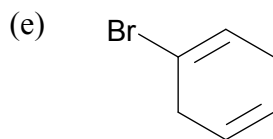
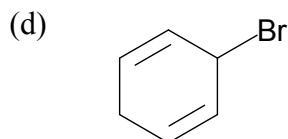
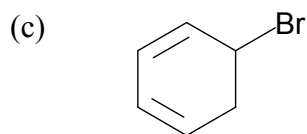
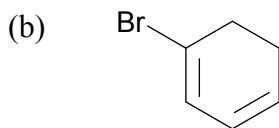
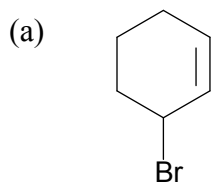
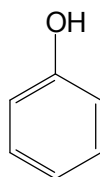


Problem Set # 3, December 2017

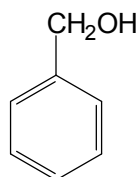
31. Which compound below has the IUPAC name 5-bromo-1,3-cyclohexadiene?



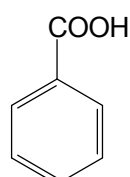
32. What is the order of increasing acid strength (weakest first, strongest last) of the set of compounds given below?



1



2



3

- (a) $1 < 2 < 3$
 (b) $1 < 3 < 2$
 (c) $2 < 1 < 3$
 (d) $2 < 3 < 1$
 (e) $3 < 2 < 1$

33. Choose the set that best describes the behaviour of H_3O^+ , BF_3 and $\text{C}\equiv\text{N}^-$ as nucleophile or electrophile.

| | H_3O^+ | BF_3 | $\text{C}\equiv\text{N}^-$ |
|-----|------------------------|---------------|----------------------------|
| (a) | electrophile | electrophile | electrophile |
| (b) | nucleophile | nucleophile | nucleophile |
| (c) | electrophile | nucleophile | nucleophile |
| (d) | electrophile | electrophile | nucleophile |
| (e) | electrophile | nucleophile | electrophile |

34. Choose the pair of sequences that arranges, respectively, the atomic radius and ionization energy from smallest to largest.

- (a) S, O, F and F, O, S
 (b) F, S, O and O, S, F
 (c) S, F, O and S, F, O
 (d) F, O, S and S, O, F
 (e) none of these

35. Which element is a liquid over the widest temperature interval?

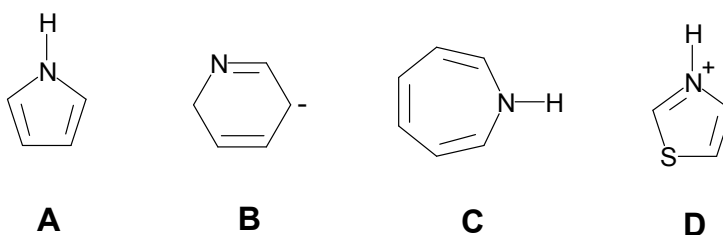
- (a) B (b) Al (c) Ga (d) Tl (e) all are the same

36. Which of the following naturally occurring amino acids contains three stereocentres?
 (a) leucine (b) isoleucine (c) cysteine (d) aspartic acid (e) none of these
37. Which of the following statements is **FALSE**?
 (a) atoms or molecules with an even number of electrons are diamagnetic
 (b) atoms or molecules with an odd number of electrons are paramagnetic
 (c) paramagnetism cannot be deduced from the Lewis structure of a molecule alone
 (d) paramagnetic molecules are attracted toward a magnetic field
 (e) N₂ molecules are diamagnetic
38. Radioactive elements decay by means of first-order kinetics. A nucleus has a decay rate constant of $1.0 \times 10^{-3} \text{ h}^{-1}$. A sample contains 5.0×10^9 radioactive nuclides. Calculate the time required to reduce that number to 2.5×10^9 .
 (a) $1.0 \times 10^3 \text{ h}$ (b) $6.9 \times 10^2 \text{ h}$ (c) $6.9 \times 10^4 \text{ h}$ (d) $4.0 \times 10^3 \text{ h}$ (e) $5.0 \times 10^2 \text{ h}$
39. For the reaction $2A + B \rightarrow 2C$, the following data were obtained at 25°C.
- | $[A]_0$ | $[B]_0$ | Initial Rate |
|---------|---------|--------------|
| 0.10 M | 0.20 M | 300 |
| 0.30 M | 0.40 M | 3600 |
| 0.30 M | 0.80 M | 14,400 |
- Which is the correct rate law?
 (a) $\text{rate} = k[A]^2[B]$
 (b) $\text{rate} = k[A][B]$
 (c) $\text{rate} = k[A][B]^2$
 (d) $\text{rate} = (k[A]^2[B])/[C]^2$
 (e) none of these
40. Silver chloride crystallizes in the same structure as sodium chloride (rock salt). The length of a unit cell is 555 pm. What is the density of AgCl?
 (a) 5.57 g cm^{-3} (b) 4.29 g cm^{-3} (c) 2.89 g cm^{-3} (d) 2.10 g cm^{-3} (e) 1.39 g cm^{-3}
41. Benzene (C₆H₆) reacts with Cl⁺ via a mechanism that is best described as a(n)
 (a) nucleophilic addition
 (b) electrophilic addition
 (c) nucleophilic substitution
 (d) electrophilic substitution
 (e) rearrangement

42. Consider an overall reaction that consists of two sequential steps in which the second step is much faster than the first step. Under these conditions, the final product will be formed
- at the same rate as the first step
 - at the same rate as the second step
 - at a rate halfway between that of the first and second steps
 - at a rate that is the rate for the first step multiplied by the rate for the second step
 - at a rate that is the sum of the rates for the first and second steps
43. How many resonance structures that contain only a single formal charge are possible for the cyclopentadienyl anion, $C_5H_5^-$?

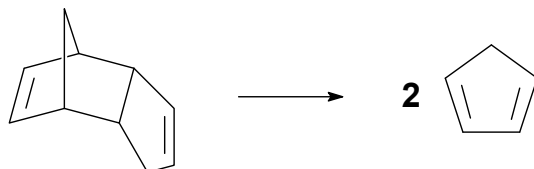


- 2
 - 3
 - 4
 - 5
 - 6
44. α -Terpinene, $C_{10}H_{16}$, is a pleasant smelling hydrocarbon that has been isolated from oil of marjoram. On hydrogenation over a palladium catalyst, α -terpinene reacts with two molar equivalents of H_2 . How many double bonds and how many rings does α -terpinene have?
- two double bonds and two rings
 - one double bond and two rings
 - three double bonds and no rings
 - one double bond and one ring
 - two double bonds and one ring
45. Which of the following compounds are aromatic?



- A and B**
 - C and D**
 - B and C**
 - A and D**
 - B, C and D**
46. The heat of formation of solid Fe_2O_3 is -826 kJ/mol. Calculate the heat for the reaction $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$ when a 55.8 g sample of iron reacts.
- 206 kJ
 - 413 kJ
 - 856 kJ
 - 1660 kJ
 - 3010 kJ

47. In the following reaction, how many σ -bonds and π -bonds are made or broken?



- (a) two σ -bonds and one π -bond are broken and two π -bonds are made
(b) three σ -bonds are broken and two π -bonds and one σ -bond are made
(c) two σ -bonds are broken and two π -bonds are made
(d) two σ -bonds and two π -bonds are broken and two σ -bonds and two π -bonds are made
(e) one σ -bond and one π -bond are broken and one σ -bond and one π -bond are made
48. Which of the following is true about coordination complexes?
- (a) the metal is a Lewis base and the ligands are Lewis acids
(b) only complexes with coordination number six are found in nature
(c) when the ligands approach a transition metal ion in an octahedral field, the d_{xz} , d_{yz} and d_{xy} atomic orbitals are affected the least by the ligands
(d) none of the above
(e) all of the above
49. Which of the following becomes appreciably more soluble in water if HCl is added?
- (a) an ether
(b) a carboxylic acid
(c) an aromatic amine
(d) an alkane
(e) an alkyne
50. The overall shape of a protein is maintained by
- (a) hydrogen bonding
(b) ionic bonds
(c) dipole-dipole bonding
(d) covalent bonds
(e) all of these

MERRY CHRISTMAS AND A HAPPY NEW YEAR!