KEY

Midterm 4, 11AM, Version C
December 5, 2008
(40 min, closed book)

Name:_____

SID:_____

TA Name:_____

- There are 15 multiple choice questions worth 2 points each.
- Be sure to bubble in the version of test on your scantron form.
- Fill in the Scantron form AND circle your answers on the exam.

Useful Equations and Constants:

$E = h\nu$

$\lambda\nu = c$

$\lambda_{deBroglie} = h / p = h / mv$
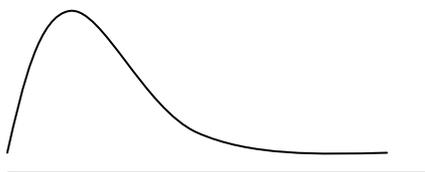
$E_{kin} (e\text{-}) = h\nu - \Phi = h\nu - h\nu_0$

$$E_n = -\frac{Z^2}{n^2} R_\infty$$

$\Delta x \, \Delta p \sim h$

$p = mv$

$A = \varepsilon lc$

1) What color does a normally blue object appear when viewed through a filter with the absorption profile shown here?

red orange yellow green blue violet

A) black   B) blue   C) green   D) colorless   E) can't tell

2) The process of removing an electron from a neutral element in the gas phase
A) requires energy for all elements, because the initial state is more stable than the final state.
B) does not require energy for any element, because the initial state is the same energy as the final state.
C) requires energy for all elements, because the initial state is less stable than the final state.
D) requires energy for some elements, because sometimes the initial state is more stable than the final state.

3) Plants absorb certain wavelengths of infrared light. This causes:

A) bond breaking   B) photosynthesis   C) bond formation   D) molecules to vibrate

4) Light of 450 nm wavelength will eject electrons from a metal sample. Which also must be true?
A) Light of 500 nm will also eject electrons.
B) Light of 400 nm will also eject electrons.
C) 450 nm light of greater intensity will eject electrons with greater kinetic energy.
D) 600 nm light will eject electrons provided the intensity is great enough.
E) None are true.

5) Black objects heated to ~600°C glow red. A black object heated to 25°C looks

A) black   B) orange   C) white   D) green

6) A blue advertising sign emits light with a wavelength of 465 nm. When the power is reduced, the light is dimmer. What has changed? (Mark all that apply.)

A) The wavelength of the light.
B) The frequency of the light.
C) The number of photons per second emitted.
D) The energy of the photons emitted.
E) All of these

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7) How does the 2s peak for lithium, Li, compare with the 2s peak for fluorine, F, in the photoelectron spectrum of lithium fluoride, LiF.

A) The 2s peak for Li is larger and at lower energy compared with the 2s peak for F.

B) The 2s peak for Li is smaller and at lower energy compared with the 2s peak for F.
C) The 2s peak for Li is larger and at higher energy compared with the 2s peak for F.
D) The 2s peak for Li is the same size but at lower energy compared with the 2s peak for F.
E) The 2s peak for both Li and F are the same height and at the same energy.

8) The electron affinity for fluorine, F, is -328 kJ/mol. Which would you predict to be the electron affinity for sodium, Na?

A) -344 kJ/mol

B) –53 kJ/mol

C) 0 kJ/mol
D) +28 kJ/mol
E) +316 kJ/mol

9) Select the best explanation for the answer to question #8.
A) Sodium has a more positively charged nucleus than fluorine.
B) Sodium is more stable as the Na^+ ion than the Na neutral atom.
C) Energy is always required to remove an electron.

D) Additional electrons are attracted to the sodium nucleus less than they are attracted to the fluorine nucleus.

10) What is the ground state 3p-orbital configuration of sulfur (S)? (Mark all that apply.)

A) [↑↓ | ↑↓ | ↑] B) [↑↓ | ↑ | ↑] C) [↑ | ↑↓ | ↑] D) [↑↓ | ↑↓ |]

11) What is the maximum number of electrons in the n=3 shell?

A) 6   B) 8   C) 10   D) 18   E) 32

12) Which statement is true about the gas phase molecule Li_2?
A) The bond order is 0.5.
B) There is one electron in the σ* molecular orbital.
C) There is one electron in the π orbital.
D) The molecule has an unpaired electron.

E) When one electron moves from the σ orbital to the σ* orbital, the bond breaks.

13) The energy of a photon depends _____.

A) only on the wavelength of the light.
B) only on the number of photons per second.
C) only on the amplitude of the wave.
E) on both the frequency and speed of the photons.

14) The electron on a hydrogen atom is excited to the n=3 energy level. The emission spectrum is shown below with increasing energy to the right. Which line corresponds to the transition from n =3 to n=2?

A   B C
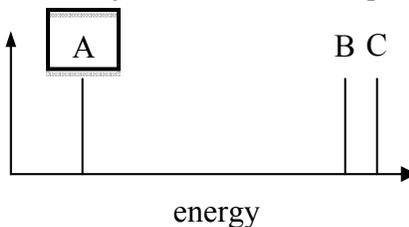
energy

15) Why do different metal atoms emit light of different wavelengths (colors)?

A) There is a different threshold energy level for the ejection of electrons.
B) The energies required for the electron to transition between orbitals are different for different metals.
C) As the energy level increases, the radius also increases.
D) This is due to the p-orbital filling.