**Topics In Chemistry Midterm – Mr. Guch**

**Fall Semester – 2024-25**

Write your name at the top of this page.

Answer the following questions by writing the letter of the correct choice to the left of the problem on the test sheet. This is shown to you on the board in this classroom. After you have finished the multiple choice questions, there is a brief short answer section at the end of this exam. It’s part of the exam, too, so do it.

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 form of an element, differing from others by the number of neutrons.
13. It is one form of an element, differing from others by atomic mass.
14. It is one form of an element, differing from 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. Electrons are treated as waves rather than particles.
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 a SI unit?
57. Meter
58. Second
59. Yard
60. All of the above are SI base units.
61. Explain why metals conduct electricity.
62. Bonding occurs when positive nuclei are held together by a “sea” of electrons.
63. Bonding occurs when cations and anions are attracted to each other.
64. Bonding occurs when cations and anions share electrons.
65. Bonding occurs because of the electronegativity differences between atoms.
66. Which of the following is a good definition for accuracy?
67. It’s a measure of how often a measurement can be repeated.
68. It’s a measure of how close a measurement is to the actual value of the thing being measured.
69. It’s a measure of the precision of the measurement that’s being taken.
70. It indicates how many significant figures should be used when recording a measurement.
71. Which of the following is true of halogens?
72. They are reactive
73. They are metals
74. They are all solid
75. All of these are true
76. John Dalton had an atomic theory with five major points. Which of these is not a characteristic of his model of the atom?
77. Atoms are spherical
78. Atoms obey the law of conservation of mass
79. Atoms are indestructible
80. Atoms of different elements have similar properties
81. Which of these is not true of the plum pudding model of the atom?
82. The positive charge in the atom has negatively-charged electrons embedded in it.
83. Electrons can be easily pulled from the atom, while the positively-charged portion of the atoms cannot.
84. There is a positively-charged nucleus in the middle of the atom.
85. Electrons have negative charge, as shown by Thomson’s cathode ray experiment.
86. Which of these phenomena convinced Rutherford that the positive charge in an atom is concentrated in the nucleus?
87. His cathode ray experiment showed that anode rays move toward the negative pole of a magnet.
88. His gold foil experiment showed that the positively-charged radioactive particles he fired at a target were deflected by positively-charged nuclei.
89. All of the positively-charged particles he shot at his gold foil target went right through the foil without being deflected at all.
90. When positively-charged particles were fired at a gold foil target, a beam of electrons was formed.
91. Which of the following is true of the halogens?
92. They are relatively unreactive.
93. They tend to form ions with a +1 charge.
94. They are diatomic.
95. They are metals.
96. What family of the periodic table contains elements that would be best suited to use as fuel in nuclear power plants?
97. Lanthanides
98. Actinides
99. Transition metals
100. Main block elements
101. Which elements on the periodic table consist of hard, relatively unreactive metals?
102. Transition metals
103. Noble gases
104. Alkali metals
105. Lanthanides
106. If a neutral atom gains an electron, which of the following is formed?
107. Proton
108. Electron
109. Cation
110. Anion
111. Which of the following is a general property of ionic compounds?
112. They conduct electricity as solids.
113. They conduct electricity when melted.
114. They have low melting and boiling points.
115. They are softer than the elements that make them up.
116. Why do ionic compounds generally have high melting and boiling points?
117. Cations are very hard
118. Anions are very hard
119. The attraction between anions and cations is strong
120. There is a lot of energy in the space around cation-cation interactions.
121. Which of these is a good definition of a “period” in the periodic table?
122. A collection of elements with similar properties.
123. A collection of elements with similar electron configurations.
124. It is another word for “group”.
125. A collection of elements in a row of the periodic table.
126. Why do salts conduct electricity when melted or dissolved in water?
127. Electricity is formed when water is melted.
128. Electricity can be caused by the movement of ions.
129. Stationary ions have electronegativity deficits.
130. The ions attach to water molecules and form ionic liquids.
131. Why are ionic compounds hard?
132. Metals are hard, so metal ions are also hard.
133. Ionic crystals are extremely stable and the ions are locked in place.
134. Covalent bonding causes the ions to repel outside forces.
135. Metallic bonding causes the ions to have a strong attraction toward each other.
136. What is spectroscopy?
137. It’s a method for identifying ionic compounds using their mass.
138. It’s a method for identifying elements using their line spectra.
139. It’s a method for identifying elements using their continuous spectra.
140. It’s a method for determining whether something is a metal, nonmetal, or metalloid.
141. Which of the following can easily conduct electricity?
142. Metals
143. Iron
144. Metalloids, but only if they’re heated or subjected to high voltage.
145. All of the above.
146. How are ionic compounds formed?
147. An element that wants to gain electrons gives electrons to one that doesn’t – this happens because of the octet rule.
148. An element that wants to lose electrons gives electrons to one that wants to gain electrons – this happens because of the octet rule.
149. Two elements that both want to gain electrons do so, causing them to form molecules according to the octet rule.
150. Something not involving the octet rule.
151. Which of these is **not** a property of the alkali metals?
152. They are reactive
153. They want to lose electrons to be like the nearest noble gas.
154. They have the smallest atomic radii of the elements in their periods.
155. They have low melting and boiling points.
156. Which is true of isotopes?
157. They are radioactive
158. They are not radioactive
159. Some are radioactive, some are not
160. Isotopes have nothing to do with radioactivity.
161. Which of these atomic particles weighs the least?
162. Protons
163. Neutrons
164. Electrons
165. 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:
166. Metallic
167. Ionic
168. Nonmetallic
169. It is impossible to tell from this information
170. Which of these statements is true?
171. Mr. Guch is the smartest teacher I have.
172. Mr. Guch is kind and gentle; animals and babies love him.
173. Mr. Guch will probably be sainted one day for being so awesome.
174. All of the above.

36) How many electrons does aluminum have?

1. 13
2. 26.982
3. 27
4. None of these
5. What is the atomic mass of the isotope of ruthenium with 56 neutrons?
6. 44
7. 100
8. 101
9. 112
10. Which of these best explains why elements have different isotopes?
11. Different numbers of neutrons can stabilize the positive charges in the nucleus
12. Different numbers of protons can stabilize the positive charges in the nucleus
13. Different numbers of protons can stabilize the negative charges in the nucleus
14. Different numbers of electrons can stabilize the negative charges in the nucleus
15. The atomic mass of an element is equal to which of these?
16. The number of protons in the atom
17. The number of neutrons in the atom
18. The number of protons + the number of neutrons in the atom
19. The number of protons + the number of electrons in the atom
20. The average atomic mass of an element is equal to which of these?
21. The number of protons in an atom.
22. The average of the atomic masses of all the isotopes
23. The average of the number of neutrons of all the isotopes
24. A weighted average of the atomic masses of all the isotopes
25. What is a continuous spectrum?
26. It’s a pattern of lines given off when an element is heated
27. It’s a pattern of lines given off when electrons fall from an excited state back down to the ground state.
28. It’s a series of colors given off by atoms when they gain energy
29. It’s a rainbow of colors given off when substances are heated.
30. What is an orbital?
31. It’s where electrons live
32. It’s where protons and neutrons live
33. It’s when atoms lose electrons due to the addition of energy
34. More than one of the above is correct.
35. What do we mean when we say that an electron is in a “ground state”?
36. It is in a low energy orbital
37. It is in a medium energy orbital
38. It is in a high energy orbital
39. It has jumped off of the atom to another atom.
40. Which of the following would NOT take place during the flame test?
41. The generation of a line spectrum
42. An excited state orbital is forced to hold three electrons.
43. The colors of light given off correspond to the energy difference between the ground state and excited state.
44. Electrons will fall from excited states back down to their ground states.
45. Which of the following is not characteristic of the Bohr model of the atom?
46. Electrons can be found in orbitals around the nucleus.
47. A maximum of two electrons can be found in an orbital.
48. Orbitals increase in energy as their distance increases from the nucleus.
49. All of the above are characteristic of the Bohr model of the atom.
50. Which of the following is the best definition of “quantitative data”?
51. Data that involves numerical data.
52. Data that involves any observational data.
53. Data that doesn’t involve numerical data.
54. Data that doesn’t use numbers.
55. Which of these is an example of a good hypothesis?
56. If I eat a sandwich, then I have probably been sitting in the sun.
57. If I eat a sandwich, then I will no longer be hungry.
58. If I eat a sandwich containing old mayonnaise, then I will become sick.
59. More than one of the above is an example of a good hypothesis.
60. What piece of lab equipment should always be worn by students?
61. Gloves
62. Apron
63. Dosimeter
64. Goggles
65. Which of the following is a good definition for precision?
66. How close a measured value is to the actual value of the thing it’s measuring
67. How often a measurement is taken during an experiment.
68. How accurate the significant figures of an experiment are.
69. How often a measured value can be reproduced.
70. Which of these is not true of the plum pudding model of the atom?
71. Atoms contain electrons
72. Atoms contain orbitals
73. Electrons are embedded in a ball of positive charge.
74. More than one of the above is not true of the plum pudding model of the atom.
75. Which of the following is true of the alkaline earth metals?
76. They have high melting and boiling points
77. They are hard and brittle
78. They are extremely reactive
79. They form ions with a +1 charge
80. What family of the periodic table contains elements that would be best suited to kill bacteria at a water treatment plant?
81. Halogens
82. Alkali metals
83. Alkaline earth metals
84. Noble gases
85. Why doesn’t hydrogen have similar properties to the other elements in group 1?
86. It is a nonmetal
87. It is a metal
88. It is extremely electronegative
89. It is smaller than the other elements in group 1
90. If a neutral atom loses an electron, which of the following is formed?
91. Cation
92. Anion
93. Polyatomic ion
94. Neutral atom
95. Which of the following is not a general property of ionic compounds?
96. They have high melting and boiling points
97. They are hard and brittle
98. They form crystals
99. They are flammable.
100. Why are ionic compounds hard?
101. Ionic compounds form crystals where the ions are held tightly to one another.
102. Ionic compounds don’t form crystals, so their amorphous structure makes them inflexible.
103. Ionic compounds have high melting points.
104. Ionic compounds have low boiling points.
105. Which of the following is a good definition of a family in the periodic table?
106. It is a column in the periodic table
107. It is a row in the periodic table
108. It contains nonmetals and metalloids
109. It contains only metals.

**Short answer questions:**

1) What is the octet rule? (3 pt)

2) What are Dalton’s five laws? Which are correct? (10 pt)

3) Explain the process by which light is given off from an atom when it is heated in a flame. (6 pt)