MARKSCHEME - SL PERIODICITY

P1A Answer Key:

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

P1B Q1: (a) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$ [1]. (b) Na_2O is ionic (basic); P_4O_{10} is covalent (acidic). **[2]**

P1B Q2: (a) Increase BP down group [1]; Increased London forces with more electrons [1]. (b) Colorless to brown/orange [1]; $Br_2 + 2I^- \rightarrow 2Br^- + I_2$ [1].

P1B Q3: (a) Increases down group [1]. (b) Radius increases [1], lower IE means electron lost more easily [1], shielding increases making outer electron less attracted [1].

P1B Q4: (a) Zeff = +7 for both [1]. (b) Cl has 3 shells vs F's 2 [1], greater distance from nucleus means larger radius [1].

P2 Q1: (a) Proton number increases but shells stay same [1], Zeff increases [1], pulling electrons closer [1]. (b) Does not form compounds readily/no attraction for shared electrons [1].

P2 Q2: (a) All are $1s^2\ 2s^2\ 2p^6$ [1]. (b) Mg^{2+} has highest proton number (+12) [1]; strongest attraction pulls electrons closest [1].

P2 Q3: $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$ [1]; $Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2NaAl(OH)_4$ [1].

P2 Q4: (a) $2K + 2H_2O \rightarrow 2KOH + H_2$ [1]. (b) K has lower IE [1], outer electron less tightly held [1].

P2 Q5: (a) Sodium, Group 1 [2]. (b) Jump from valence (3s) to inner shell (2p) [1], 2p is closer to nucleus/less shielded [1].

P2 Q6: (a) Si is giant covalent (many strong bonds) vs P is simple molecular (weak London forces) [2]. (b) Ar is monatomic [1], extremely weak London forces [1].

P2 Q7: (a) $2Na + Cl_2 \rightarrow 2NaCl$ [1]. (b) Ionic bonding [1].

P2 Q8: (a) Al has more delocalized electrons (3 vs 1) [1] and smaller ions [1]. (b) Aluminum [1], more delocalized electrons per atom [1].