T5 paper 1 with Mark Scheme (SL)

1) B Heat loss to the environment

2) A Hess's law

3) D

$Q = cm \cdot \Delta T = n \cdot \Delta H$

$C = \frac{Q}{m \cdot \Delta T} = \frac{200}{(5)(10)} = 4$

4) A: Exothermic VS Endothermic
Enthalpy ⇒ per mole

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5) C

6) A

7) D

Exothermic Reaction
⇒ negative bond enthalpy: $\underbrace{\sum \Delta H_{(broken)}}_{\text{Reactant}} - \underbrace{\sum \Delta H_{(formed)}}_{\text{Product}}$
⇒ products are more stable

$3H_2(g) + N_2(g) \rightleftarrows 2NH_3(g)$

$3(H-H) + \ddot{N}\equiv\ddot{N} \rightleftharpoons [H-\ddot{N}(-H)-H](2)$

$3(436) + (945) - 2(3)(391)$

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8) C

9) B

10) C

Exothermic
⇒ combustion
⇒ neutralization
⇒ bond formation
⇒ state of matter (l, g, s)

Endothermic
⇒ Bond breaking
⇒ state of matter (l, g, s)

$\Delta H = \frac{cm \cdot \Delta T}{n} \rightsquigarrow = + \frac{(4.18)(25)(14)}{0.1 \times 1000}$

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11) C

12) ~~B~~ A $\Sigma H_f^\theta = \Sigma H_p^\theta - \Sigma H_R^\theta$

- Incomplete combustion
- Flame color
- CO_2 to CO

13) D

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14) C −144−11 Hess's Law

~~$2CuO(s) \rightarrow Cu_2O(s) + \frac{1}{2}O_2(g)$~~

~~$Cu_2O(s) \rightarrow Cu(s) + CuO(s)$~~

$$Cu_2O + \frac{1}{2}O_2 \rightarrow 2CuO \quad -144$$
$$CuO \rightarrow Cu + CuO \quad -11$$
$$Cu + \frac{1}{2}O_2 \rightarrow CuO \quad -144-11$$

15) C

16) C Enthalpy VS Bond Enthalpy

17) D $n \cdot \Delta H = cm \cdot \Delta T$

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18) A

19) A* $Q = cm \cdot \Delta T$

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20) C

$2(-286) + 0 - H_{f(N_2H_4)} - 0 = -623$

$H_{f(N_2H_4)} = -572 + 623$

21) B

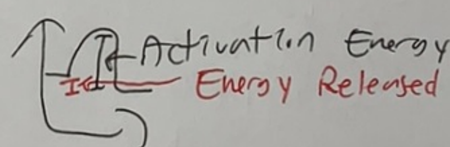
$cm \cdot \Delta T = n \cdot \Delta H$

22) C

Ice melting : $s \rightarrow l$: endothermic

23) D

Page 8 (Paper 1)



24) A

25) A

26) D ⟶ $(0.450)(20.0)(50.0)$

$(0.450)(1000) = 450$

27) B

Page 9 (Paper 1)

28) D ⟹ $\Delta H = \frac{cm\Delta T}{n} = -\frac{(4.2)(50)(20)}{0.10 \times 1000}$

29) A

30) B

Page 10 (Paper 1)

31) A $Br_2 \rightarrow 2Br$ Bond breaking

Exothermic
⇒ neutralization
⇒ combustion

32) A $Q = cm \cdot \Delta T$

33) D (Hess's Law)

Page 11 (SL Paper 1)

34) B

35) C

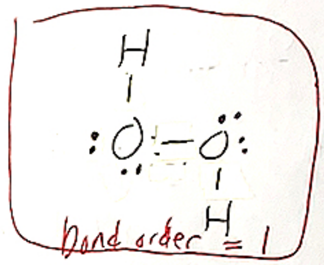
- $\sum \Delta H_c^\theta = \sum \Delta H^\theta_{Products} - \sum \Delta H^\theta_{Reactants}$
- Enthalpy for elements = 0

36) B

O_3 : bond order = 1.5

O_2 : bond order = 2

H_2O_2



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37) C

38) B

39) D $n \cdot |\Delta H| = cm \cdot \Delta T \Rightarrow \Delta H = -\frac{cm\Delta T}{n}$ (exothermic)

40) C $(Mr)(n) = \frac{Q(Mr)}{|\Delta H|} = \text{mass} = \frac{683.5}{1367} \cdot 46.0$

$\Delta H = \frac{4.18 \times 50 \times \Delta T \times 10^{-3}}{25 \times 0.1 \times 10^{-3}}$ unit conversion cancels out

41) B

$-390 - 2(286) + 890 = -72$

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42) C

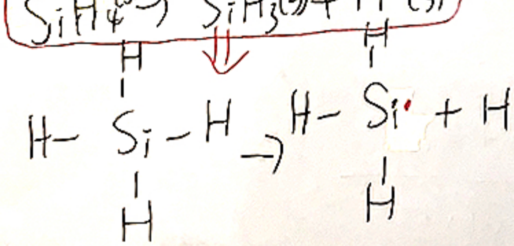
43) B

44) B

$-2x$	$2C(s) + 2O_2(g) \rightarrow 2CO_2(g)$
$-3y$	$3H_2(g) + \frac{3}{2}O_2(g) \rightarrow 3H_2O(l)$
z	$2CO_2(g) + 3H_2O \rightarrow C_2H_6(g) + 3\frac{1}{2}O_2$
	$2C(s) + 3H_2(g) \rightarrow C_2H_6(g)$

Ionic?

$SiH_4(g) \rightarrow SiH_3(g) + H(s)$



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45) B

46) D

47) B

$n = \frac{(M \cdot \Delta T}{\Delta H}$ ~~(4.13)(50.0)(52)~~

$\Delta T = \frac{n \cdot |\Delta H|}{C \cdot M}$ ($m \div 4$, $n \div 4$) ΔT is same

48) A

200 cm^3 ⇒ 200 g
50 cm^3 ⇒ 50 g } ÷ 4, Q ÷ 4

Page 15 (SL Paper 1)

48) D

49) D

50) D

Rate of reaction
① temperature
② concentration
③ pressure
④ surface area

$2CaO(s) \rightarrow$ ~~$2Ca(s) + O_2(g)$~~ $-x$

~~$2Ca(s) + 1.0\,O_2(g)$~~ $+ 2CO_2(g) \rightarrow 2CaCO_3(s)$ 24

$2CaO(s) + 2CO_2 \rightarrow 2CaCO_3(s)$

$\frac{1}{2}[-x+24]$

51) C

−1669	$Fe_2O_3(s) \rightarrow 2Fe(s) +$ ~~$\frac{3}{2}O_2(g)$~~ 822 kJ
822	$2Al(s) +$ ~~$\frac{3}{2}O(g)$~~ $\rightarrow Al_2O_3(s)$ −1669
−847	$Fe_2O_3(s) + 2Al(s) \rightarrow 2Fe(s) + Al_2O_3(s)$

Page 16 (paper 1, SL)

52) B

53) A

54) B

$Q = cm \cdot \Delta T$ $\quad 4Q = cm \cdot 4\Delta T$

$x = \Delta T = \frac{Q}{cm}$ $\quad \Delta T = \frac{Q}{cm} = x$

⇝ $n \cdot |\Delta H| = cm \cdot \Delta T \Rightarrow \Delta T = \frac{cm}{n \cdot |\Delta H|}$

- Enthalpy remains constant
- moles is multiplied by 4
- mass is multiplied by 4

Page 17 (Paper 1, SL)

55) D

56) B

57) C

58) A

$Q = cm \cdot \Delta T$
$= (0.9)(10)(20)$
$= (0.9)(200)$
$= 180$

Page 18 (Paper 1, SL)

59) B ⇝

60) A

61) A

−394	$C(s) + O_2(g) \rightarrow$ ~~$CO_2(g)$~~
283	~~$CO_2(s)$~~ $\rightarrow CO(s) + \frac{1}{2}O_2(s)$
−111	$C(s) + \frac{1}{2}O_2 \rightarrow CO(s)$

Page 19 (Paper 1, SL)

62) B

63) D*

64) A

$$Fe_2O_3(s) \rightarrow 2Fe(s) + \frac{3}{2}O_2(g) \quad | -x$$

$$3CO(g) + \frac{3}{2}O_2(g) \rightarrow 3CO_2(g) \quad | 3y$$

$$Fe_2O_3(s) + 3CO(g) \rightarrow 3CO_2(g) + 2Fe(s) \quad | 3y - x$$

Page 20 (Paper 1, SL)

65) C

$(H\text{-}H) + (I\text{-}I) - 2(H\text{-}I)$

$= 440 + 150 - 600$

$= 590 - 600$

$= -10$

66) C

67) D

68) A

$\Delta H + \Delta H_2 = \Delta H_1 \Rightarrow \Delta H = \Delta H_1 - \Delta H_2$

Page 21 (SL Paper 1)

69) B

70) A

$-1301 + Y = -788 - 286$

$Y = -788 - 286 + 1301$

Page 22 (SL, Paper 1)

71) A

C=N → C−N

longer bond length

less enthalpy

Page 19 (Paper 1, SL)

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63) D*

64) A

$Fe_2O_3(s) \rightarrow 2Fe(s) + \cancel{\frac{3}{2}O_2(g)}$ | $-x$

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$\Delta T = \frac{n \cdot |\Delta H|}{c \cdot m}$ ($m \div 4$, $n \div 4$) ΔT is same

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$200\ cm^3 \Rightarrow 200g$
$50\ cm^3 \Rightarrow 50g$
$\div 4$, $Q \div 4$

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