MARKSCHEME - HL BONDING

P1A Answer Key:

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

P1B Q1: (a) Structure III [1]. FC are zero or on most EN atom (N vs S) [1]. (b) Between 1.5 and 2 (Hybrid of single/triple and double) [1].

P1B Q2: (a) Symmetrical inverse trend; higher order = stronger pull = shorter length [2]. (b) 1.5 [1].

P1B Q3: (a) Trigonal bipyramidal [1]; 90, 120, 180 [1]. (b) LP-LP and LP-BP repulsion is stronger than BP-BP [1], pushing bond angles below ideal 90 [1].

P1B Q4: (a) 1.5 [1]. (b) ~321 kJ mol-1 (Average of 146 and 496) [2].

P2 Q1: (a) Lewis SF4 (4 domains + 1 LP), SF6 (6 domains) [2]. (b) SF4: See-saw [1]. SF6: Octahedral [1].

P2 Q2: (a) FC = 7 - 0 - 4 = +3 [2]. (b) With 3 double bonds, FC = 7 - 0 - 7 = 0 [1]. Stable because FC closer to zero [1].

P2 Q3: (a) Ethene: sp2 [0.5], Ethyne: sp [0.5]. (b) Side-on overlap of unhybridized p orbitals [2]. (c) Region of high electron density in pi bond attracts electrophiles [2].

P2 Q4: (a) Equal bond lengths, higher stability/enthalpy than expected, only one isomer for 1,2-dichlorobenzene [3]. (b) 6 sigma bonds (sp2) [1], 6 unhybridized p orbitals overlap [1] to form delocalized ring [1].

P2 Q5: (a) NO_3^-: Trigonal planar, sp2; NO_2^+: Linear, sp; NO_2^-: Bent, sp2 [3]. (b) NO_2^- (<120) < NO_3^- (120) < NO_2^+ (180) [3].

P2 Q6: (a) Sigma has head-on overlap (greater overlap energy) [1] vs pi has side-on [1]. (b) Multiple electrons increase attraction; addition of pi bonds pulls nuclei closer [2].

P2 Q7: XeF_2: Linear [2]. ICl_4^-: Square Planar [2].

P2 Q8: Promotion of 2s electron to 2p [1], mixing of one s and three p orbitals [1] to form four degnerate sp3 orbitals [1].

P2 Q9: Propan-1-ol has Hydrogen bonding [1], Propanone has dipole-dipole [1]. H-bonding is stronger, requires more energy to break [1].

P2 Q10: Cis is polar [1], dipoles sum up [1]. Trans is non-polar [1], dipoles cancel [1].