BitWith Bite

PHYSICS WORKSHEET

Thermal Expansion

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

SCORE ___ / 20

Name _____ Class _____ Date _____

AFTER THIS WORKSHEET YOU CAN

✓ Understand: Why Materials Expand ✓ Understand: Linear Expansion ✓ Understand: Area and Volume Expansion ✓ Understand: Expansion Joints

Section A · Concept Check

• BEGINNER 4 × 1 = 4

1 A 20m rod (alpha=0.000012) is heated by 40°C. Find its change in length.

2 A 2m rod expands by 0.0006m after heating by 30°C. Find its coefficient of linear expansion.

3 Is the volume expansion coefficient roughly 2x or 3x the linear coefficient?

4 Why might railway tracks buckle in extremely hot weather without expansion gaps?

Section B · Problem Solving

• INTERMEDIATE 4 × 3 = 12

5 Why can pipes burst in freezing weather?

6 A 15m bridge section (alpha=0.000011) experiences a 35°C temperature swing. Find its change in length.

7 Why is it useful for engineers to know a material's coefficient of linear expansion before construction?

8 Does thermal expansion generally increase or decrease a solid's density (assuming mass stays the same)?

Section C · Challenge

• CHALLENGE 2 × 2 = 4

9 A bimetallic strip (two different metals bonded together) bends when heated. Why?

10 Why does liquid mercury (or alcohol) rise in a traditional thermometer as temperature increases?

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 = delta_L=0.000012*20*40=0.0096m 2 = alpha=delta_L/(L0*delta_T)=0.0006/(2*30)=0.00001 per °C 3 = 3x 4 = The rails expand due to heat, and without room to expand, the resulting stress can bend or buckle the tracks | 5 = Water expands as it freezes, and if it's trapped inside a rigid pipe, the expansion can crack or burst the pipe 6 = delta_L=0.000011*15*35≈0.00578m 7 = It lets them calculate exactly how much a structure will expand or contract, so they can design appropriate gaps or supports 8 = Decrease, since the same mass now occupies a larger volume | 9 = The two metals expand at different rates (different coefficients), causing the strip to curve as one side grows more than the other 10 = Thermal expansion increases the liquid's volume, pushing it up the narrow calibrated tube