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PHYSICS WORKSHEET

Entropy

Chapter: Thermodynamics · Level ★★★ · Time: 30 min

SCORE ___ / 20

Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

- ✓ Understand: What is Entropy?
- ✓ Understand: The Second Law in Terms of Entropy
- ✓ Understand: Entropy Change Formula (Simple Case)
- ✓ Understand: Microscopic View of Entropy

Section A · Concept Check

• BEGINNER 4 × 1 = 4

1 300 J of heat transfers to a system at 500K (reversibly). Find delta_S.

2 150 J of heat transfers to a system at 300K (reversibly). Find delta_S.

3 Which has higher entropy: steam or liquid water (at the same mass)?

4 Why can a shuffled deck of cards be thought of as having higher entropy than a perfectly ordered deck?

Section B · Problem Solving

• INTERMEDIATE 4 × 3 = 12

5 If a system's entropy decreases in one region, what must happen elsewhere to satisfy the second law overall?

6 Why is 'entropy always increases' considered a statistical statement rather than an absolute law that can never have exceptions?

7 A perfectly reversible process occurs with no net entropy change. What does 'reversible' mean here?

8 Why does mixing hot and cold water together represent an entropy increase?

Section C · Challenge

• CHALLENGE 2 × 2 = 4

9 If delta_S=2 J/K for a process transferring 400 J of heat, find the temperature at which this occurred (reversible, constant T).

10 Why is it essentially impossible for scrambled eggs to spontaneously unscramble back into a whole egg?

Reflection — the most useful thing I learned:

A ___/4 B ___/12 C ___/4 **Total ___/20**

Teacher's Signature

Parent's Signature

✂ ANSWER KEY — FOLD OR CUT BEFORE HANDING OUT

1 = 0.6 J/K 2 = 0.5 J/K 3 = Steam (gas has the most disordered, highest-entropy state) 4 = There are vastly more possible shuffled arrangements than there are ordered ones, making the shuffled state overwhelmingly more probable and higher in entropy | 5 = Entropy must increase by at least as much somewhere else (like the surroundings), so total entropy doesn't decrease 6 = It reflects overwhelming probability (vastly more disordered arrangements than ordered ones) rather than a strict impossibility, though violations at macroscopic scale are practically never observed 7 = The process could be run exactly backward, returning both the system and surroundings to their exact original states 8 = The mixed, uniform-temperature state has more possible molecular arrangements (higher disorder) than the separated hot and cold portions | 9 = T=Q/delta_S=400/2=200K 10 = The unscrambled state has vastly lower entropy than the scrambled state, making a spontaneous reversal statistically astronomically improbable