高雄醫學大學 105 學年度 研究所碩士班 招生考試　　**系所：醫藥暨應用化學系**
科目： 普通化學

本試題允許考生使用計算機作答，並請使用答案卡由電腦閱卷 。第四頁有週期表
請務必於答案卡上作答，違者該科不於計分。
單選題：本試題共有 40 題單選題，每題 2.5 分，總分為 100 分

1. Which one is **covalent bonding**?
   [A]π- π interaction, [B] van der Waals Interaction [C] Electrostatic interaction [D]Hydrogen Bond [E]C-F bond

2. For H_2, which of the following statements is **NOT** true?
   [A] Its HOMO is the σ_{1s} orbital. [B] Its LUMO is the σ_{1s}^* orbital. [C] Its lowest-energy excited state electron configuration is $(\sigma_{1s})^1(\sigma_{1s}^*)^1$ [D] The bond order for Its lowest-energy excited state is **1** [E] Its ground state electron configuration is $(\sigma_{1s})^2$

3. **Name** the following structures: $CH_3–(CH_2)_6–CH_3$?
   [A]pentane. [B]Hexane. [C]Heptane. [D]Octane. [E]Nonane

4. For which of the following compound(s) are ***cis*** and ***trans*** isomers possible?
   [A] 2,3-dimethyl-2-butene. [B] 3-methyl-2-pentene. [C] 4,4-dimethylcyclohexanol. [D] *ortho*-chlorotoluene. [E] All can exhibit *cis*/*trans* isomers

5. How many **isomers** are there of "dichloroethene"?
   [A]2. [B]3. [C]4. [D]5. [E]6

6. Which of the following is a d^7 ion?
   [A] Co(II). [B] Cu(II). [C] Mn(II). [D] Mn(IV). [E]Cu(I)

7. The spectro-chemical series is $I^- < Br^- < Cl^- < F^- < OH^- < H_2O < NH_3 <$ en $< NO_2^- < CN^-$ Which of the following complexes will absorb visible radiation of the **highest** energy (shortest wavelength)?
   [A] $[Co(H_2O)_6]^{3+}$. [B] $[Co(I)_6]^{3-}$. [C] $[Co(OH)_6]^{3-}$. [D] $[Co(en)_3]^{3+}$. [E] $[Co(NH_3)_6]^{3+}$

8. Which of the following complexes would be diamagnetic (all electrons paired)? Assume the **strong-field** case for all complexes.
   [A] $[Ni(CN)_6]^{4-}$. [B] $[Ti(CN)_6]^{3-}$. [C] $[Co(CN)_6]^{3-}$. [D] $[Cr(CN)_6]^{3-}$. [E] none of these

9. In which of the following compounds does N have its **maximum** oxidation state?
   [A] NH_3. [B] N_2O. [C] N_2. [D] $NaNO_3$. [E] HN_3

10. Cs-131 nuclide has a half-life of 30 years. After 144years, about 3.0 grams remain. The original mass of the Cs-131 sample is closest to?
    [A] 167 g. [B] 42 g. [C] 90g. [D] 292 g. [E]100 g

11. Which of the following is true for the cell shown here? $Zn(s) \mid Zn^{2+}(aq) \parallel Cr^{3+}(aq) \mid Cr(s)$
    [A] The electrons flow from the cathode to the anode. [B] The electrons flow from the zinc to the chromium.
    [C] The electrons flow from the chromium to the zinc. [D] The chromium is oxidized. [E] The zinc is reduced.

12. Consider an electrochemical cell with a zinc electrode immersed in 1.0 *M* Zn^{2+} and a silver electrode immersed in 1.0 *M* Ag^{+}. $Zn^{2+} + 2e^- \rightarrow Zn$ $\varepsilon^\circ = -0.755$ V; $Ag^{+} + e^- \rightarrow Ag$ $\varepsilon^\circ = 0.800$ V
Calculate the ε° for this cell?
[A] 0.045 V. [B] -0.045 V. [C] 1.555 V. [D] -1.555 V. [E] none of these

13. Which of the following would be the **BEST** oxidizing agent?
[A] Cl_2. [B]Fe. [C] Na. [D] Na^{+}. [E] F^{-}

14. For which of the following processes would ΔS be expected to be most **positive**?
[A] $O_2(g) + 2H_2(g) \rightarrow 2H_2O(g)$. [B] $H_2O(l) \rightarrow H_2O(s)$. [C] $NH_3(g) + HCl(g) \rightarrow NH_4Cl(g)$.
[D] $2NH_4NO_3(s) \rightarrow 2N_2(g) + O_2(g) + 4H_2O(g)$. [E] $N_2O_4(g) \rightarrow 2NO_2(g)$

15. Order the intermolecular forces (dipole-dipole (I), London dispersion (II), ionic (III), and hydrogen-bonding(IV)) from weakest to strongest.
[A]I<II<III<IV. [B]II<I<IV<III. [C]IV<I<II<III. [D]I<II<IV<III. [E]II<III<I<IV

16. A crystal was analyzed with x-rays having 1.57 Å wavelength. A reflection was produced at $\theta = 21.9$. Assuming $n = 1$, what is the distance between the layers of atoms in the crystal?
[A] 8.42 Å. [B] 4.21 Å. [C] 0.475 Å. [D] 0.846 Å. [E] 2.10 Å

17. Which one of the following statements about solid Cu (face-centered cubic unit cell) is **incorrect**?
[A] It will conduct electricity. [B] There are two atoms per unit cell. [C] The number of atoms surrounding each Cu atom is 12. [D] The solid has a cubic closest-packed structure. [E] The length of a face diagonal is four times the Cu radius.

18. The hybridization of the central atom in I_3^- is?
[A] *sp*. [B] sp^2. [C] sp^3. [D] dsp^3. [E] d^2sp^3

19. A π (pi) bond is the result of the?
[A] overlap of two *s* orbitals. [B] overlap of an *s* orbital and a *p* orbital. [C] overlap of two *p* orbitals along their axes. [D] sidewise overlap of two parallel *p* orbitals. [E] sidewise overlap of two *s* orbitals

20. Consider the following reaction ? $A_2 + B_2 \rightarrow 2AB$ $\Delta H = 365$ kJ, The bond energy for A_2 is half the amount of AB. The bond energy of B_2 = 447 kJ/mol. What is the **bond energy** of A_2 (kJ/mol)?
[A] 812. [B]630. [C]271. [D]183. [E]120

Consider the following molecules to answer **question 21, 22 and 23**
I. BF_3 II. $CHBr_3$ III.Br_2 IV.$XeCl_2$ V.CO VI.SF_4

21. Which of these molecules **violate** the octet rule?
[A] I, II, IV. [B] I, III, IV, VI. [C] III, V, VI. [D] I, IV, VI. [E] I, II, IV, VI

22. Which of these molecules have a **zero** net dipole moment.
[A] III, V. [B] I, III, IV. [C] III, IV, V. [D] I, III, IV, VI. [E] none of them

23. Which of these molecules have a **trigonal bipyramidal** electron pair arrangement?
[A] II, IV, VI. [B] I, IV. [C] IV, VI. [D] VI only. [E] none of them

24. How many of the following molecules or ions are **linear**?

NH_3, OF_2, HCN, CO_2, NO_2

[A]0. [B]1. [C]2. [D]3. [E]4

25. The energy of the light emitted when a hydrogen electron goes from $n = 2$ to $n = 1$ is what fraction of its ground-state ionization energy?

[A]3/4. [B]1/2. [C]1/8. [D]1/16. [E]1

26. How many ***f*** orbitals have when n=6?

[A]2. [B]7. [C]10. [D]5. [E]18

27. Which of the following atoms would have the **largest** second ionization energy?

[A]Mg. [B]Cl. [C]S. [D]Ca. [E]Na

28. A sample of He gas (3.0 L) at 5.6 atm and 25 °C was combined with 4.5 L of Ne gas at 3.6 atm and 25 °C at constant temperature in a 9.0 L flask. The total pressure in the flask was _____ atm. Assume the initial pressure in the flask was 0.00 atm and the temperature upon mixing was 25 °C?

[A] 2.6 [B] 9.2. [C] 1.0. [D] 3.7. [E] 24

29. For which of the following transitions does the light emitted 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 $n = 1$

30. Bromine exists naturally as a mixture of bromine-79 and bromine-81 isotopes. An atom of bromine-79 contains ?

[A] 35 protons, 44 neutrons, 35 electrons. [B] 34 protons and 35 electrons, only. [C] 44 protons, 44 electrons, and 35 neutrons. [D] 35 protons, 79 neutrons, and 35 electrons. [E] 79 protons, 79 electrons, and 35 neutrons

31. How many grams of oxygen are in 0.52g of $NaHCO_3$?

[A] 0.099 g. [B] 0.019 g. [C] 6.19×10^3 g. [D] 0.033 g. [E] 0.30 g

32. In a given period this group has the element with the largest atomic **radius** ?

[A] Group 1A. [B] Group 2A. [C] Group 3A. [D] Group 4A. [E] Group 5A

33. An unknown salt, M_3Z, has a K_{sp} of 1.2×10^{-17}. Calculate the **solubility** in mol/L of M_3Z ?

[A] 2.6×10^{-5} *M*. [B] 3.5×10^{-9} *M*. [C] 1.4×10^{-6} *M*. [D] 2.2×10^{-6} *M*. [E] none of the above

34. Which of the following solid salts should be more soluble in 1.0 *M* NH_3 than in water?

[A] Na_2CO_3. [B] KCl. [C] AgBr. [D] KNO_3. [E] none of these

35. The properties of **graphene** include?

[A] high strength. [B] low thermal conductivity. [C] a zero energy gap. [D] A and C. [E] A, B and C

36. Which one of the following **vitamins** is water soluble?

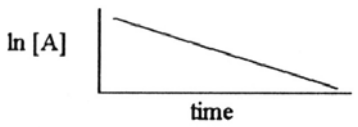
[A] vitamins A. [B] vitamins B. [C] vitamins K. [D] vitamins D.
[E] vitamins E

37. Which of the following is **NOT** classified as a nanomaterial?

[A] isoprene. [B] C60. [C] carbon nanotubes. [D] graphene.

[E] All of the above are nanomaterials

38. Which one of the following graphs shows the **correct** relationship between concentration and time for a reaction that is second order in [A] ?

[A] 

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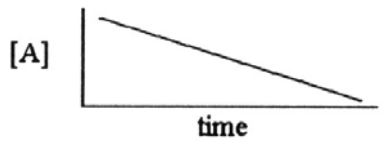
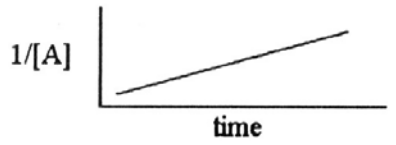
[B] 

[C] 

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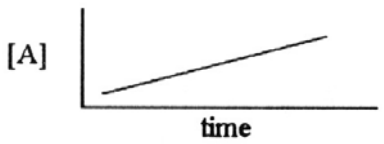
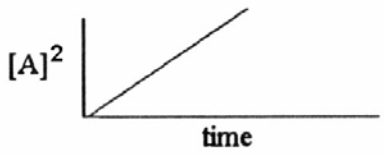
[D] 

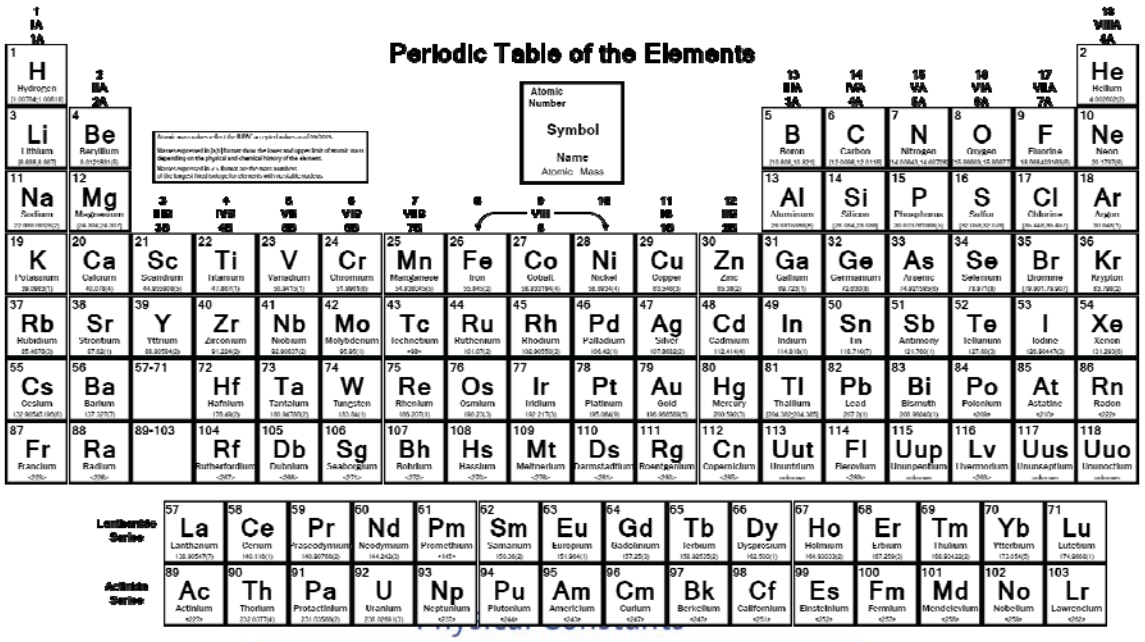
[E] 

39. How many chiral centers are there in $CH_3CHClCH_2CH_2CHBrCH_3$?

[A]0. [B]1. [C]2. [D]3. [E]4

40. How many Department named “Medicinal and Applied Chemistry in Taiwan?

[A]0. [B]1. [C]2. [D]3. [E]4



Constant	Symbol	Value
Atomic mass unit	amu	1.66054×10^{-27} kg
Avogadro's number	N	6.02214×10^{23} mol^{-1}
Bohr radius	a_0	5.292×10^{-11} m
Boltzmann constant	k	1.38066×10^{-23} J/K
Charge of an electron	e	1.60218×10^{-19} C
Faraday constant	F	96.485 C/mol
Gas constant	R	8.31451 J/Kmol 0.08206 L · atm/K · mol
Mass of an electron	m_e	9.10939×10^{-31} kg 5.48580×10^{-4} amu
Mass of a neutron	m_n	1.67493×10^{-27} kg 1.00866 amu
Mass of a proton	m_p	1.67262×10^{-27} kg 1.00728 amu
Planck's constant	h	6.62608×10^{-34} J · s
Speed of light	c	2.99792458×10^{8} m/s