**Topics In Chemistry Midterm Answer Sheet 2023-24**

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**Topics In Chemistry Midterm. VERSION A**

**Fall Semester – 2023-24**

The rules for this thing:

1. Answer each question with the correct response.
2. Write legibly – I will not give credit to responses I can’t read.
3. Write your name on your answer sheet.
4. Write your class period on your answer sheet.
5. Write the test version on your answer sheet. **THIS IS VERSION A OF THE MIDTERM**
6. Please do not write on this test sheet. You will be provided with scratch paper.

Good luck!

1. How many electrons does oxygen-16 have?
2. 8
3. 16.999
4. 16
5. 24
6. How many neutrons are present in plutonium-245?
7. 94
8. 150
9. 151
10. 244
11. What is an isotope?
12. It is one of the forms of an element, differing from the others by the number of neutrons.
13. It is one of the forms of an element, differing from the others by atomic mass.
14. It is one of the forms of an element, differing from the others by the number of protons.
15. More than one of the above is correct.
16. What is a line spectrum?
17. The spectrum of sunlight.
18. A spectrum that consists only of certain energies of light.
19. A pattern of light given off by a Bunsen burner.
20. A set of orbitals that are given off by an element.
21. What is an orbital?
22. It’s another word for an electron
23. It’s where the electrons exist in the plum pudding model of the atom.
24. It’s where neutrons can be found in the atom.
25. It’s where electrons can be found in the atom.
26. What do we mean when we say that an electron is in an “excited state”?
27. It is in a low energy orbital.
28. It is in a high energy orbital.
29. It is jumping between orbitals.
30. It is giving off light.
31. What is spectroscopy?
32. It’s a way of heating elements.
33. It’s how you can tell if an atom has electrons.
34. It’s a way of identifying an unknown element from its protons.
35. It’s a way of identifying an unknown element from the light it emits.
36. Which of the following is characteristic of the Bohr model of the atom?
37. Orbitals near the nucleus have lower energy than those farther away.
38. Electrons can be found in circular orbits around the nucleus.
39. The energies of electrons can be determined by the variable n.
40. All of the above.
41. Which of the following is the best definition of the “scientific method”?
42. It is a method that’s used when graphing scientific data.
43. It’s a systematic stepwise method for approaching scientific problems.
44. It’s a systematic method for determining the independent variable in an experiment.
45. It’s an approach to doing science that involves a “guess and check” way of solving problems.
46. What is a hypothesis?
47. It’s a statement in which a prediction is made about what will happen when the independent variable in an experiment is changed.
48. It’s a statement in which a prediction is made about what will happen when the dependent variable in an experiment is changed.
49. It’s a statement that explains the purpose of an experiment.
50. It’s a summary of the data collected in an experiment.
51. What piece of lab equipment should *always* be worn by students?
52. Beaker
53. Safety hat
54. Goggles
55. Rubber gloves
56. Which of the following is NOT an SI base unit?
57. Meter
58. Second
59. Yard
60. All of the above are SI base units.
61. What does the prefix “milli-“ mean?
62. One thousandth (0.001)
63. One millionth (0.000001)
64. One thousand (1,000)
65. One million (1,000,000)
66. Explain why metals conduct electricity.
67. The electron sea theory, in which delocalized bonds hold the metal atoms together.
68. Bonding occurs when cations and anions are attracted to each other.
69. Bonding occurs when cations and anions share electrons.
70. Bonding occurs because of the electronegativity differences between atoms.
71. Which of the following is a good definition for accuracy?
72. It’s a measure of how often a measurement can be repeated.
73. It’s a measure of how close a measurement is to the actual value of the thing being measured.
74. It’s a measure of the precision of the measurement that’s being taken.
75. It indicates how many significant figures should be used when recording a measurement.
76. Provide the name for the compound PbO2
77. Lead oxide
78. Lead dioxide
79. Lead (II) oxide
80. Lead (IV) oxide
81. John Dalton had an atomic theory with five major points. Which of these is not a characteristic of his model of the atom?
82. Atoms are spherical
83. Atoms obey the law of conservation of mass
84. Atoms are indestructible
85. Atoms are very small
86. Which of these is not true of the plum pudding model of the atom?
87. The positive charge in the atom has negatively-charged electrons embedded in it.
88. Electrons can be easily pulled from the atom, while the positively-charged portion of the atoms cannot.
89. There is a positively-charged nucleus in the middle of the atom.
90. Electrons have negative charge, as shown by Thomson’s cathode ray experiment.

**Just for fun**: Did you put your name, period, and test version (**which for you is A**) on the answer sheet? If not, take a minute and do that!

1. Which of these phenomena convinced Rutherford that the positive charge in an atom is concentrated in the nucleus?
2. His cathode ray experiment showed that anode rays move toward the negative pole of a magnet.
3. His gold foil experiment showed that the positively-charged radioactive particles he fired at a target were deflected by positively-charged nuclei.
4. All of the positively-charged particles he shot at his gold foil target went right through the foil without being deflected at all.
5. When positively-charged particles were fired at a gold foil target, a beam of electrons was formed.
6. Which of the following is true of the halogens?
7. They are relatively unreactive.
8. They tend to form ions with a +1 charge.
9. They are diatomic.
10. They are metals.
11. What family of the periodic table contains elements that would be best suited to use as fuel in nuclear power plants?
12. Lanthanides
13. Actinides
14. Transition metals
15. Main block elements
16. Which elements on the periodic table consist of hard, relatively unreactive metals?
17. Transition metals
18. Noble gases
19. Alkali metals
20. Lanthanides
21. Which of the following elements has six valence electrons?
22. Carbon
23. Oxygen
24. Gallium
25. Bromine
26. If a neutral atom gains an electron, which of the following is formed?
27. Proton
28. Electron
29. Cation
30. Anion

**Fun activity**: Check to see if you’ve put your name, period, and test version (**this is version A**) on your answer sheet!

1. Which of the following is a general property of ionic compounds?
2. They conduct electricity as solids.
3. They conduct electricity when melted.
4. They have low melting and boiling points.
5. They are softer than the elements that make them up.
6. Why do ionic compounds generally have high melting and boiling points?
7. Cations are very hard
8. Anions are very hard
9. The attraction between anions and cations is strong
10. There is a lot of energy in the space around cation-cation interactions.
11. Which of these is a good definition of a “period” in the periodic table?
12. A collection of elements with similar properties.
13. A collection of elements with similar electron configurations.
14. It is another word for “group”.
15. A collection of elements in a row of the periodic table.
16. Which of the following is a demonstration of the octet rule?
17. Lithium gaining an electron to form a +1 ion.
18. Lithium gaining an electron to form a -1 ion.
19. Helium losing an electron to form a +1
20. Chlorine gaining an electron to form a -1 ion.
21. Which of the following is a reasonable explanation for why oxygen is less reactive than fluorine?
22. It has to lose two electrons to get the same number of valence electrons as neon.
23. It has to gain two electrons to get the same number of valence electrons as neon.
24. It has to lose six electrons to get the same number of valence electrons as helium.
25. It has to gain six electrons to get the same number of valence electrons as helium.
26. Which of the following is most likely not an ionic compound?
27. Beryllium acetate
28. CuOH
29. Carbon dioxide
30. KBr
31. Why do salts conduct electricity when melted or dissolved in water?
32. Electricity is formed when water is melted.
33. Electricity can be caused by the movement of ions.
34. Stationary ions have electronegativity deficits.
35. The ions attach to water molecules and form ionic liquids.
36. Why are ionic compounds hard?
37. Metals are hard, so metal ions are also hard.
38. Ionic crystals are extremely stable and the ions are locked in place.
39. Covalent bonding causes the ions to repel outside forces.
40. Metallic bonding causes the ions to have a strong attraction toward each other.
41. What is the charge of an iron(II) ion?
42. -2
43. +2
44. +3
45. It varies on what compound it’s in.
46. What is the name of Sr3N2?
47. strontium nitride
48. strontium (II) nitride
49. strontium nitrate
50. strontium (II) nitrate
51. What is spectroscopy?
52. It’s a method for identifying ionic compounds using their mass.
53. It’s a method for identifying elements using their line spectra.
54. It’s a method for identifying elements using their continuous spectra.
55. It’s a method for determining whether something is a metal, nonmetal, or metalloid.
56. Which of the following can easily conduct electricity?
57. Metals
58. Iron
59. Metalloids, but only if they’re heated or subjected to high voltage.
60. All of the above.
61. How are ionic compounds formed?
62. An element that wants to gain electrons gives electrons to one that doesn’t – this happens because of the octet rule.
63. An element that wants to lose electrons gives electrons to one that wants to gain electrons – this happens because of the octet rule.
64. Two elements that both want to gain electrons do so, causing them to form molecules according to the octet rule.
65. Something not involving the octet rule.

**Comedy corner:** Knock knock! *Who’s there?*

You *You who?*

No, I meant that I don’t know who you are because you didn’t put your name, period, or test version (A) on your answer sheet. You should do that now.

1. Which of these is **not** a property of the alkali metals?
2. They are reactive
3. They want to lose electrons to be like the nearest noble gas.
4. They have the smallest atomic radii of the elements in their periods.
5. They have low melting and boiling points.
6. Which is true of isotopes?
7. They are radioactive
8. They are not radioactive
9. Some are radioactive, some are not
10. Isotopes have nothing to do with radioactivity.
11. Which of these atomic particles weighs the least?
12. Protons
13. Neutrons
14. Electrons
15. Nucleons
16. I did an experiment in which I tested the conductivity of a material. When I did this, I found that it did conduct electricity. This material is most likely:
17. Metallic
18. Ionic
19. Nonmetallic
20. It is impossible to tell from this information
21. Which of these statements is true?
22. Mr. Guch is the smartest teacher I have.
23. Mr. Guch is kind and gentle; animals and babies love him.
24. Mr. Guch will probably be sainted one day for being so awesome.
25. All of the above.

**STOP**. That’s it for this test. You can’t leave, but you can check your work. Go do that.

Also, you might want to make sure that you’ve put your name, period, and test version on your exam. **Your test version is A**.

**Mystery riddle:**

* What has four legs in the morning, two legs in the day, and three legs at night?
* Answer: Anybody who doesn’t write their name, period, and test version A on their answer sheet. Why not do that now?

**Practice Midterm:**

1. How many electrons does aluminum have?
2. 13
3. 26.982
4. 27
5. None of these
6. How many neutrons are present in plutonium-243?
7. 94
8. 149
9. 243
10. 244
11. What is the atomic mass of the isotope of ruthenium with 56 neutrons?
12. 44
13. 100
14. 101
15. 112
16. Which of these best explains why elements have different isotopes?
17. Different numbers of neutrons can stabilize the positive charges in the nucleus
18. Different numbers of protons can stabilize the positive charges in the nucleus
19. Different numbers of protons can stabilize the negative charges in the nucleus
20. Different numbers of electrons can stabilize the negative charges in the nucleus
21. The atomic mass of an element is equal to which of these?
22. The number of protons in the atom
23. The number of neutrons in the atom
24. The number of protons + the number of neutrons in the atom
25. The number of protons + the number of electrons in the atom
26. The average atomic mass of an element is equal to which of these?
27. The number of protons in an atom.
28. The average of the atomic masses of all the isotopes
29. The average of the number of neutrons of all the isotopes
30. A weighted average of the atomic masses of all the isotopes
31. What is a continuous spectrum?
32. It’s a pattern of lines given off when an element is heated
33. It’s a pattern of lines given off when electrons fall from an excited state back down to the ground state.
34. It’s a series of colors given off by atoms when they gain energy
35. It’s a rainbow of colors given off when substances are heated.
36. What is an orbital?
37. It’s where electrons live
38. It’s where protons and neutrons live
39. It’s when atoms lose electrons due to the addition of energy
40. More than one of the above is correct.
41. What do we mean when we say that an electron is in a “ground state”?
42. It is in a low energy orbital
43. It is in a medium energy orbital
44. It is in a high energy orbital
45. It has jumped off of the atom to another atom.
46. Which of the following would NOT take place during the flame test?
47. The generation of a line spectrum
48. An excited state orbital is forced to hold three electrons.
49. The colors of light given off correspond to the energy difference between the ground state and excited state.
50. Electrons will fall from excited states back down to their ground states.
51. Which of the following is not characteristic of the Bohr model of the atom?
52. Electrons can be found in orbitals around the nucleus.
53. A maximum of two electrons can be found in an orbital.
54. Orbitals increase in energy as their distance increases from the nucleus.
55. All of the above are characteristic of the Bohr model of the atom.
56. Which of the following is the best definition of “quantitative data”?
57. Data that involves numerical data.
58. Data that involves any observational data.
59. Data that doesn’t involve numerical data.
60. Data that doesn’t use numbers.
61. Which of these is an example of a good hypothesis?
62. If I eat a sandwich, then I have probably been sitting in the sun.
63. If I eat a sandwich, then I will no longer be hungry.
64. If I eat a sandwich containing old mayonnaise, then I will become sick.
65. More than one of the above is an example of a good hypothesis.
66. What piece of lab equipment should always be worn by students?
67. Gloves
68. Apron
69. Dosimeter
70. Goggles
71. Which of the following is NOT an SI base unit?
72. Degree Fahrenheit
73. Kelvin
74. Meter
75. Gram
76. What does the prefix “centi-“ mean?
77. One-millionth
78. One-hundredth
79. One hundred
80. One million
81. If I have 8.7 centigrams, how many kilograms is this?
82. 87 kg
83. 0.87 kg
84. 0.087 kg
85. 0.0087 kg
86. Which of the following is a good definition for precision?
87. How close a measured value is to the actual value of the thing it’s measuring
88. How often a measurement is taken during an experiment.
89. How accurate the significant figures of an experiment are.
90. How often a measured value can be reproduced.
91. What is the name of the compound Na2S?
92. Disodium sulfide
93. Disodium sulfate
94. Sodium (I) sulfide
95. Sodium sulfide
96. Which of these is an example of the law of conservation of mass:
97. When I hit my son with a water balloon, the weight of my wet son was the same as the weight of my dry son plus the weight of the water in the balloon.
98. When I rear ended somebody else’s car with mine, the original weight of my car was equal to the weight of my crashed car and the bumper that fell from it.
99. When I washed my cat, the weight of the water that was originally in the tub was equal to the weight of the final weight of the water in the tub plus the weight of the water that my cat had splashed around.
100. All of these are examples of the law of conservation of mass.
101. John Dalton had an atomic theory with five major points. Which of these is not a characteristic of his model of the atom?
102. Atoms are small
103. Atoms contain electrons
104. Atoms obey the law of conservation of mass
105. Atoms cannot be destroyed
106. Which of these is not true of the plum pudding model of the atom?
107. Atoms contain electrons
108. Atoms contain orbitals
109. Electrons are embedded in a ball of positive charge.
110. More than one of the above is not true of the plum pudding model of the atom.
111. Which of the following is true of the alkaline earth metals?
112. They have high melting and boiling points
113. They are hard and brittle
114. They are extremely reactive
115. They form ions with a +1 charge
116. What family of the periodic table contains elements that would be best suited to kill bacteria at a water treatment plant?
117. Halogens
118. Alkali metals
119. Alkaline earth metals
120. Noble gases
121. Which of the following elements has four valence electrons?
122. Copper
123. Silicon
124. Gallium
125. Sulfur
126. Why doesn’t hydrogen have similar properties to the other elements in group 1?
127. It is a nonmetal
128. It is a metal
129. It is extremely electronegative
130. It is smaller than the other elements in group 1
131. If a neutral atom loses an electron, which of the following is formed?
132. Cation
133. Anion
134. Polyatomic ion
135. Neutral atom
136. Why can’t two metals react with one another to form an ionic compound?
137. Neither of them is electronegative, so neither will transfer electrons to the other.
138. They have similar electronegativities, so neither will transfer electrons to the other.
139. Metals are highly conductive, so their electrons prefer to stay on their original atom.
140. More than one of the above is correct.
141. Which of the following is not a general property of ionic compounds?
142. They have high melting and boiling points
143. They are hard and brittle
144. They form crystals
145. They are flammable.
146. Why are ionic compounds hard?
147. Ionic compounds form crystals where the ions are held tightly to one another.
148. Ionic compounds don’t form crystals, so their amorphous structure makes them inflexible.
149. Ionic compounds have high melting points.
150. Ionic compounds have low boiling points.
151. Generally speaking, why does fluorine form so many ionic compounds?
152. It is a nonmetal
153. It has lots of valence electrons
154. It is extremely electronegative so it’s good at pulling electrons off other atoms.
155. It wants to be like a noble gas, causing it to readily lose electrons.
156. Which of the following is a good definition of a family in the periodic table?
157. It is a column in the periodic table
158. It is a row in the periodic table
159. It contains nonmetals and metalloids
160. It contains only metals.
161. Which of the following is a poor definition of the octet rule?
162. Elements want to gain or lose electrons to get the same electron configurations the nearest noble gas.
163. Elements will become cations if they need to gain electrons to be like the nearest noble gas, and become anions if they need to lose electrons to be like the nearest noble gas.
164. All elements want to be like the nearest noble gas.
165. Because noble gas electron configurations are extremely stable, all elements want to get similar electron configurations to them.
166. Which of the following is a good explanation for why beryllium is less reactive than lithium?
167. It needs to gain more electrons to be like the nearest noble gas.
168. It needs to lose more electrons to be like the nearest noble gas.
169. It is a larger atom, making it harder to lose electrons.
170. It is a smaller atom, making it easier to lose electrons.
171. Which of the following is most likely an ionic compound?
172. Sodium acetate
173. Nitrogen
174. Copper (II) sulfate
175. More than one of these is an ionic compound.
176. Why don’t salts conduct electricity unless they are melted or dissolved in water?
177. Moving ions result in electrical conductivity.
178. Moving ions cause conductivity to increasingly insulate going across a period.
179. Moving ions cause new crystal lattices to form when compounds are melted or dissolved in water.
180. Ions remain stationary, causing charged ions to conduct electricity.
181. Why do ionic compounds have high melting and boiling points?
182. Ionic compounds contain metals, which have high melting and boiling points.
183. Ionic compounds are brittle, causing them to shatter when heated.
184. Ionic compounds conduct electricity, causing the ions to stick together in higher temperatures.
185. The interaction between cations and anions is very strong, requiring a great deal of energy to break.
186. What is the charge of a phosphide ion?
187. +3
188. -3
189. +1
190. -1
191. Why are ionic compounds usually formed when a metal bonds with a nonmetal?
192. Metals have high electronegativity, making it easy for them to transfer electrons to nonmetals.
193. Metals have low electronegativity, making it easy for them to transfer electrons to nonmetals.
194. Nonmetals have high electronegativity, making it easy for them to transfer electrons to nonmetals.
195. Nonmetals have low electronegativity, making it easy for them to transfer electrons to nonmetals.
196. What is the difference between a copper(I) and copper(II) ion?
197. Compounds containing copper(I) are green and compounds containing copper(II) are blue.
198. Copper(I) has a higher ionization energy
199. Copper(II) can be used to form ionic compounds and copper(I) cannot.
200. Copper(II) has a higher positive charge than copper(I)
201. Why do ionic compounds have high melting and boiling points?
202. The combination of an anion and cation forms a very stable compound.
203. Anions are always more stable than cations.
204. Because ionic compounds are also hard and brittle.
205. Electronegativities increase as you move across a period.
206. Why do metals usually form cations in ionic compounds?
207. Metals have low electronegativities
208. Metals lose electrons when placed into contact with electronegative elements.
209. Nonmetals have much higher electronegativities than metals.
210. All of the above.