

JSD 3D Learning Activity Template

Grade: 6th

Title: Drawing Molecules

Utah Science with Engineering Education Standard (SEEd): Develop models to show that molecules are made up of different kinds, proportions, and quantities of atoms.

Key crosscutting concept(s) (CCC): Structure and function and Scale, proportion, and quantity

Key science and engineering practice(s) (SEP): Developing and using models and Obtaining, evaluating, and communicating information.

Materials: Paper, pencil, markers, colored pencils, crayons, a copy of atoms, one laptop per group.

Time: 2 days: Day 1 - 1 hour, day 2 – 45 minutes

Teacher background, key content information and hints: Understand that molecules are made of different proportions and quantities of atoms. List of different molecules that students can develop models of based on the list of atoms provided.

Prior knowledge that students need: Molecules are made of different combinations of atoms with certain combinations of atoms forming specific molecules.

Learning Activity Plan

These three aspects of a lesson should be identified in your learning activity.

Gathering: *(Obtain Information, Ask Questions/Define Problems, Plan & Carry Out Investigations, Use Models to Gather Data and Information, Use Mathematics/Computational Thinking.)*

Reasoning: *(Evaluate Information, Analyze Data, Use Mathematics/Computational Thinking, Construct Explanations/Solve Problems, Develop Arguments from Evidence, Use Models to Predict & Develop Evidence.)*

Communicating: *(Communicate Information, Argue from Evidence (written & oral), Use Models to Communicate).*

Phenomenon: Atoms are combined in different proportions and quantities to form molecules.

Learning Activity: Day 1: Review atoms using the Periodic Table of Elements. Explain that atoms in different proportions and quantities make up molecules. Model a simple molecule – water H₂O and explain that it is made up of 2 hydrogen and 1 oxygen atom. Give **each** group a list of common atoms (see student worksheet) and a list of common molecules without the formula. Students need to make a key for each atom – they choose a color for each different atom. The groups must research the formula for 10 different molecules. They can choose 10 from the list or research molecules from the following site http://www.periodni.com/solcalc-chemical_compounds.html. If they choose molecules that contain atoms that are not listed on the student worksheet, they need to add the atom and color code that as well. **Day 2: Groups will share their molecules with the class.**

Materials for Each Group: Paper, pencil, markers, colored pencils, crayons, a copy of atoms, one laptop per group.

Procedure: Review atoms with the class and introduce molecules using simple molecules such as water (H₂O). Groups draw a model for 10 molecules using the color code they make for each atom. Each group will share their 10 molecules with the class and explain the atoms and quantities that make up each molecule.

Assessment of student learning

Teacher will informally assess each group as they work making sure all student are participating. Each group will be assessed on the student worksheet – color code for atoms and correctly modeling 10 molecules.

<u>Atoms</u>	<u>Color</u>
Hydrogen	H
Oxygen	O
Nitrogen	N
Carbon	C
Sodium	Na
Chlorine	Cl

<u>Atoms</u>	<u>Color</u>
Magnesium	Mg
Sulfur	S
Copper	Cu
Lithium	Li
Fluorine	F
Calcium	Ca

Molecules

Water	Ammonia	Ammonium Ion
Carbon Dioxide	Methane Gas	Nitrogen Gas
Propane	Butane	Nitrate
Nitrate Ion	Sucrose	Peroxide
Caffeine	Aspirin	Carbon Monoxide
Magnesium Chloride	Copper Oxide	Sulfuric Acid
Baking Soda	Lithium Chloride	Fluoride
Sodium Chloride (salt)	Hydrochloric Acid	Sodium Hydroxide
Sodium Cyanide	Calcium Cyanide	Elemental Chlorine
Hydrogen Chloride	Carbon Monoxide	Chlorine Gas
Ozone	Sulfur Dioxide	Carbon Tetrachloride
Sulfate Ion	Hydrogen Peroxide	Nitrogen Monoxide
Nitrogen Dioxide		

Link for other molecules: http://www.periodni.com/solcalc-chemical_compounds.html

Molecules

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.

No.	Compound name	Molecular formula
1	Acetaldehyde	C_2H_4O
2	Acetamide	C_2H_5NO
3	Acetic acid	CH_3COOH
4	Acetone	C_3H_6O
5	Acetonitrile	C_2H_3N
6	Aluminium chloride	$AlCl_3$
7	Aluminium nitrate	$Al(NO_3)_3$
8	Aluminium sulfate	$Al_2(SO_4)_3$
9	Ammonia	NH_3
10	Ammonium acetate	CH_3COONH_4
11	Ammonium carbonate	$(NH_4)_2CO_3$
12	Ammonium chloride	NH_4Cl
13	Ammonium dichromate	$(NH_4)_2Cr_2O_7$
14	Ammonium hydroxide	NH_4OH
15	Ammonium nitrate	NH_4NO_3
16	Ammonium oxalate	$(NH_4)_2C_2O_4$
17	Ammonium sulfate	$(NH_4)_2SO_4$
18	Antimony(III) chloride	$SbCl_3$
19	Antimony(V) chloride	$SbCl_5$
20	Barium chloride	$BaCl_2$
21	Barium hydroxide	$Ba(OH)_2$
22	Barium nitrate	$Ba(NO_3)_2$
23	Bismuth(III) chloride	$BiCl_3$
24	Bismuth(III) nitrate	$Bi(NO_3)_3$
25	Butan-1-ol	$C_4H_{10}O$
26	Butyric acid	$C_4H_8O_2$
27	Cadmium nitrate	$Cd(NO_3)_2$
28	Cadmium sulfate	$CdSO_4$
29	Calcium chloride	$CaCl_2$
30	Calcium hydroxide	$Ca(OH)_2$

31	Calcium nitrate	$\text{Ca}(\text{NO}_3)_2$
32	Calcium sulfate	CaSO_4
33	Carbon disulfide	CS_2
34	Chloroacetic acid	$\text{C}_2\text{H}_3\text{ClO}_2$
35	Chloroauric acid	HAuCl_4
36	Chloroform	CHCl_3
37	Chloroplatinic acid	H_2PtCl_6
38	Chromium(III) chloride	CrCl_3
39	Chromium(III) nitrate	$\text{Cr}(\text{NO}_3)_3$
40	Chromium(III) sulfate	$\text{Cr}_2(\text{SO}_4)_3$
41	Chromium(VI) oxide	CrO_3
42	Citric acid	$\text{C}_6\text{H}_8\text{O}_7$
43	Cobalt(II) nitrate	$\text{Co}(\text{NO}_3)_2$
44	Cobalt(II) sulfate	CoSO_4
45	Copper(I) chloride	Cu_2Cl_2
46	Copper(II) chloride	CuCl_2
47	Copper(II) nitrate	$\text{Cu}(\text{NO}_3)_2$
48	Copper(II) sulfate	CuSO_4
49	Dichloroacetic acid	$\text{C}_2\text{H}_2\text{Cl}_2\text{O}_2$
50	Diethyl ether	$(\text{C}_2\text{H}_5)_2\text{O}$
51	Dimethylglyoxime	$(\text{CH}_3\text{CNOH})_2$
52	EDTA, disodium salt	$\text{Na}_2\text{C}_{10}\text{H}_{14}\text{N}_2\text{O}_8$
53	Ethanol	$\text{C}_2\text{H}_5\text{OH}$
54	Ethylene glycol	$(\text{CH}_2\text{OH})_2$
55	Formaldehyde	CH_2O
56	Formic acid	CH_2O_2
57	Fructose	$\text{C}_6\text{H}_{12}\text{O}_6$
58	Glucose	$\text{C}_6\text{H}_{12}\text{O}_6$
59	Glycerol	$\text{C}_3\text{H}_8\text{O}_3$
60	Hexafluorosilicic acid	H_2SiF_6
61	Hydrazine	N_2H_4

62	Hydrobromic acid	HBr
63	Hydrochloric acid	HCl
64	Hydrocyanic acid	HCN
65	Hydrofluoric acid	HF
66	Hydrogen peroxide	H ₂ O ₂
67	Hydroiodic acid	HI
68	Iodic acid	HIO ₃
69	Iron(II) ammonium sulfate	FeSO ₄ +(NH ₄) ₂ SO ₄
70	Iron(II) sulfate	FeSO ₄
71	Iron(III) chloride	FeCl ₃
72	Iron(III) nitrate	Fe(NO ₃) ₃
73	Iron(III) sulfate	Fe ₂ (SO ₄) ₃
74	Isobutanol	C ₄ H ₁₀ O
75	Lactic acid	C ₃ H ₆ O ₃
76	Lactose	C ₁₂ H ₂₂ O ₁₁
77	Lead(II) acetate	Pb(C ₂ H ₃ O ₂) ₂
78	Lead(II) chloride	PbCl ₂
79	Lead(II) nitrate	Pb(NO ₃) ₂
80	Lead(IV) acetate	Pb(C ₂ H ₃ O ₂) ₄
81	Lithium chloride	LiCl
82	Magnesium chloride	MgCl ₂
83	Magnesium nitrate	Mg(NO ₃) ₂
84	Magnesium sulfate	MgSO ₄
85	Maleic acid	C ₄ H ₄ O ₄
86	Malonic acid	C ₃ H ₄ O ₄
87	Maltose	C ₁₂ H ₂₂ O ₁₁
88	Manganese(II) chloride	MnCl ₂
89	Manganese(II) sulfate	MnSO ₄
90	Mannitol	C ₆ H ₁₄ O ₆
91	Mercury(II) chloride	HgCl ₂
92	Mercury(II) nitrate	Hg(NO ₃) ₂

93	Mercury(II) sulfate	HgSO ₄
94	Methanol	CH ₃ OH
95	Methyl acetate	C ₃ H ₆ O ₂
96	Nickel chloride	NiCl ₂
97	Nickel nitrate	Ni(NO ₃) ₂
98	Nickel sulfate	NiSO ₄
99	Nicotine	C ₁₀ H ₁₄ N ₂
100	Nitric acid	HNO ₃
101	Oxalic acid	H ₂ C ₂ O ₄
102	Pentan-1-ol	C ₅ H ₁₁ OH
103	Perchloric acid	HClO ₄
104	Phenol	C ₆ H ₆ O
105	Phosphoric acid	H ₃ PO ₄
106	Potassium bicarbonate	KHCO ₃
107	Potassium bromate	KBrO ₃
108	Potassium bromide	KBr
109	Potassium carbonate	K ₂ CO ₃
110	Potassium chlorate	KClO ₃
111	Potassium chloride	KCl
112	Potassium chromate	K ₂ CrO ₄
113	Potassium cyanide	KCN
114	Potassium dichromate	K ₂ Cr ₂ O ₇
115	Potassium dihydrogen phosphate	KH ₂ PO ₄
116	Potassium hexacyanoferrate(II)	K ₄ Fe(CN) ₆
117	Potassium hexacyanoferrate(III)	K ₃ Fe(CN) ₆
118	Potassium hydrogen phosphate	K ₂ HPO ₄
119	Potassium hydroxide	KOH
120	Potassium iodate	KIO ₃
121	Potassium iodide	KI
122	Potassium nitrate	KNO ₃
123	Potassium nitrite	KNO ₂

124	Potassium permanganate	KMnO_4
125	Potassium sulfate	K_2SO_4
126	Potassium sulfite	K_2SO_3
127	Potassium tartrate	$\text{K}_2\text{C}_4\text{H}_4\text{O}_6$
128	Potassium thiocyanate	KCNS
129	Propan-1-ol	$\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
130	Propan-2-ol	$\text{CH}_3\text{CHOHCH}_3$
131	Pyridine	$\text{C}_5\text{H}_5\text{N}$
132	Resorcinol	$\text{C}_6\text{H}_6\text{O}_2$
133	Saccharose	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$
134	Silver nitrate	AgNO_3
135	Silver sulfate	Ag_2SO_4
136	Sodium acetate	$\text{NaC}_2\text{H}_3\text{O}_2$
137	Sodium arsenate	Na_3AsO_4
138	Sodium bromide	NaBr
139	Sodium carbonate	Na_2CO_3
140	Sodium chlorate	NaClO_3
141	Sodium chloride	NaCl
142	Sodium chromate	Na_2CrO_4
143	Sodium citrate	$\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$
144	Sodium dichromate	$\text{Na}_2\text{Cr}_2\text{O}_7$
145	Sodium dihydrogen phosphate	NaH_2PO_4
146	Sodium formate	HCOONa
147	Sodium hydrogen carbonate	NaHCO_3
148	Sodium hydrogen phosphate	Na_2HPO_4
149	Sodium hydrogen tartrate	$\text{NaHC}_4\text{H}_4\text{O}_6$
150	Sodium hydroxide	NaOH
151	Sodium nitrate	NaNO_3
152	Sodium nitrite	NaNO_2
153	Sodium phosphate	Na_3PO_4
154	Sodium potassium tartrate	$\text{NaKC}_4\text{H}_4\text{O}_6$

155	Sodium sulfate	Na_2SO_4
156	Sodium sulfide	Na_2S
157	Sodium sulfite	Na_2SO_3
158	Sodium tartrate	$\text{Na}_2\text{C}_4\text{H}_4\text{O}_6$
159	Sodium thiosulfate	$\text{Na}_2\text{S}_2\text{O}_3$
160	Strontium chloride	SrCl_2
161	Strontium nitrate	$\text{Sr}(\text{NO}_3)_2$
162	Strontium sulfate	SrSO_4
163	Sulfuric acid	H_2SO_4
164	Sulfurous acid	H_2SO_3
165	Tartaric acid	$\text{H}_2\text{C}_4\text{H}_4\text{O}_6$
166	Thiourea	$\text{CH}_4\text{N}_2\text{S}$
167	Tin(II) chloride	SnCl_2
168	Tin(IV) chloride	SnCl_4
169	Trichloroacetic acid	CCl_3COOH
170	TRIS	$(\text{HOCH}_2)_3\text{CNH}_2$
171	Urea	$(\text{NH}_2)_2\text{CO}$
172	Urethane	$\text{C}_3\text{H}_7\text{NO}_2$
173	Zinc bromide	ZnBr_2
174	Zinc chloride	ZnCl_2
175	Zinc nitrate	$\text{Zn}(\text{NO}_3)_2$
176	Zinc sulfate	ZnSO_4