

Bond	Bond Energy (kJ/mol)
C≡C	839
C—H	413
O=O	495
C=O	799
O—H	467

Estimate the heat of combustion of one mole of acetylene.
$C_2H_2(g) + 5/2\ O_2(g) \rightarrow 2\ CO_2(g) + H_2O(g)$
(A) 1228 kJ (B) −1228 kJ (C) −447 kJ (D) 447 kJ (E) 365 kJ

19. For which compound is resonance required to describe the structure adequately?
(A) Li_2S (B) NH_3 (C) NO_2^- (D) ClO_4^- (E) none of the above

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20. Which statement is FALSE? (A) C_2 is paramagnetic (B) C_2 is diamagnetic (C) The carbon-carbon bond in C_2^{2-} is stronger than the one in CH_3CH_3 (D) The carbon-carbon bond in C_2^{2-} is shorter than the one in CH_3CH_3 (E) two of these

工程數學

21. Consider the wave equation $c^2u_{xx} = u_{tt}$, $u(0,t) = u(L,t) = 0$, $u(x,0) = f(x), u_t(x,0) = g(x)$ for $0 \le x \le L$, $0 \le t$. By the method of separation of variables, we have $u(x,t) = X(x)T(t)$ and $\frac{X''}{X} = \frac{T''}{c^2T} = \text{constant} = -\kappa^2$, $\kappa > 0$. If $n = 1,2,3\ldots$, κ is equal to

(A) $\frac{2n\pi}{L}$ (B) $\frac{n\pi}{2L}$ (C) $\frac{n\pi}{L}$ (D) $\frac{(2n-1)\pi}{2L}$ (E) $\frac{(2n-1)\pi}{L}$

22. Following the above problem, *u(x,t)* is the superposition of the possible *X(x)T(t)* and has the form $u(x,t) = \sum_{n=1}^{\infty} A_n X_n(x) T_n(t)$. Then $X_n(x)$ is equal to

(A) $\sin\frac{2n\pi}{L}x$ (B) $\cos\frac{n\pi}{2L}x$ (C) $\sin\frac{n\pi}{L}x$ (D) $\cos\frac{(2n-1)\pi}{2L}x$ (E) $\sin\frac{(2n-1)\pi}{L}x$

23. Which of the following complex functions is NOT differentiable?

(A) $\cos z$ (B) z (C) $e^{\sin z}$ (D) $|z|^2$ (E) $\frac{1}{z}(z \neq 0)$

24. On the complex z plane, let C be a closed circle cent ered at $z = 0$ with a radius of 2 and oriented counterclockwise, then $\oint \frac{1}{z^2} dz$ is equal to

(A) 0 (B) πi (C) $2\pi i$ (D) $-\pi i$ (E) $-2\pi i$

25. On the complex z plane, let C be a closed circle centered at $z = 0$ with a radius of 2 and oriented counterclockwise, then $\oint \frac{z}{z^2 - 2z + 1} dz$ is equal to

(A) 0 (B) πi (C) $2\pi i$ (D) $-\pi i$ (E) $-2\pi i$

26. A,B,C 爲向量，$\|A\|$ 爲長度，A・B 爲內積，A×B 爲 cross product，下列那些是不對的？

(A) A・B＝0，則 A 與 B 垂直 (B) A×B=0，則 A 與 B 同方向 (C) $|A \cdot B| \le \|A\|\|B\|$

(D) $|A \times B|$爲 A 與 B 所夾平行四邊形之面積 (E) $\|A\| + \|B\| \le \|A + B\|$

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$A=\begin{pmatrix}1\\0\\0\end{pmatrix}$ $B=\begin{pmatrix}0\\1\\0\end{pmatrix}$ $C=\begin{pmatrix}4\\5\\6\end{pmatrix}$ (27-29)

27. $A \cdot (B \times C) = ?$

(A) 0 (B) 2 (C) 4 (D) 6 (E) 8

28. A 與 C 之夾角=

(A) 0° (B) $\cos^{-1}\frac{4}{\sqrt{77}}$ (C) $\sin^{-1}\frac{5}{\sqrt{66}}$ (D) $\cos^{-1}\frac{6}{\sqrt{88}}$ (E) $\cos^{-1}\frac{6}{\sqrt{66}}$

29. A 與 B 構成平面之法線與 C 之夾角爲

(A) 0° (B) $\cos^{-1}\frac{4}{\sqrt{77}}$ (C) $\cos^{-1}\frac{6}{\sqrt{77}}$ (D) $\sin^{-1}\frac{6}{\sqrt{77}}$ (E) $\sin\frac{4}{\sqrt{77}}$

30. 三度空間之曲面爲 $z=x^2+y^2$，其法線爲

(A) $\begin{pmatrix}2x\\2y\\1\end{pmatrix}$ (B) $\begin{pmatrix}-2x\\2y\\1\end{pmatrix}$ (C) $\begin{pmatrix}-2x\\-2y\\1\end{pmatrix}$ (D) $\begin{pmatrix}2x\\-2y\\1\end{pmatrix}$ (E) $\begin{pmatrix}-2x\\2y\\-1\end{pmatrix}$

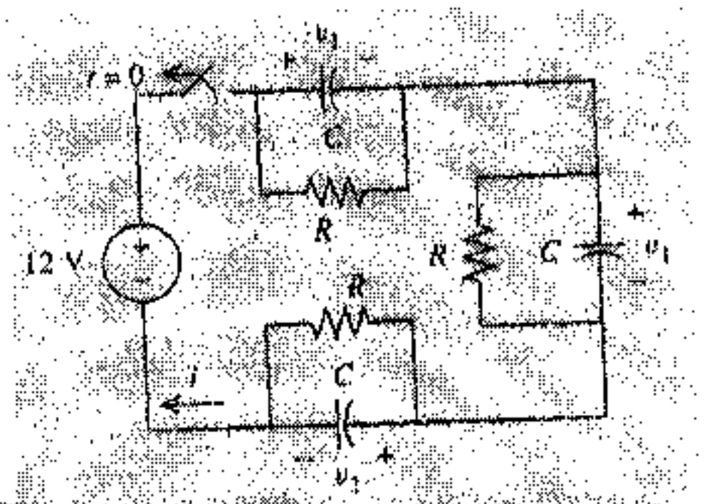
應用電子學

31. The circuit is in dc steady state at t = 0–, find i(0–)

(A) 0 (B) 4/RC (C) 4/R (D) 4/C (E) 4/R+C

32. Follow problem 31, the circuit is in dc steady state at t = 0–, find i(0+)

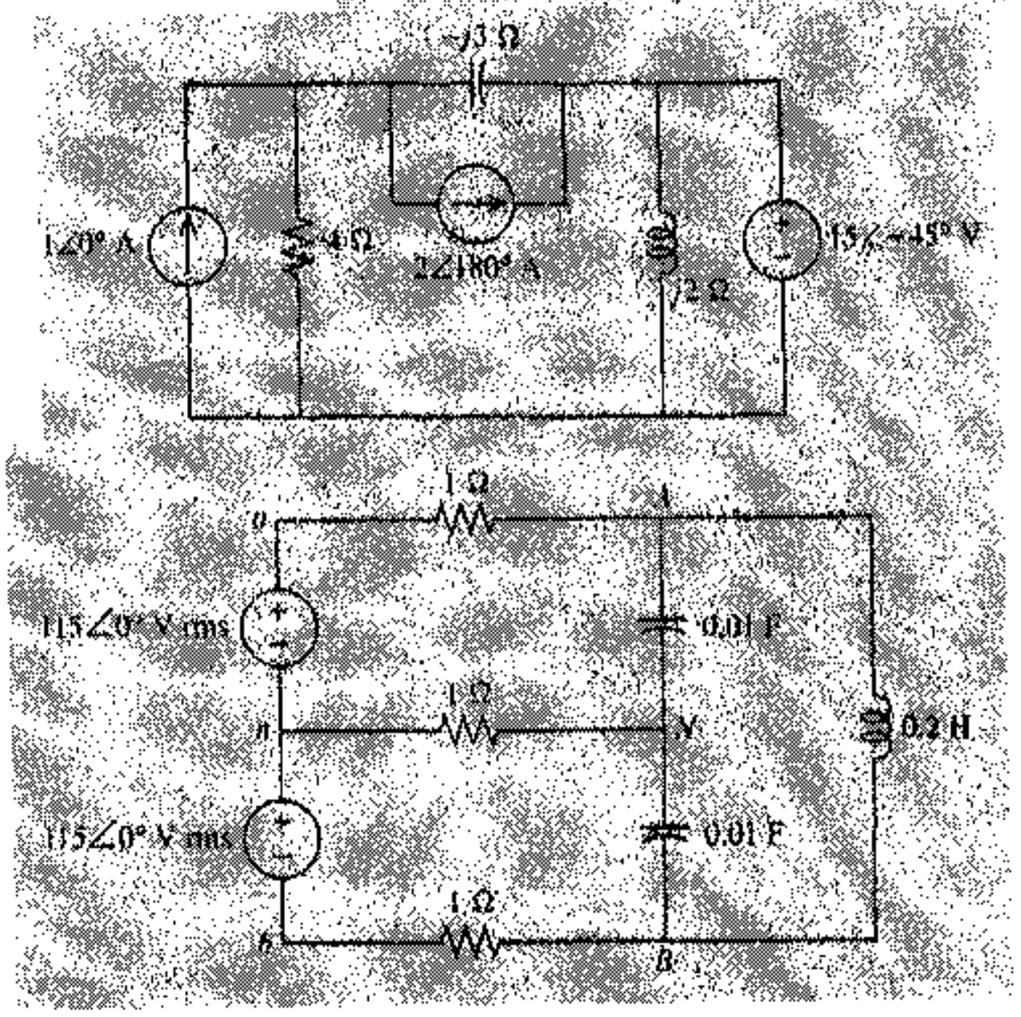
(A) 0 (B) 4/RC (C) 4/R (D) 4/C (E) 4/R+C



33. Find the voltage between the 4Ω resistance

(A) $27\angle -24.5^\circ$ (B) $18\angle -24.5^\circ$ (C) $9\angle -24.5^\circ$

(D) $3\angle -24.5^\circ$ (E) 0



34. Find I_{aA} (A), the source frequency is 60Hz.

(A) 0 (B) $3\angle -88.5^\circ$ (C) $15\angle -72.5^\circ$

(D) $27\angle -61.5^\circ$ (E) $36\angle -43.5^\circ$

35. Follow problem 34, find I_{nN}(A)

(A) 0 (B) $3\angle -88.5^\circ$ (C) $15\angle -72.5^\circ$

(D) $27\angle -61.5^\circ$ (E) $36\angle -43.5^\circ$

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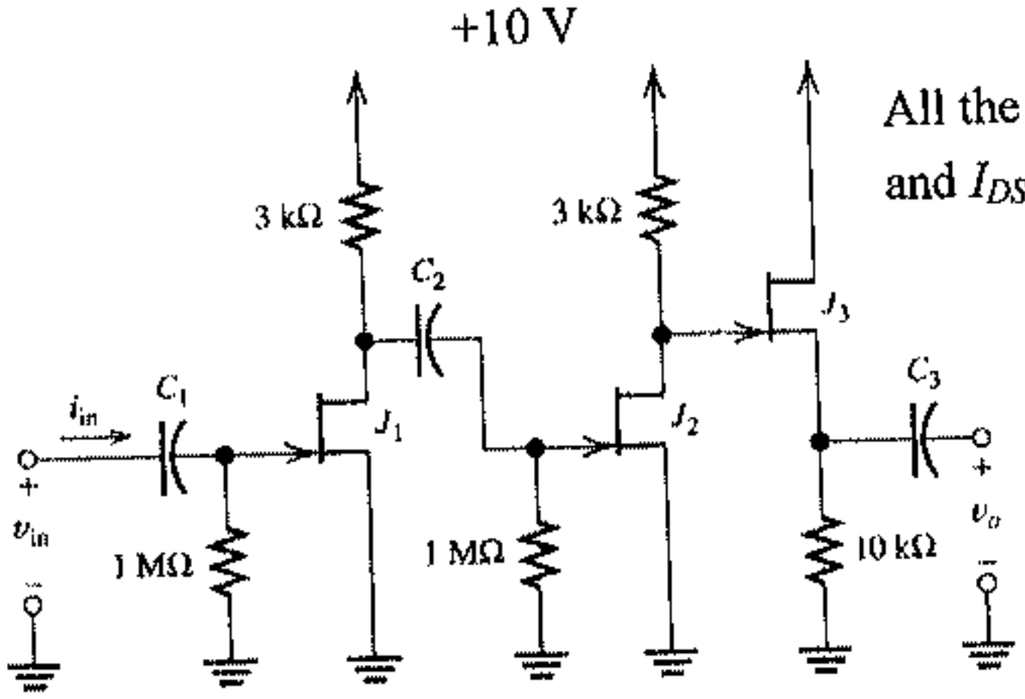
36. Consider the three-stage RC-coupled JFET amplifier shown in Fig. 36-39. Find the Q-point drain current for transistor J_1. (A) 19.88 μA (B) 3.33 mA (C) 9.97 μA (D) 2 mA (E) 1 mA



All the FETs have $V_p = -2$ V and $I_{DSS} = 2$ mA.

Three-stage *RC*-coupled JFET amplifier.

Fig. 36-39

37. Find the Q-point drain current for transistor J_2 for the circuit shown in Fig. 36-39.
(A) 1 mA (B) 3.33 mA (C) 9.97 μA (D) 2 mA (E) 0.77 mA

38. Find the Q-point drain current for transistor J_3 for the circuit shown in Fig. 36-39.
(A) 0.5 mA (B) 6.67 mA (C) 1.54 mA (D) 3 mA (E) 1 mA

39. Find the midband values for the voltage gain of the amplifier shown in Fig. 36-39.
(A) –6 (B) –5.98 (C) 32.6 (D) 0.91 (E) 25.1

40. Three amplifiers with the following characteristics are cascaded in the order of 2, 3, 1.
Amplifier 1: $A_{vo1} = 1$, $R_{i1} = 2$ kΩ, $R_{o1} = 1$ kΩ
Amplifier 2: $A_{vo2} = 2$, $R_{i2} = 4$ kΩ, $R_{o2} = 2$ kΩ
Amplifier 3: $A_{vo3} = 3$, $R_{i3} = 6$ kΩ, $R_{o3} = 3$ kΩ
The cascaded amplifier is then connected to a load of 1 kΩ. Find the open-circuit voltage gain of the overall cascaded connection. (A) 6 (B) 0.9 (C) 1 (D) 2 (E) 1.8

熱力學

41. Indicate the wrong statement for the properties of activity coefficient (γ) : (A) a correlation factor between ideal and non-ideal solution behavior, (B) γ=1 indicating an ideal solution, (C) γ>1 indicating "repulsion" between two components of the mixtures, (D) the Raoult's law is valid for ideal solution (γ=1) only, (E) γ<1 having a high tendency to compound formation with an endothermic reaction.

42. Indicate the wrong statement for the properties of regular solutions: (A) $\gamma \neq 1$, (B) $\Delta H^M \neq 0$, (C) $S^{excess}=0$, (D) $\Delta S^M=0$, (E) $G^{excess}=\Delta H^M$.

43. What is the entropy of carbon mono-oxide (CO) at 0^oK?
(A) $R\ ln(2)$, (B) 0, (C) $R\ ln(3)$, (D) $2R\ ln(2)$, (E) $3R\ ln(3)$.

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44. Indicate the wrong statement for the reaction $H_2O(S) \rightarrow H_2O(l)$ in an ice-water bath at 0°C:
(A) $\Delta S>0$, (B) $\Delta H>0$, (C) $\Delta E>0$, (D) $\Delta G<0$, (E) $\Delta V<0$.

45. Indicate the wrong statement for the stability criteria of thermodynamic systems:
(A) $dS=0$, (B) $d^2S<0$, (C) $C_v>0$, (D) $(\partial^2 G/\partial T^2)_{P,n}\geq 0$, (E) κ (coefficient of compressibility)>0.

46. For vapor pressure: $\ln P = -A/T + B \ln T + C$. The value of $\triangle Cp$ is equivalent to
(A)1 (B) RB (C) B (D) R (E) A+BT

47. For exothermically forming solution (A) $\gamma_i = 0$ (B) $\gamma_i < 1$ (C) $\gamma_i > 1$ (D) $\gamma_i = 1$ (E)none of above

48. Evaluate the entropy of mixing by mixing 1 mole of A atoms at P = 1 atm with 1 moles of B atom at P = 2 atm. Assume that the mixing is carried out at constant total volume.
(A) $\triangle S = 0$ (B) $\triangle S = -R \ln 2/9$ (C) $\triangle S = 3 R \ln 2$ (D) $\triangle S = -R \ln 2/3$ (E) $\triangle S = -R \ln 1/3$

49. Find the temperature at which the process is adiabatic for the condensed phase reaction
$A + B \rightarrow C + D$
Where $\triangle G = a + bT \ln T + c T$ cal/mole
(A) T = a (B) T = a/b (C) T = a/b + C (D) T = b/a – C (E) T = b/a + C

50. For a regular solution (A) $\Delta S^{xs} > 0$ (B) $\Delta S^{xs} = 0$ (C) $\Delta S^{xs} < 0$ (D) $\Delta H^m \neq G^{xs}$
(E) $\Delta \overline{H_i^m} = RT \ln a_i$

物理冶金

51. If two grains of one phase meeting a grain of the other phase at a common intersection, and the surface tensions in the boundaries are in static equilibrium, which of the following equations is **correct**?
(A) $\gamma_{11} = 2\gamma_{12}\cos(\theta/2)$; (B) $\gamma_{12} = 2\gamma_{11}\cos(\theta/2)$; (C) $\gamma_{11} = 2\gamma_{12}\sin(\theta/2)$;
(D) $\gamma_{12} = 2\gamma_{11}\sin(\theta/2)$; (E) none of above.

52. Which of the following mechanism related to the Hall-Patch equation?
(A) The working hardening rate decreases due to the dynamic recovery;
(B) The higher the flow stress, the greater the density of dislocation inside the crystal;
(C) The smaller the grain size, the more dislocations pile up against the grain boundary;
(D) The smaller the grain size, the less dislocations pile up against the grain boundary;
(E) Needs more energy for creating kinks and jogs as dislocations intersecting to each other.

53. Which of the following statement has **no** interaction between the solute atom and the dislocation?
(A) Substitutional atoms in b.c.c. material and negative edge dislocation;
(B) Interstitial atoms in f.c.c. material and positive edge dislocation;
(C) Interstitial atoms in f.c.c. material with left-hand screw dislocation;
(D) Interstitial atoms in b.c.c. material with right-hand screw dislocation;
(E) none of above.

54. The solubility of Carbon in f.c.c. Iron is much larger than that in b.c.c. Iron. Which of the following statement is **related**? (A) Packing factor; (B) Carbon atoms is smaller than Iron atom;
(C) Slip system in f.c.c. is well defined; (D) Slip lines in b.c.c. is wavy; (E) Shape of holes.

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55. Which of the following statements is **wrong**?
(A) Dislocation never ends inside a crystal because it is the boundary between sheared and un-sheared area;
(B) An edge dislocation is a two-dimensional defect, because it has an extra half-plane atoms (or vacancies);
(C) The Burgers vector of every point along an dislocation is same, unless some another dislocation connecting with it;
(D) The tilt boundary does not posses a long-range stress field;
(E) There is a driving force that attracts the edge dislocations to a tilt boundary.

56.二元相圖中的超晶格(superlattice)是指
(A)兩種原子的固溶體是正偏差(positive deviation)
(B)同類原子的鍵結比異類原子鍵結來得強
(C)高溫具短程有序規律(short-range ordering)，低溫則分爲雙相結構
(D)高溫具短程有序規律，低溫則有長程(long-range)有序規律
(E)以上皆非

57.鐵原子在 bcc 鐵中、鐵原子在 fcc 鐵中、碳原子在 bcc 鐵中、碳原子在 fcc 鐵中發生擴散(diffusion)的活化能分別以 a, b, c, d 來表示，則四者之大小關係爲
(A)a>b>c>d (B)b>a>c>d (C)d>c>b>a (D)b>a>d>c (E) d>c>a>b

58.有一棒狀合金鑄錠的凝固狀況是固相中溶質完全沒有擴散，液相中溶質完全擴散，則凝固後，其溶質分佈情形，從最先凝固端算起爲
(A)都是固定成份 (B)高溶質變成固定溶質再變成低溶質 (C) 高溶質持續降低到最後 (D)低溶質逐漸持續升高到最後 (E)低溶質變成固定溶質再變成高溶質

59.一個鑄錠在凝固過程時樹枝晶(dendrite)延伸很長，熔湯中含氣量很少，且模壁與鑄錠間因爲鑄錠收縮而生縫隙，則容易產生
(A)內偏析(coring) (B)重力偏析(gravity-induced segregation) (C)樹枝間孔隙(interdendritic porosity)
(D)逆偏析(inverse segregation) (E)以上皆非

60.在液相中產生固相，其孕核(nucleation)速率最快的溫度是在低於熔點一些的地方；低於此溫度，其孕核速率變慢，主要原因是
(A)原子不容易躍過界面 (B)原子容易躍過界面 (C)臨界胚核(embryo)的能障太大 (D)臨界胚核的能障太小 (E)以上皆非

近代物理

61. Which of the following system shows energy levels with equal spacing
(A) the vibration of a diatomic molecule. (B) the rotation of a diatomic molecule.
(C) the translation of a diatomic molecule. (D) the electron orbital in a diatomic molecule.
(E) none of the above systems.

62. About the tunnel effect,
(A) the particle wave in the potential barrier forms a standing wave.
(B) it occurs when the particle's energy is lower than the potential barrier height.
(C) the tunnel probability has nothing to do with the thickness of the potential barrier.

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(D) $\frac{\partial \psi}{\partial x} = 0$ at the edge of the potential barrier.

(E) $\frac{\partial^2 \psi}{\partial x^2} = 0$ at the edge of the potential barrier.

63. An electron wave function in the hydrogen atom, when expressed in spherical coordinates, is

(A) $\psi(r,\theta,\phi) = R(r)\Theta(\theta)\Phi(\phi)$.

(B) $\psi(r,\theta,\phi) = R(r) + \Theta(\theta) + \Phi(\phi)$.

(C) $\psi(r,\theta,\phi) = R(r)\Theta(\theta) + R(r)\Phi(\phi) + \Theta(\theta)\Phi(\phi)$.

(D) $\psi(r,\theta,\phi) = | R(r)\Theta(\theta)\Phi(\phi) |$.

(E) $\psi(r,\theta,\phi) = (R(r)\Theta(\theta) + R(r)\Phi(\phi) + \Theta(\theta)\Phi(\phi)) / | R(r)\Theta(\theta)\Phi(\phi) |$.

64. The general condition necessary for an atom in an excited state to radiate is that

(A) $\int_{-\infty}^{\infty} \psi\, x\, \psi^* dx = 0$. (B) $\int_{-\infty}^{\infty} \psi\, x\, \psi^* dx \neq 0$. (C) $\int_{-\infty}^{\infty} x |\psi|^2 dx = 0$. (D) $\int_{-\infty}^{\infty} x |\psi|^2 dx \neq 0$.

(E) $\int_{-\infty}^{\infty} |\psi|^2 dx = 0$.

65. Zeeman effect is the experimental verification of

(A) the principal quantum number. (B) the orbital quantum number. (C) the magnetic quantum number. (D) the selection rule of atomic radiation. (E) none of the above.

66. Due to the spin-orbit coupling, how many spectral lines you can observe for the 2p → 1s transition.

(A) one (B) two (C) three (D) four (E) five

67. Which one 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) 2 (C) 3 (D) 4 (E) 5

68 An atom with a missing inner electron can lose excitation energy and eject an outer-shell electron. This phenomenon is called as (A) Photoemission effect (B)Compton effect (C) Auger effect (D) Pair production (E) Blackbody radiation

69. In CO molecule the J=0 → J=1 absorption line of rotational spectra occurs at a frequency of 1.15×10^{11} Hz. What is the bond length of the CO molecule?

(A) 0.11 nm (B) 0.22 nm (C) 0.33 nm (D) 0.44 nm (E) 0.55 nm

70. When you want to tell the characteristics of carbon bonding (i.e. sp^3 or sp^2 bonding) in molecules, which spectra can give you this information? (A) rotation spectra (B) vibration spectra (C) electronic spectra (D) all of the above three spectra (5) none of the above three spectra.

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71. Alkenes (A) are relatively nonpolar compounds. (B) have lower boiling points than alcohols of similar molecular weight. (C) are reasonably soluble in water. (D) both A and B. (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。

72. Predict the two most likely mechanisms which occur when 2-iodohexane is heated in ethanol.
(A) S_N2 and S_N1 (B) E1 and E2 (C) S_N2 and E2 (D) E1 and S_N1 (E) none of the above.

73. 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.

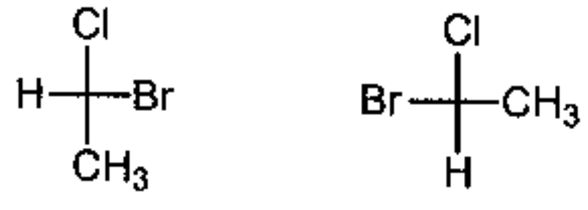
74. The relationship between ketones and their corresponding enols is one of:
(A) tautomers. (B) stereoisomers. (C) enantiomers. (D) diastereomers. (E) none of the above.

75. The rate of a reaction typically increases as the temperature increases because:
(A) the A term in the Arrhenius equation increases.
(B) the fraction of molecules with kinetic energy greater than Ea increases.
(C) the activation energy decreases.
(D) the activation energy increases.
(E) none of the above.1.

76. Which of the following method is the best synthesis of 2,2-dibromopropane?
(A) $CH_3CH{=}CH_2 + Br_2/CCl_4$ (B) $CH_3CH{=}CH_2 + Br_2$/light (C) $CH_3CH{=}CH_2 + Br_2$/peroxide
(D) $CH_3C{\equiv}CH + 2$ HBr (E) $CH_3C{\equiv}CH + 2$ HBr /peroxide

77. Which is the correct order of decreasing acidity in the following compounds?
H_2O (**A**) CH_3CH_3 (**B**) NH_3 (**C**) $CH_2{=}CH_2$ (**D**) $HC{\equiv}CH$ (**E**)
(A) A > E > C > D > B (B) D > A > E > C > B (C) E > A > C > B > D
(D) C > A > E > D > B (E) B > D > E > A > C

78. What is the relationship between the structures shown below?



(A) Enantiomers (B) Diastereomers (C) Configurational isomers
(D) Conformational isomers (E) Identical compounds

79. Which of the following is not an electrophile?
(A) H^+ (B) NH_3 (C) BF_3 (D) Br_2 (E) Fe^{3+}

80. What is the strongest intermolecular force present in liquid ethanol?
(A) induced dipole – induced dipole (B) dipole – induced dipole (C) hydrogen bonding – hydrogen bonding (D) hydrogen bonding – dipole (E) hydrogen bonding – induced dipole

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。

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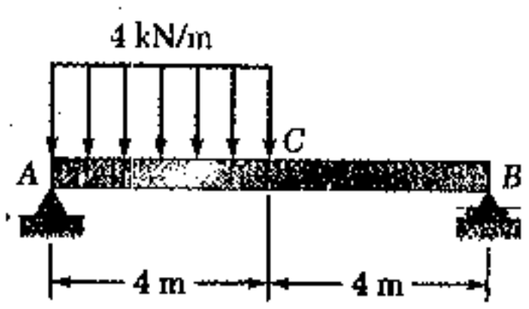
For the beam and loading shown,

81. the shear force at point *C* is

(A) 3 kN (B) 4 kN (C) 5 kN
(D) 6 kN (E) 7 kN



82. the mending moment at point *C* is

(A) 12 kN-m (B) 14 kN-m (C) 16 kN-m
(D) 18 kN-m (E) 20 kN-m

83. the maximum shear in the beam is

(A) 6 kN (B) 8 kN (C) 10 kN
(D) 12 kN (E) 14 kN

84. the maximum bending moment in the beam is

(A) 12 kN-m (B) 14 kN-m (C) 16 kN-m
(D) 18 kN-m (E) 20 kN-m

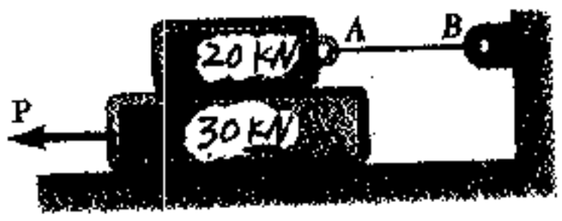
For the system shown in figures, the coefficient of static friction is $\mu_S = 0.4$ between all surfaces of contact

85. the smallest force *P* required to start the block moving is

(A) 12 kN (B) 14 kN (C) 16 kN
(D) 18 kN (E) 20 kN

86. the smallest force *P* required to start the block moving is

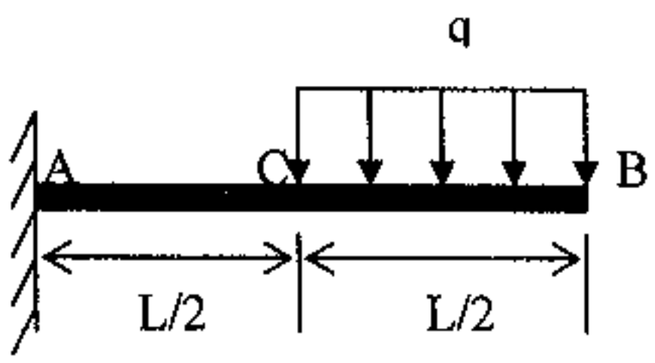
(A) 14 kN (B) 16 kN (C) 18 kN
(D) 20 kN (E) 22 kN



87. the smallest force *P* required to start the block moving is

(A) 36 kN (B) 38 kN (C) 40 kN
(D) 42 kN (E) 44 kN

A cantilever beam supporting a uniform load of intensity q acting over the right-hand half of the beam with length of L and constant flexural rigidity EI. (88-89)



88. What is the angle of rotation θ_B at free end B:

(A) $5qL^3/(48EI)$, (B) $6qL^3/(48EI)$, (C) $7qL^3/(48EI)$, (D) $8qL^3/(48EI)$, (E) $9qL^3/(48EI)$.

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。

89. What is the deflection δ_B at free end B
(A)$25qL^4/(384EI)$, (B) $32qL^4/(384EI)$, (C) $36qL^4/(384EI)$, (D) $41qL^4/(384EI)$, (E) $45qL^4/(384EI)$

90. In a cylindrical pressure vessel with the wall thickness of t and inner radius of r, the hoop stress and the axial stress are denoted as σ_1 and σ_2, respectively. If the internal pressure of the vessel is p. which relationship listed in the following is correct. (A) $\sigma_1 = 2pr/t$, $\sigma_2 = pr/(2t)$, (B) $\sigma_1 = pr/(2t)$, $\sigma_2 = pr/t$, (C) $\sigma_1 = 3pr/t$, $\sigma_2 = pr/(3t)$, (D) $\sigma_1 = 3pr/t$, $\sigma_2 = pr/(2t)$, (E) $\sigma_1 = pr/t$, $\sigma_2 = pr/(2t)$.