

MARKSCHEME - HL PERIODICITY

P1A Answer Key:

1.B, 2.B, 3.C, 4.D, 5.B, 6.A, 7.C, 8.B, 9.C, 10.A, 11.C, 12.B, 13.C, 14.B, 15.D, 16.B, 17.A, 18.A, 19.C, 20.B, 21.A, 22.D, 23.A, 24.B, 25.A, 26.C, 27.A, 28.D, 29.A, 30.D, 31.D, 32.A, 33.A, 34.A, 35.B, 36.D, 37.A, 38.A, 39.A, 40.B

P1B Q1: (a) Group 13 [1]; Jump after IE3 [1]. (b) [Ne] 3s² 3p¹ or valence 3 [1].

P1B Q2: (a) Oxygen has 4e⁻ in p-subshell [1]; Electron-electron repulsion in paired orbital makes it easier to remove [1].

P1B Q3: (a) Si [1]. Giant covalent network with many strong bonds [1]. (b) Al has more delocalized electrons (3 vs 1 for Na) [1] and higher charge density cation [1].

P2 Q1: (a) $N^+(g) \rightarrow N^{2+}(g) + e^-$ [1]. (b) Electron being removed from a positive ion; closer to nucleus/less repulsion. **[2]**

P2 Q2: (a) $O(g) + e^- \rightarrow O^-(g)$ [1]. (b) F is small; high electron density causes repulsion for incoming electron [2].

P2 Q3: (a) $O^-(g) + e^- \rightarrow O^{2-}(g)$ [1]. (b) Repulsion between incoming electron and negative ion requires energy [2].

P2 Q4: (a) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$ [1]. (b) $MgO + H_2O \rightarrow Mg(OH)_2$ [1]. (c) $SO_2 + H_2O \rightarrow H_2SO_3$ [1].

P2 Q5: (a) Si: Giant covalent; P: Molecular covalent (P₄) [2]. (b) S₈ is larger molecule than P₄; stronger London forces [2].

P2 Q6: Si⁴⁺ to P³⁻ is crossing from cations to anions [1]. P³⁻ has a full additional shell/effective shells increase and less nuclear pull per electron [2].

P2 Q7: Boron and Oxygen [2].

P2 Q8: (a) [Al(OH)₄]⁻ or sodium aluminate [1].

P2 Q9: Group 15 [1], p-block [1].

P2 Q10: Shielding: inner electrons blocking nuclear charge [1]. Down G1: shells increase, shielding increases, IE decreases [2].