Thermodynamics

SSSS 2018-2019

KEY

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Name:______________________ Date:________________________

Team:______________________ Division:_____________________

1. C
2. A
3. C
4. B
5. B
6. D
7. C
8. B
9. A
10. A
11. A
12. A
13. E
14. D
15. E
16. C
17. C
18. D
19. E
20. D
21. A
22. D
23. D
24. C
25. D
26. C
27. D
28. C
29. B
30. B

Short Answer Questions.

1. H = Hbond breakage + Hbond formation

4(C – H) = 4 . 414 = 1656 4(C – H) = 1656
1(C = C) = 612 2(C – Br) = 2 . 276 = 552
1(Br – Br) = 193 1(C – C) = 347
H = [+1656 + 612 + 193] – [1656 + 552 + 347]
H = +2461 – 2555 = – 94 kJ

2. (a) $\Delta A = \gamma A_0 \Delta T$

$0.020\text{cm}^2 = [34 \times 10^{-6}°\text{C}^{-1}](9.980cm^2)(\Delta T)$

$\Delta T = 59°\text{C}$

$T = T_0 + \Delta T = 20.0 + 59 = 79°\text{C}$

(b) $A_c + \Delta A_c = A_s + \Delta A_s$

$A_c + \gamma_c A_c \Delta T = A_s + \gamma A_s \Delta T$

$\gamma_c A_c \Delta T - \gamma A_s \Delta T = A_s - A_c$

$$\Delta T = \frac{A_s - A_c}{\gamma_c A_c - \gamma_s A_s}$$

$$= \frac{10.000\ cm^2 - 9.980cm^2}{(34 \times 10^{-6}°\text{C}^{-1})(9.980cm^2) - (22 \times 10^{-6}°\text{C}^{-1})(10.000cm^2)} = \Delta T = 170°\text{C}$$

3. (a) $P = \frac{kA(T_h - T_c)}{L}$

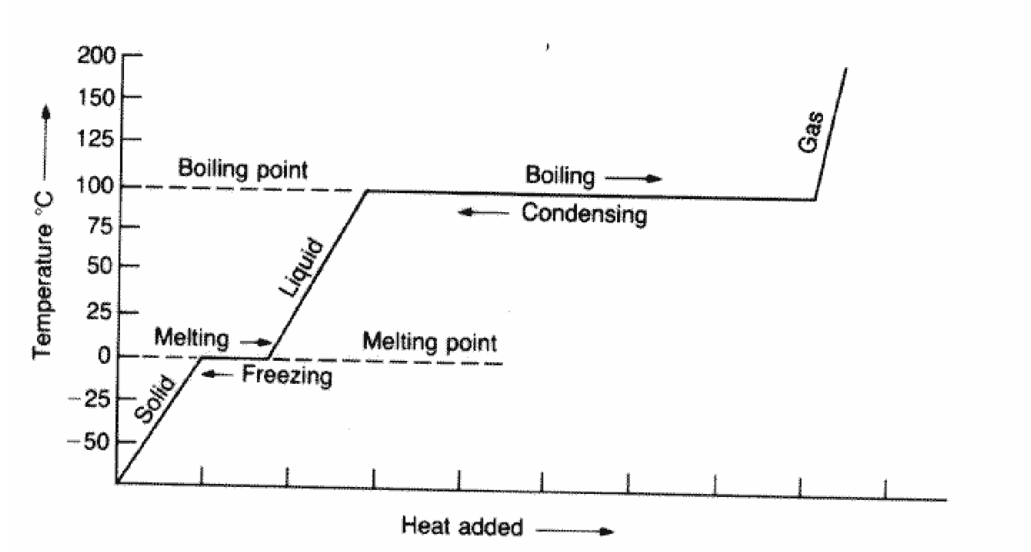
$$P = \frac{(\frac{0.21J}{mk})(1.73m^2)(37.0°\text{C} - 33.0°\text{C})}{(2.0 \times 10^{-2}m)} = 73W$$

(b) $Q = P\Delta t = (73W)(3{,}600s) = 2.6 \times 10^5 J$

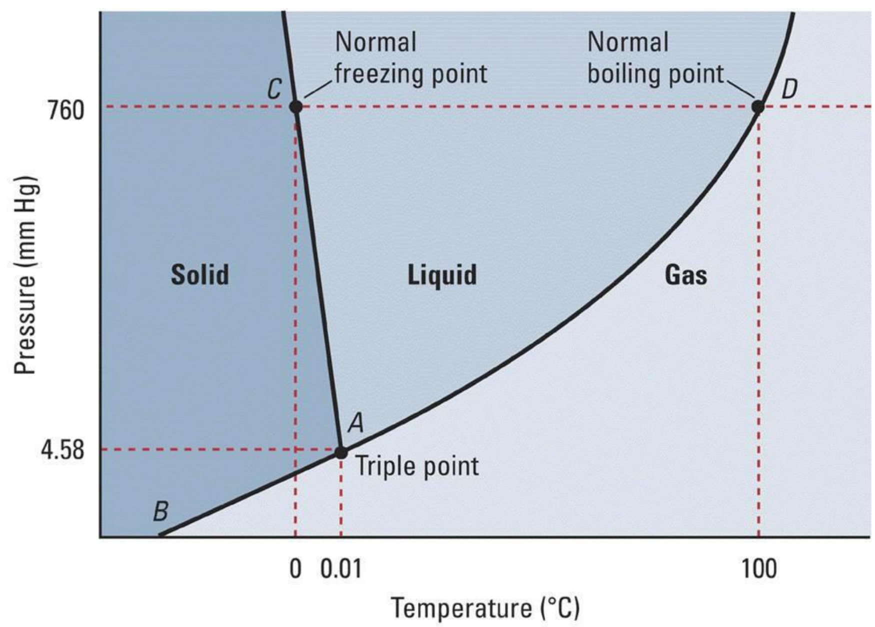
(c) $Q = mc\Delta T$

$$\Delta T = \frac{Q}{mc} = \frac{2.6 \times 10^5 J}{(75kg)(\frac{3{,}470J}{kgK})} = 1.0°\text{C}$$

4. (heating curve)



(phase diagram)



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(a) $A = 4\pi R^2 = 4\pi (6.02 \times 10^8 \, m)^2 = 4.55 \times 10^{18} m^2$

$P = \sigma A e T^4 = (5.67 \times 10^{-18} \, W/m^2 \cdot k^4)(4.55)(10^{18} m^2)$

$= ~~2.90 \times 10~~$

$= 2.90 \times 10^{26} W$

(b) $A_{pd} = \pi r^2 = \pi (6.64 \times 10^6 \, m)^2 = 1.39 \times 10^{14} m^2$

$A_o = 4\pi r_o^2 = 4\pi (6.00 \times 109 \, m)^2 = 4.52 \times 10^{20} m^2$

$P_I = \left(\frac{A_{pd}}{A_o} \right) P = \left(\frac{1.39 \times 10^{14} m^2}{4.52 \times 10^{20} m^2} \right) (2.90 \times 10^{26} W)$

$= 8.92 \times 10^{19} W$

(c) $P_I = \sigma A e T^4 = (5.67 \times 10^{-8} \, W/m^2 \cdot k^4)(5.54 \times 10^{14} m^2)(1.00)(T^4)$

$= (3.15 \times 10^7 \, W/k^4) T^4 = 8.92 \times 10^{19} W$

$T = 1.30 \times 10^3 k$

5.