What Stays Dissolved?

Use solubility data to predict changes in water.

CHE.8.3 "Analyze and interpret data to predict the effect of temperature and pressure on solids and gases dissolved in water."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the sentences that describe temperature effects, circle the pressure rule, and mark two pairs of table rows that let you test one change at a time.

Inside a Sealed Water Tank

1. A sealed lab tank holds water beneath compressed air. A student can adjust the water temperature and the air pressure above it, then measure how much of a substance dissolves at equilibrium. Solubility is the greatest amount that stays dissolved under those conditions. If more solid is added than can dissolve, some remains as crystals.

2. For many ionic solids, warmer water can hold more dissolved material because dissolving absorbs energy. Dissolved gases often behave differently: warmer water holds less gas. Raising the pressure of a gas above water usually increases how much of that gas dissolves. Ordinary pressure changes have little effect on the solubility of most solids.

3. The table reports approximate equilibrium limits for potassium nitrate, KNO_3, and oxygen, O_2, in water. Each solid value is grams per 100 grams of water; each gas value is milligrams per liter of water. The pressure is air pressure, with the same oxygen fraction in every trial. Compare rows that change only one condition before judging a trend.

APPROXIMATE SOLUBILITY IN WATER

Temperature (°C)	Air pressure (atm)	KNO_3 (g per 100 g water)	O_2 (mg/L)
20	1	32	9.1
40	1	64	6.4
20	2	32	18.2
40	2	64	12.8

2 ANSWER WITH EVIDENCE

Use the passage

1. At 1 atm, about how much KNO_3 might dissolve in 100 g of water at 30°C? Use the two temperatures in the table to explain your estimate.

2. At 20°C, what happens to the solubility of each substance when air pressure rises from 1 atm to 2 atm?

3. At 1 atm, predict how cooling water from 40°C to 20°C changes the solubility of each substance. Support your prediction with table values.

4. A tank changes from 20°C at 1 atm to 40°C at 2 atm. Does oxygen solubility rise or fall overall? Explain why the temperature trend alone would not predict the result.

3 YOUR TURN

Your own words

A tank begins at 40°C and 1 atm. In 3 to 4 sentences, choose the table setting with the highest oxygen solubility, compare both substances before and after the change, and predict what happens if the water initially holds 50 g of dissolved KNO_3 per 100 g of water.

What Stays Dissolved?

PART 1 · READ AND MARK

Underline the sentences that describe temperature effects, circle the pressure rule, and mark two pairs of table rows that let you test one change at a time. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	At 1 atm, about how much KNO_3 might dissolve in 100 g of water at 30°C? Use the two temperatures in the table to explain your estimate.	**About 48 g. At 1 atm, the limit rises from 32 g at 20°C to 64 g at 40°C, so a midpoint estimate is 48 g.**
2	At 20°C, what happens to the solubility of each substance when air pressure rises from 1 atm to 2 atm?	**O_2 solubility doubles from 9.1 to 18.2 mg/L. KNO_3 solubility stays at about 32 g per 100 g water.**
3	At 1 atm, predict how cooling water from 40°C to 20°C changes the solubility of each substance. Support your prediction with table values.	**KNO_3 solubility falls from 64 to 32 g per 100 g water. O_2 solubility rises from 6.4 to 9.1 mg/L.**
4	A tank changes from 20°C at 1 atm to 40°C at 2 atm. Does oxygen solubility rise or fall overall? Explain why the temperature trend alone would not predict the result.	**It rises from 9.1 to 12.8 mg/L. Warming alone lowers oxygen solubility, but the increase in pressure more than offsets that effect.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

I would cool the tank to 20°C and raise the air pressure to 2 atm, the setting with the highest oxygen solubility shown. Oxygen solubility rises from 6.4 to 18.2 mg/L, while KNO_3 solubility falls from 64 to 32 g per 100 g water. If the water initially contains 50 g of dissolved KNO_3 per 100 g water, 18 g would crystallize at equilibrium.

Accept a reasonable estimate near 48 g for question 1 if the student explains how the two table values support it. For the open task, the 18 g prediction assumes equilibrium is reached.