



**SCIENCE OLYMPIAD**  
— AT THE —  
**UNIVERSITY OF FLORIDA**

Northern Regional: January 19<sup>th</sup>, 2019

# Thermodynamics B Answer Key

**Name(s):** \_\_\_\_\_

**Team Name:** \_\_\_\_\_

**School Name:** \_\_\_\_\_

**Team Number:** \_\_\_\_\_

**Rank:** \_\_\_\_\_

**Score:** \_\_\_\_\_

Science Olympiad North Florida Regional at the University of Florida  
Thermodynamics Division B Written Test 2019

ANSWER KEY

Section 1: Multiple Choice (2 points each)

- |      |       |       |       |       |
|------|-------|-------|-------|-------|
| 1. A | 6. B  | 11. B | 16. C | 21. D |
| 2. D | 7. C  | 12. A | 17. D |       |
| 3. C | 8. D  | 13. A | 18. D |       |
| 4. B | 9. C  | 14. C | 19. C |       |
| 5. B | 10. D | 15. A | 20. C |       |

Section 2: Free Response (7 points each)

22.  $q(\text{out}) = mC\Delta T = 102.5 \text{ g} * 4.184 \text{ J}/(\text{g } ^\circ\text{C}) * (65.6 ^\circ\text{C} - 35.0 ^\circ\text{C})$   
 $q(\text{in}) = mC\Delta T = 102.5 \text{ g} * 4.184 \text{ J}/(\text{g } ^\circ\text{C}) * (35.0 ^\circ\text{C} - 18.5 ^\circ\text{C})$   
 $q(\text{cal}) = C(\text{cal})\Delta T(\text{cal}) = C(\text{cal}) * (35 ^\circ\text{C} - 18.5 ^\circ\text{C})$   
 $q(\text{out}) - q(\text{in}) = q(\text{cal}) = C(\text{cal})\Delta T(\text{cal})$   
 $C(\text{cal}) = (q(\text{out}) - q(\text{in})) / \Delta T(\text{cal}) = 6046.9 \text{ J} / 16.5 \text{ K} = 366.5 \text{ J} / \text{K}$

23.  $q(\text{out}) = mC\Delta T = 139 \text{ g} * C * (96.4 ^\circ\text{C} - 23.7 ^\circ\text{C})$   
 $q(\text{in}) = mC\Delta T = 70.9 \text{ g} * 4.184 \text{ J}/(\text{g } ^\circ\text{C}) * (23.7 ^\circ\text{C} - 20 ^\circ\text{C})$   
 $q(\text{cal}) = C(\text{cal})\Delta T(\text{cal}) = 12.6 \text{ J}/\text{K} * (23.7 ^\circ\text{C} - 20 ^\circ\text{C})$   
 $q(\text{out}) - q(\text{in}) = q(\text{cal})$   
 $10105.3 * C - 1097.6 = 46.62$   
 $C = 0.1132 \text{ J}/(\text{g } ^\circ\text{C})$

24.  $q(\text{soln}) = 1.357 \text{ kg} * 1000 \text{ g}/\text{kg} * 4.184 \text{ J}/(\text{g } ^\circ\text{C}) * (32.692 ^\circ\text{C} - 23.64 ^\circ\text{C})$   
 $q(\text{cal}) = 0.885 \text{ kJ}/^\circ\text{C} * 1000 \text{ J}/\text{kJ} * (32.692 ^\circ\text{C} - 23.64 ^\circ\text{C})$   
 $q(\text{rxn}) = -(q(\text{soln}) + q(\text{cal}))$   
 $\Delta E(\text{rxn}) = q(\text{rxn}) / \text{mol } \text{C}_6\text{H}_6 = -(51,394.4 \text{ J} + 8,011.02 \text{ J}) / 0.0173 \text{ mol } \text{C}_6\text{H}_6$   
 $= -3433.8 \text{ kJ}/\text{mol}$