IB physics SL – Thermal physics paper 1

Page 1

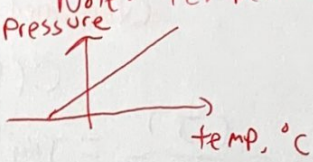
1) A

2) A

3) C

$nRT = PV \Rightarrow \frac{P}{T} = \frac{nR}{V}$

Note: temperature is in °C



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4) A — Same type of problem in Pg1.1 — Insulation & closed system

5) D → Ideal gas
- no intermolecular force
- perfectly elastic

6) C

7) D

$Q_{released} = Q_{absorbed}$

$2Cm(80-T) = Cm(T-20)$

$2(80-T) = T-20$

$160 - 2T = T - 20$

$180 = 3T$

$T = 60\ ^\circ C$

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8) B

9) B $Q = cm \cdot \Delta T$

10) A $Q = P \cdot \Delta t = cm \cdot \Delta T \Rightarrow c = \frac{P\Delta t}{\Delta T m} = \frac{6000}{(0.1)(40)}$

11) C Molar mass vs atomic mass

Page 4)

12) C $350 - 273 = 50 + 27 = 77$

$T(^\circ K) = T(^\circ C) + 273.15$

13) D

15) D → $L \cdot \Delta T$ is not even the correct formula ?!?!

16) B Solid → liquid: PE↑, KE↓ } melting point ⇒ temperature remains constant

17) C Solid: PE↓, KE↑

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18) A Internal Energy = Total Kinetic Energy + Total Potential Energy

19) D

20) D $P = \frac{Q}{\Delta t} = \frac{cm\Delta T}{\Delta t} = \text{constant}$ (slope)

21) B

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22) C

23) B

24) C

$T(°K) = T(°C) + 273.15$

$Q_{absorbed} = Q_{released}$ (Pg 2.7)

$C(10)(T-10) = C(20)(70-T)$

$T-10 = 2(70-T)$

$T-10 = 140-2T$

$3T = 150 \Rightarrow T = 50°C$

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25) C

$[C] = \frac{[J]}{[Kg \cdot K]} = JKg^{-1}K^{-1}$

$[L] = \frac{[J]}{[Kg]} = JKg^{-1}$

26) C

27) B

28) A

$1800 = 10(C_\ell M + C_c M_c)$

$180 = C_\ell M_\ell + C_c M_c$ ①

$3000 = 10(C_\ell 2M_\ell + C_c M_c)$ ②

$300 = 2C_\ell M_\ell + C_c M_c$

$300 = 2C_\ell M_\ell + 180 - C_\ell M_\ell$

$120 = C_\ell M_\ell$

$C_\ell = \frac{120}{M_\ell} = \frac{120}{m}$ ANS

Real gas → Ideal gas

① low P, high T

② low density ρ

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29) A

30) B

31) B

32) C

33) D

Latent heat capacity definition

$nRT = PV$

K (kinetic energy) $\propto T$ (temperature)

Note: $W = nRT = P \cdot \Delta V = FL$

Ideal gas equation

$W = nRT = PV$

$W = NK_B T$

↑ # of moles ≠ N molecules

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34) C

35) C

36) B

37) A

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38) D
39) A
40) A

Page 11

41) A
42) B
43) B
44) C
45) B

Page 12

46) A
47) B

Page 13

48) C
49) B
50) D
51) B
52) C

Page 14

53) D
54) B

Page 15

55) B
56) A
57) C
58) D

$Q_{absorbed} = Q_{released}$ (Pg 2.7, Pg 6.24)

$C(0.2)(T-20) = C(0.4)(80-T)$

$T-20 = 2(80-T)$

$T-20 = 160-2T$

$3T = 180$

$T = 60\,^{\circ}C$

$P = \frac{Q}{\Delta t} = cm\frac{\Delta T}{\Delta t}$ (Pg 5.)

$P = cm \cdot K \Rightarrow m = \frac{P}{Kc}$

$P = \frac{cm \cdot \Delta T}{\Delta t} = \frac{(0.5)(4)(80)(10^3)}{8200} = 800\,W$

$1000\,W - 800\,W = 200\,W$

$P = cm\frac{\Delta T}{\Delta t}$, $P = m\frac{L}{\Delta t}$

⇒ greater slope, smaller heat capacity

⇒ longer the time, larger the latent heat capacity

Ideal gas: no inter molecular forces between molecules ⇒ $PE = 0$

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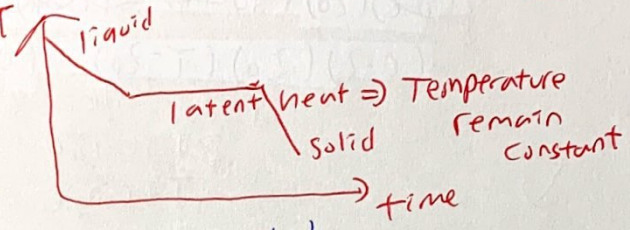
59) A

60) A

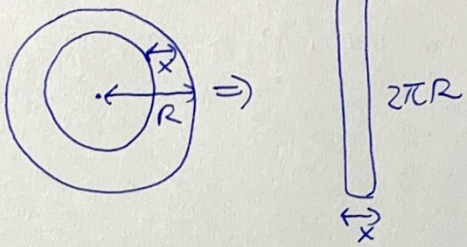
61) A

wrong Approach

$\frac{Q}{T} = \frac{CM\Delta T}{\Delta T} = CM \Rightarrow \frac{T}{Q} = \frac{1}{CM}$



$P = \frac{F}{A} = \frac{W}{2\pi RX}$



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62) A

63) B

$P = CM\frac{\Delta T}{\Delta t}$

$P \propto CMK$

64) D

65) D

66) A

67) [illegible]

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B → same temperature ⇒ same kinetic energy

Liquid → gas : PE↑ since atoms are farther apart from each other

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