Chem1901/3 **Sample Quiz 1 (i)** **Last update: 21/03/17**

1. What is the decay product resulting from the emission of an alpha particle from $^{210}_{85}\text{At}$?

a) $^{207}_{82}\text{Pb}$ b) $^{210}_{86}\text{Rn}$ c) $^{206}_{83}\text{Bi}$ d) $^{206}_{81}\text{Tl}$ e) $^{206}_{85}\text{At}$

2. Which nuclide is needed to balance the following nuclear reaction?

$$^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow \text{?} + {}^{96}_{39}\text{Y} + 3\,{}^{1}_{0}\text{n}$$

a) $^{139}_{53}\text{I}$ b) $^{138}_{53}\text{I}$ c) $^{137}_{53}\text{I}$ d) $^{136}_{53}\text{I}$ e) $^{135}_{53}\text{I}$

3. Only one of the following isotopes of strontium undergoes radioactive decay by β^- emission? Which one is it?

a) $^{83}_{38}\text{Sr}$ b) $^{86}_{38}\text{Sr}$ c) $^{87}_{38}\text{Sr}$ d) $^{88}_{38}\text{Sr}$ e) $^{90}_{38}\text{Sr}$

4. For which one of the following atoms or ions would the 2*s* and 2*p* orbitals have the same energy?

a) O^{2-} b) H c) He d) Li^{+} e) F^{6+}

5. Which of the following electron excitations of the hydrogen atom requires light of the *shortest* wavelength?

a) $n = 2$ to $n = 3$

b) $n = 3$ to $n = 4$

c) $n = 4$ to $n = 20$

d) $n = 5$ to $n = 100$

e) $n = 4$ to $n = 1000$

6. How many nodes does a 5*s* atomic orbital have?

a) 0 planar nodes and 0 spherical nodes
b) 3 planar nodes and 2 spherical nodes
c) 1 planar node and 1 spherical node
d) 0 planar nodes and 4 spherical nodes
e) 2 planar nodes and 3 spherical nodes

7. The $1s\ 3p \rightarrow 1s^2$ transition of He is at 54 nm. Which of the following statements is correct?

a) The $1s\ 2p \rightarrow 1s^2$ transition of He is at a longer wavelength than 54 nm.
b) The $1s\ 2p \rightarrow 1s^2$ transition of He is at a shorter wavelength than 54 nm.
c) The $1s\ 2p \rightarrow 1s^2$ transition of He is also at 54 nm.
d) No deduction about the $1s\ 2p \rightarrow 1s^2$ transition of He can be made.

8. The half-life of ^{14}C is 5730 years. Which of the following can be usefully dated using ^{14}C dating methods?

a) dinosaur bones (70 million years old)
b) 15th century paintings
c) rocks that are 2 billion years old
d) early human ancestor remains (approximately 2 million years old)
e) a corpse in a murder investigation (less than 2 years old)

9. Which one of the following sets of quantum numbers is valid?

	n	l	m_l	m_s
a)	3	1	0	0
b)	1	1	0	–½
c)	3	3	–2	+½
d)	1	1	1	0
e)	5	4	3	+½

10. Reference: http://firstyear.chem.usyd.edu.au/LabManual/W5.pdf

When computed on a calculator, the algebraic expression $\frac{0.350\ \text{kg} \times 141\ \text{J}}{(0.921\ \text{m} + 68\ \text{m})}$ has a value of 0.716037202. Expressed to the appropriate number of significant figures, this is:

a) 0.7 kg J m^{-1}
b) 0.71 kg J m^{-1}
c) 0.72 kg J m^{-1}
d) 0.716 kg J m^{-1}
e) 0.71604 kg J m^{-1}

Correct answers: 1C, 2C, 3E, 4B, 5A, 6D, 7A, 8B, 9E, 10C

Chem1901/3 **Sample Quiz 1 (ii)** **Last update: 23/03/17**

1. What is the decay product resulting from electron capture by the $^{144}_{61}\text{Pm}$ nuclide?

a) $^{144}_{60}\text{Pm}$ b) $^{144}_{62}\text{Pm}$ c) $^{145}_{60}\text{Nd}$ d) $^{144}_{60}\text{Nd}$ e) $^{144}_{62}\text{Sm}$

2. Which nuclide is needed to balance the following nuclear reaction?

$$^{233}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow \; ? \; + \; ^{101}_{42}\text{Mo} + 3\,{}^{1}_{0}\text{n}$$

a) $^{132}_{50}\text{Sn}$ b) $^{131}_{50}\text{Sn}$ c) $^{130}_{50}\text{Sn}$ d) $^{129}_{50}\text{Sn}$ e) $^{128}_{50}\text{Sn}$

3. Only one of the following isotopes of gallium does not undergo radioactive decay via electron capture. Which one is it?

a) $^{69}_{31}\text{Ga}$ b) $^{68}_{31}\text{Ga}$ c) $^{67}_{31}\text{Ga}$ d) $^{66}_{31}\text{Ga}$ e) $^{65}_{31}\text{Ga}$

4. For which one of the following atoms or ions would the 2*s* and 2*p* orbitals have the same energy?

a) O^{2-} b) H^{-} c) He d) Be^{2+} e) N^{6+}

5. Which of the following electron excitations of the hydrogen atom requires light of the *longest* wavelength?

a) $n = 2$ to $n = 3$

b) $n = 3$ to $n = 4$

c) $n = 4$ to $n = 20$

d) $n = 5$ to $n = 100$

e) $n = 4$ to $n = 1000$

6. How many nodes does a 2*p* atomic orbital have?

a) 0 planar nodes and 0 spherical nodes
b) 0 planar nodes and 1 spherical nodes
c) 1 planar nodes and 0 spherical nodes
d) 1 planar node and 1 spherical node
e) 2 planar nodes and 2 spherical nodes

7. The $1s\ 3p \rightarrow 1s^2$ transition of He is at 54 nm. Which of the following statements is correct?

a) The $1s\ 2p \rightarrow 1s^2$ transition of He is at a longer wavelength than 54 nm.
b) The $1s\ 2p \rightarrow 1s^2$ transition of He is at a shorter wavelength than 54 nm.
c) The $1s\ 2p \rightarrow 1s^2$ transition of He is also at 54 nm.
d) No deduction about the $1s\ 2p \rightarrow 1s^2$ transition of He can be made.

8. The half-life of ^{14}C is 5730 years. Which of the following can be usefully dated using ^{14}C dating methods?

a) dinosaur bones (70 million years old)
b) 15th century paintings
c) rocks that are 2 billion years old
d) early human ancestor remains (approximately 2 million years old)
e) a corpse in a murder investigation (less than 2 years old)

9. Which one of the following sets of quantum numbers is valid?

	n	l	m_l	m_s
a)	4	4	3	+½
b)	2	1	0	–½
c)	3	2	–2	+1
d)	1	1	1	0
e)	3	1	0	0

10. Reference: http://firstyear.chem.usyd.edu.au/LabManual/W5.pdf

When computed on a calculator, the algebraic expression $\frac{3.69\ \text{kg} \times 30.\ \text{J}}{(87.1\ \text{m} + 98.5\ \text{m})}$ has a value of 0.596443966. Expressed to the appropriate number of significant figures, this is:

a) 0.5 kg J m^{-1}
b) 0.6 kg J m^{-1}
c) 0.59 kg J m^{-1}
d) 0.60 kg J m^{-1}
e) 0.596 kg J m^{-1}

Correct answers: 1D, 2C, 3A, 4E, 5D, 6C, 7A, 8B, 9B, 10D