BitWith Bite

PHYSICS WORKSHEET

Second Law of Thermodynamics

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

SCORE ___ / 20

Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

✓ Understand: The Second Law Statement ✓ Understand: Entropy

✓ Understand: Why Some Processes Are Irreversible ✓ Understand: Heat Engines and Efficiency Limits

Section A · Concept Check • BEGINNER 4 × 1 = 4

1 If total entropy of the universe could spontaneously decrease, what law would that violate?

2 Why is breaking an egg easy, but 'unbreaking' it essentially impossible spontaneously?

3 What must every real heat engine do with some of its absorbed heat?

4 Why does ice melt in a warm room, but a puddle of water doesn't spontaneously freeze in the same warm room?

Section B · Problem Solving • INTERMEDIATE 4 × 3 = 12

5 What allows a heat pump to warm a house by extracting heat from cold outdoor air?

6 Why is entropy sometimes described as 'time's arrow'?

7 Can the entropy of a specific small part of a system ever decrease?

8 Why is perfect (100%) energy conversion efficiency impossible in a heat engine, even in principle?

Section C · Challenge • CHALLENGE 2 × 2 = 4

9 What kind of process is theoretically 'reversible' with zero increase in total entropy?

10 Why does gas naturally spread to fill an entire container rather than staying concentrated in one corner?

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 = The second law of thermodynamics 2 = The broken state has much higher entropy than the intact state, and natural processes favor increasing entropy 3 = Expel some of it to a colder reservoir, rather than converting all of it to work 4 = Heat flows spontaneously from the warmer room to the colder ice, but not spontaneously from cooler water to a warmer room | 5 = External work (electrical energy) drives the process, making it non-spontaneous and consistent with the second law 6 = Because entropy naturally increases over time in isolated systems, giving a directional sense to how physical processes unfold 7 = Yes, but only if the entropy of the rest of the system (or its surroundings) increases by at least as much, keeping total entropy non-decreasing 8 = Some heat must always be released to a cold reservoir to complete the thermodynamic cycle, which is a direct consequence of the second law | 9 = An idealized process that occurs infinitely slowly and without friction or other losses 10 = The spread-out state has vastly higher entropy (more possible particle arrangements), which is statistically overwhelmingly favored