**General Chemistry Midterm Answer Sheet**

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**General Chemistry Midterm**

**Fall Semester – 2021-22**

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. 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 characteristic of the quantum model of the atom?
42. Electrons are treated as waves.
43. Electrons can be found in circular orbits.
44. Orbitals can hold up to six electrons at a time.
45. None of the above is true of the quantum model of the atom.
46. What element is represented by the electron configuration 1s2 2s2 2p6 3s2 3p6 4s2 3d10 4p6 5s2 4d1?
47. Scandium (Sc)
48. Yttrium (Y)
49. Lanthanum (La)
50. This doesn’t represent any element because it is not a valid electron configuration.
51. Which of the following is the best definition of the “scientific method”?
52. It is a method that’s used when graphing scientific data.
53. It’s a systematic stepwise method for approaching scientific problems.
54. It’s a systematic method for determining the independent variable in an experiment.
55. It’s an approach to doing science that involves a “guess and check” way of solving problems.
56. What is a hypothesis?
57. It’s a statement in which a prediction is made about what will happen when the independent variable in an experiment is changed.
58. It’s a statement in which a prediction is made about what will happen when the dependent variable in an experiment is changed.
59. It’s a statement that explains the purpose of an experiment.
60. It’s a summary of the data collected in an experiment.
61. Which of the following pieces of lab equipment can be used to accurately measure the volume of a liquid?
62. Graduated cylinder
63. Beaker
64. Erlenmeyer flask
65. Balance
66. What piece of lab equipment should *always* be worn by students?
67. Beaker
68. Safety hat
69. Goggles
70. Rubber gloves
71. Which of the following is NOT an SI base unit?
72. Meter
73. Second
74. Yard
75. All of the above are SI base units.
76. What does the prefix “milli-“ mean?
77. One thousandth (0.001)
78. One millionth (0.000001)
79. One thousand (1,000)
80. One million (1,000,000)
81. What is the density of a ball that has a volume of 95 mL and a mass of 34 grams?
82. 0.036 g/mL
83. 0.36 g/mL
84. 0.28 g/mL
85. 2.8 g/mL
86. Which of the following is a good definition for accuracy?
87. It’s a measure of how often a measurement can be repeated.
88. It’s a measure of how close a measurement is to the actual value of the thing being measured.
89. It’s a measure of the precision of the measurement that’s being taken.
90. It indicates how many significant figures should be used when recording a measurement.
91. Which of these numbers has three significant figures?
92. 0.01
93. 0.010
94. 0.0010
95. 0.00100
96. Which of the following is not a characteristic of a good graph?
97. The data is graphed using a best fit line.
98. The independent variable is shown on the x-axis.
99. The best fit line should never pass through the origin.
100. Both axes are labeled
101. Which of these is a homogeneous mixture?
102. My Uncle Merle
103. A bottle of Kool Aid
104. An ice-cold, refreshing can of Faygo brand diet cola
105. A mixture of rocks and water.
106. Which of these results in a chemical change?
107. Putting a hot dog in a blender
108. Putting a hot dog in a refrigerator
109. Putting a hot dog in a blast furnace
110. Soaking a hot dog in salt water until it shrivels up.
111. Which of these is an extensive property of my nephew’s hamster?
112. It does not rust when put into salt water.
113. It has a mass of 205 grams.
114. It is flammable (though this is *not* something we know from experience!)
115. All of the above are extensive properties of the hamster.
116. John Dalton had an atomic theory with five major points. Which of these is not a characteristic of his model of the atom?
117. Atoms are spherical
118. Atoms obey the law of conservation of mass
119. Atoms are indestructible
120. Atoms are very small
121. Which of these is not true of the plum pudding model of the atom?
122. The positive charge in the atom has negatively-charged electrons embedded in it.
123. Electrons can be easily pulled from the atom, while the positively-charged portion of the atoms cannot.
124. There is a positively-charged nucleus in the middle of the atom.
125. Electrons have negative charge, as shown by Thomson’s cathode ray experiment.
126. Which of these phenomena convinced Rutherford that the positive charge in an atom is concentrated in the nucleus?
127. His cathode ray experiment showed that anode rays move toward the negative pole of a magnet.
128. His gold foil experiment showed that the positively-charged radioactive particles he fired at a target were deflected by positively-charged nuclei.
129. All of the positively-charged particles he shot at his gold foil target went right through the foil without being deflected at all.
130. When positively-charged particles were fired at a gold foil target, a beam of electrons was formed.
131. Which of the following is true of the halogens?
132. They are relatively unreactive.
133. They tend to form ions with a +1 charge.
134. They are diatomic.
135. They are metals.
136. What family of the periodic table contains elements that would be best suited to use as fuel in nuclear power plants?
137. Lanthanides
138. Actinides
139. Transition metals
140. Main block elements
141. Which of the following best describes electronegativity?
142. It is a measurement of the size of the atoms of an element.
143. It is a measurement of how much atoms expand when an electron is added to them.
144. It is a measurement of how much atoms tend to pull electrons away from other atoms they have bonded to.
145. It is a way of measuring the positive charge in the nucleus of an atom
146. Which of the following elements has the highest atomic radius out of all these choices?
147. Helium
148. Iodine
149. Lithium
150. Rubidium
151. Which of the following elements has the smallest ionization energy?
152. Fluorine
153. Lithium
154. Cesium
155. Iodine
156. Which of the following elements has six valence electrons?
157. Carbon
158. Oxygen
159. Gallium
160. Bromine
161. If a neutral atom gains an electron, which of the following is formed?
162. Proton
163. Electron
164. Cation
165. Anion
166. Which of the following is a general property of ionic compounds?
167. They conduct electricity as solids.
168. They conduct electricity when melted.
169. They have low melting and boiling points.
170. They are softer than the elements that make them up.
171. Why do ionic compounds generally have high melting and boiling points?
172. Cations are very hard
173. Anions are very hard
174. The attraction between anions and cations is strong
175. There is a lot of energy in the space around cation-cation interactions.
176. Which of these is a good definition of a “period” in the periodic table?
177. A collection of elements with similar properties.
178. A collection of elements with similar electron configurations.
179. It is another word for “group”.
180. A collection of elements in a row of the periodic table.
181. Which of the following is a demonstration of the octet rule?
182. Lithium gaining an electron to form a +1 ion.
183. Lithium gaining an electron to form a -1 ion.
184. Helium losing an electron to form a +1
185. Chlorine gaining an electron to form a -1 ion.
186. How does the shielding effect cause the ionization energy of elements to decrease as you move from top to bottom down a group in the periodic table?
187. Inner electrons are bigger than the outer electrons, making it harder to remove an electron from an atom.
188. Outer electrons are bigger than inner electrons, making it harder to remove an electron from an atom.
189. Inner electrons have a higher charge than outer electrons, making it easier for an atom to lose electrons.
190. The combined charge of the inner electrons push outer electrons away, making it easier to pull them away from the atom.
191. Which of the following is a reasonable explanation for why oxygen is less reactive than fluorine?
192. It has to lose two electrons to get the same number of valence electrons as neon.
193. It has to gain two electrons to get the same number of valence electrons as neon.
194. It has to lose six electrons to get the same number of valence electrons as helium.
195. It has to gain six electrons to get the same number of valence electrons as helium.
196. Which of the following is most likely not an ionic compound?
197. Beryllium acetate
198. CuOH
199. Carbon
200. KBr
201. Why do salts conduct electricity when melted or dissolved in water?
202. Electricity is formed when water is melted.
203. Electricity can be caused by the movement of ions.
204. Stationary ions have electronegativity deficits.
205. The ions attach to water molecules and form ionic liquids.
206. Why are ionic compounds hard?
207. Metals are hard, so metal ions are also hard.
208. Ionic crystals are extremely stable and the ions are locked in place.
209. Covalent bonding causes the ions to repel outside forces.
210. Metallic bonding causes the ions to have a strong attraction toward each other.
211. What is the charge of an iron(II) ion?
212. -2
213. +2
214. +3
215. It varies on what compound it’s in.
216. What is the name of Sr3N2?
217. strontium nitride
218. strontium (II) nitride
219. strontium nitrate
220. strontium (II) nitrate
221. What is spectroscopy?
222. It’s a method for identifying ionic compounds using their mass.
223. It’s a method for identifying elements using their line spectra.
224. It’s a method for identifying elements using their continuous spectra.
225. It’s a method for determining whether something is a metal, nonmetal, or metalloid.
226. Which of these elements is most electronegative?
227. He
228. H
229. F
230. Fr
231. Which of the following can easily conduct electricity?
232. Metals
233. Iron
234. Metalloids, but only if they’re heated or subjected to high voltage.
235. All of the above.
236. How are ionic compounds formed?
237. Electronegative elements give electrons to elements that are less electronegative.
238. Electronegative elements receive electrons from elements that are less electronegative.
239. Two cations stick together to form a compound.
240. Two anions stick together to form a compound.
241. Which of these is **not** a property of the alkali metals?
242. They are reactive
243. They want to lose electrons to be like the nearest noble gas.
244. They have the smallest atomic radii of the elements in their periods.
245. They have low melting and boiling points.
246. Which of these statements is true?
247. Mr. Guch is the smartest teacher I have.
248. Mr. Guch is kind and gentle; animals and babies love him.
249. Mr. Guch will probably be sainted one day for being so awesome.
250. All of the above.

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

**Practice Midterm: Day 1**

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 not characteristic of the quantum model of the atom?
57. Electrons can be found in orbitals around the nucleus
58. A maximum of two electrons can be found in an orbital.
59. Orbitals increase in energy as their distance increases from the nucleus.
60. All of the above are characteristic of the Bohr model of the atom.
61. Which of these is the electron configuration of lead (Pb)?
62. 1s2 2s2  2p6 3s2  3p6 4s2  3d10 4p6 5s2  4d10 5d6 6s2  4f14 5d10 6p2
63. 1s2 2s2  2p6 3s2  3p6 4s2  3d10 4p6 5s2  4d10 5d6 6s2  4f14 6d10 6p2
64. 1s2 2s2  2p6 3s2  3p6 4s2  4d10 4p6 5s2  5d10 5d6 6s2  6f14 6d10 6p2
65. None of these are the correct electron configuration of lead.
66. Which of these is the abbreviated electron configuration for osmium?
67. [Xe] 6s2  4f14 5d5
68. [Xe] 6s2  4f14 5d6
69. [Rn] 6s2  4f14 5d5
70. [Rn] 6s2  4f14 5d6
71. What is an orbital filling diagram?
72. It’s a picture that shows where the ground states in an atom are.
73. It’s a picture that shows where the nucleus of the atom is.
74. It’s a picture that shows where the electrons in an atom are.
75. It’s another word for a complete electron configuration.
76. What is the Pauli Exclusion Principle?
77. No two atoms can have the same number of electrons.
78. No two atoms have have electrons with the same four quantum numbers
79. Electrons prefer to remain unpaired whenever possible.
80. Electrons will only pair up when they are in different energy levels.
81. Which of the following is the best definition of “quantitative data”?
82. Data that involves numerical data.
83. Data that involves any observational data.
84. Data that doesn’t involve numerical data.
85. Data that doesn’t use numbers.
86. Which of these is an example of a good hypothesis?
87. If I eat a sandwich, then I have probably been sitting in the sun.
88. If I eat a sandwich, then I will no longer be hungry.
89. If I eat a sandwich containing old mayonnaise, then I will become sick.
90. More than one of the above is an example of a good hypothesis.
91. Which of the following pieces of lab equipment can be used to accurately measure the mass of a liquid?
92. Beaker
93. Graduated cylinder
94. Balance
95. Volumetric flask
96. What piece of lab equipment should always be worn by students?
97. Gloves
98. Apron
99. Dosimeter
100. Goggles

**Practice Midterm: Day 2**

1. Which of the following is NOT an SI base unit?
2. Degree Fahrenheit
3. Kelvin
4. Meter
5. Gram
6. What does the prefix “centi-“ mean?
7. One-millionth
8. One-hundredth
9. One hundred
10. One million
11. If I have 8.7 centigrams, how many kilograms is this?
12. 87 kg
13. 0.87 kg
14. 0.087 kg
15. 0.0087 kg
16. What is the density of a cat that has a mass of 1.4 kg and a volume of 1.3 L?
17. 1.1 kg/L
18. 0.93 kg/L
19. 1.0 kg/L
20. 0.90 kg/L
21. Which of the following is a good definition for precision?
22. How close a measured value is to the actual value of the thing it’s measuring
23. How often a measurement is taken during an experiment.
24. How accurate the significant figures of an experiment are.
25. How often a measured value can be reproduced.
26. How many significant figures does the number 0.040 have?
27. 1
28. 2
29. 3
30. 4
31. Why do chemists use significant figures in their work?
32. To let others know the precision with which the data were collected.
33. To let others know how accurate their data are.
34. To let others know how many digits there are in measured data.
35. To demonstrate a clear knowledge of the experimental procedure.
36. Which of the following is characteristic of a good graph?
37. It has a line going through the origin
38. It always involves time as a variable
39. The independent variable is shown on the x-axis
40. The control variable is shown on the y-axis.
41. Which of these is a heterogeneous mixture?
42. American cheese
43. My annoying neighbor
44. Crisp, refreshing Kool Aid
45. Nitrogen gas
46. Which of these is a physical change?
47. The time I set a pizza on fire in my oven.
48. The time I left my hammer outside and it rusted.
49. The time I found a bird my cat had killed and it had started to decompose.
50. The time I crashed my car into the car in front of me.
51. Which of these is an intensive property of a squirrel?
52. It is warm
53. It is 30 cm long
54. It weighs 1.2 kg
55. It is 50 cm tall when it stands up and demands food.
56. When I heated a solid material, it started to smoke. This indicates a \_\_\_\_\_\_\_\_\_ change took place.
57. Physical
58. Chemical
59. Intensive
60. Extensive
61. Which of these is an example of the law of conservation of mass:
62. 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.
63. 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.
64. 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.
65. All of these are examples of the law of conservation of mass.
66. John Dalton had an atomic theory with five major points. Which of these is not a characteristic of his model of the atom?
67. Atoms are small
68. Atoms contain electrons
69. Atoms obey the law of conservation of mass
70. Atoms cannot be destroyed
71. Which of these is not true of the plum pudding model of the atom?
72. Atoms contain electrons
73. Atoms contain orbitals
74. Electrons are embedded in a ball of positive charge.
75. More than one of the above is not true of the plum pudding model of the atom.
76. Which of the following is true of the alkaline earth metals?
77. They have high melting and boiling points
78. They are hard and brittle
79. They are extremely reactive
80. They form ions with a +1 charge
81. What family of the periodic table contains elements that would be best suited to kill bacteria at a water treatment plant?
82. Halogens
83. Alkali metals
84. Alkaline earth metals
85. Noble gases
86. Which of the following best describes ionization energy?
87. It’s the amount of energy required to pull an electron from a neighboring atom.
88. It’s the amount of energy required to conduct electricity.
89. It’s the amount of energy required to remove an electron from an atom.
90. Ionization energy is the same thing as electronegativity.
91. Which of the following elements has the smallest atomic radius?
92. Lithium
93. Copper
94. Fluorine
95. Neon
96. Which of the following elements has the largest electronegativity?
97. Hydrogen
98. Helium
99. Iodine
100. Francium

**Practice Midterm: Day 3**

1. Which of the following elements has four valence electrons?
2. Copper
3. Silicon
4. Gallium
5. Sulfur
6. Why doesn’t hydrogen have similar properties to the other elements in group 1?
7. It is a nonmetal
8. It is a metal
9. It is extremely electronegative
10. It is smaller than the other elements in group 1
11. Another term for s- and p-block elements is:
12. Alkaline earth metals
13. Main block elements
14. Lanthanides
15. Transition metals
16. If a neutral atom loses an electron, which of the following is formed?
17. Cation
18. Anion
19. Polyatomic ion
20. Neutral atom
21. Why can’t two metals react with one another to form an ionic compound?
22. Neither of them is electronegative, so neither will transfer electrons to the other.
23. They have similar electronegativities, so neither will transfer electrons to the other.
24. Metals are highly conductive, so their electrons prefer to stay on their original atom.
25. More than one of the above is correct.
26. Which of the following is not a general property of ionic compounds?
27. They have high melting and boiling points
28. They are hard and brittle
29. They form crystals
30. They are flammable.
31. Why are ionic compounds hard?
32. Ionic compounds form crystals where the ions are held tightly to one another.
33. Ionic compounds don’t form crystals, so their amorphous structure makes them inflexible.
34. Ionic compounds have high melting points.
35. Ionic compounds have low boiling points.
36. Generally speaking, why does fluorine form so many ionic compounds?
37. It is a nonmetal
38. It has lots of valence electrons
39. It is extremely electronegative so it’s good at pulling electrons off other atoms.
40. It wants to be like a noble gas, causing it to readily lose electrons.
41. Which of the following is a good definition of a family in the periodic table?
42. It is a column in the periodic table
43. It is a row in the periodic table
44. It contains nonmetals and metalloids
45. It contains only metals.
46. Which of the following is a poor definition of the octet rule?
47. Elements want to gain or lose electrons to get the same electron configurations the nearest noble gas.
48. 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.
49. All elements want to be like the nearest noble gas.
50. Because noble gas electron configurations are extremely stable, all elements want to get similar electron configurations to them.
51. Which of the following is a good definition of the shielding effect?
52. Outer electrons push inner electrons toward the nucleus
53. Outer electrons pull on inner electrons toward the outer orbitals.
54. Inner electrons push outer electrons away from the nucleus
55. Inner electrons pull outer electrons toward the nucleus.
56. Which of the following is a good explanation for why beryllium is less reactive than lithium?
57. It needs to gain more electrons to be like the nearest noble gas.
58. It needs to lose more electrons to be like the nearest noble gas.
59. It is a larger atom, making it harder to lose electrons.
60. It is a smaller atom, making it easier to lose electrons.
61. Which of the following is most likely an ionic compound?
62. Sodium acetate
63. Nitrogen
64. Copper (II) sulfate
65. More than one of these is an ionic compound.
66. Why don’t salts conduct electricity unless they are melted or dissolved in water?
67. Moving ions result in electrical conductivity.
68. Moving ions cause conductivity to increasingly insulate going across a period.
69. Moving ions cause new crystal lattices to form when compounds are melted or dissolved in water.
70. Ions remain stationary, causing charged ions to conduct electricity.
71. Why do ionic compounds have high melting and boiling points?
72. Ionic compounds contain metals, which have high melting and boiling points.
73. Ionic compounds are brittle, causing them to shatter when heated.
74. Ionic compounds conduct electricity, causing the ions to stick together in higher temperatures.
75. The interaction between cations and anions is very strong, requiring a great deal of energy to break.
76. What is the charge of a phosphide ion?
77. +3
78. -3
79. +1
80. -1
81. Why are ionic compounds usually formed when a metal bonds with a nonmetal?
82. Metals have high electronegativity, making it easy for them to transfer electrons to nonmetals.
83. Metals have low electronegativity, making it easy for them to transfer electrons to nonmetals.
84. Nonmetals have high electronegativity, making it easy for them to transfer electrons to nonmetals.
85. Nonmetals have low electronegativity, making it easy for them to transfer electrons to nonmetals.
86. What is the difference between a copper(I) and copper(II) ion?
87. Compounds containing copper(I) are green and compounds containing copper(II) are blue.
88. Copper(I) has a higher ionization energy
89. Copper(II) can be used to form ionic compounds and copper(I) cannot.
90. Copper(II) has a higher positive charge than copper(I)
91. Why do ionic compounds have high melting and boiling points?
92. The combination of an anion and cation forms a very stable compound.
93. Anions are always more stable than cations.
94. Because ionic compounds are also hard and brittle.
95. Electronegativities increase as you move across a period.
96. Why do metals usually form cations in ionic compounds?
97. Metals have low electronegativities
98. Metals lose electrons when placed into contact with electronegative elements.
99. Nonmetals have much higher electronegativities than metals.
100. All of the above.