This print-out should have 6 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

LDE Bond Order 005
001   10.0 points
All of the species below have the same bond order except for one. Which is it?

1. F_2^+

2. Li_2^- **correct**

3. N_2^{3+}

4. C_2^+

5. B_2^-

Explanation:
All of the species have a bond order of 1.5 except for Li_2^-, whose bond order is 0.5.

LDE Paramagnetism 004
002   10.0 points
Which of the following species is/are paramagnetic?
  I) Li_2^-
  II) O_2
  III) H_2^+

1. I and II

2. I only

3. I and III

4. II and III

5. II only

6. I, II and III **correct**

7. III only

Explanation:
Li_2^- and H_2^+ both have an odd number of electrons and therefore must be paramagnetic. O_2 has 16 total electrons, the last two of which must go into separate degenerate π^* anti-bonding orbitals.

LDE Bond Order 006
003   10.0 points
Rank the following species from strongest to weakest bonds based on bond order: O_2, N_2^+, H_2^-, Li_2, C_2^{2-}.

1. $N_2^+ > O_2 > C_2^{2-} > Li_2 > H_2^-$

2. $C_2^{2-} > N_2^+ > O_2 > H_2^- > Li_2$

3. $N_2^+ > O_2 > C_2^{2-} > H_2^- > Li_2$

4. $N_2^+ > C_2^{2-} > O_2 > Li_2 > H_2^-$

**5.** $C_2^{2-} > N_2^+ > O_2 > Li_2 > H_2^-$ **correct**

Explanation:
The species O_2, N_2^+, H_2^-, Li_2 and C_2^{2-} have bond orders of 2, 2.5, 0.5, 1 and 3 respectively.

LDE Ideal Gas Reaction 003
004   10.0 points

Consider the reaction below. If one mole of carbonic acid (H_2CO_3) decomposes completely and the resulting gas is collected in a 0.2 L vessel, what will the pressure be inside that vessel at standard temperature?

$$H_2CO_3(aq) \longrightarrow H_2O(l) + CO_2(g)$$
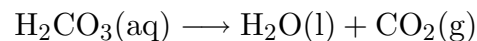
1. 22.4 atm

2. 11,348 atm

3. 2,270 atm

4. 112 atm **correct**

Explanation:
One mole of carbonic acid would decompose to produce one mole of carbon dioxide.

$$PV = nRT$$

$$P = \frac{nRT}{V} = \frac{1 * 0.0821 * 273}{0.2} = 112 \text{ atm}$$

LDE Ideal Gas Calculation 005
005　10.0 points

A sample of gas has a volume of 4.40 L at STP. What will the volume be if the temperature is raised to 546 K and the pressure is lowered to 0.5 atm?

1. 8.80 L

2. 17.60 L

3. 4.40 L **correct**

4. 1.10 L

5. 2.20 L

Explanation:
　The increase in temperature will double the volume, but the decreased in pressure will halve the volume. There will no net change in volume.

LDE Kinetic Theory 004
006　10.0 points

If every assumption of kinetic molecular theory were true, which of the statements below would be a consequence?

1. Diffusion would happen as rapidly as a gas' velocity.

2. None of these would be a consequence.

3. Diatomic gases would not exist.

4. Liquids and solids would not exist. **correct**

Explanation:
　If gases were infinitely small and did not attract or repel each other, they would never condense into liquids or solids. The fact that gases have non-zero volumes and attractive forces results in condensation and freezing in a temperature-dependent manner.