

Gas Law Simulation A Criteria

I. Data Collection

A. 1=m, 2=n, 3=o, 4=p. [Particles, atoms, molecules], [collisions, crash], [velocity, speed], [energy, force].

- a. particles are moving in straight lines
- b. particles are colliding with walls
- c. particles are colliding with each other
- d. particles collide or crash
- e. speeds of particles are not the same
- f. speed(s) of particle(s) change(s)
- g. force or energy of collision influences speed of particles.

B.

OBSERVATION (graph)

- a. straight line (between collisions)
- b. angle of collision with walls

EXPLANATION:

- c. speed changes as a result of collision with other particles
- d. direction changes

MISCONCEPTION:

- e. speed changes as a result of collision with wall

C.

- a. organized

LABELS (incl. correct units)

- b. 1.01 atm (pressure)
- c. 22.4 L (volume)
- d. 275.25 K (temp.)

D. (pt. 1)

- a. different particles have different speeds
- b. speed(s) of particle(s) change(s)
- c. average speed is constant

D. (pt. 2)

- a. draw graph
- b. label axis (x: speed, y: number of particles)
- c. label line (average speed)
- d. label blocks (number of particles in a particular speed)

E.

OBSERVATION

- a. as pressure increases, volume decreases, or vice versa
- b. no changes in velocity distribution or average velocity
- c. number of collision increases or velocity changes more often when

volume decreases.

EXPLANATION

- d. pressure increases because collision with walls increases
- e. pressure increases because collision increases

MISCONCEPTION

- f. average speed changes
- g. pressure increases because collision between particles increases

II. Data Analysis

- a. correct graph
- b. pressure and volume are inversely proportional (in word)
- c. $pV = \text{constant}$ or $p \propto 1/V$

MISCONCEPTION

- d. wrong graph
- e. $p = 1/V$
- f. $y = ax + b$

III. Interpretation and Conclusions

A.

- a. pressure and volume are inversely proportional, or $PV = c$ or $p \propto 1/V$

B.

- a. show two situations with different volumes and same number of particles
- b. explain that the collisions in a unit time are different
- c. (because) average speeds are the same but volumes are different
- d. two situations with different volumes and different number of particles

C.

- a. correct answer (e.g. 0.226 atm and 275 K) extrapolated from graph that $pV = c = 22.6$
- b. correct answer from $pV = nRT$ or $p_1 V_1 = p_2 V_2$
- c. correct answer only