Gateways School

**Atomic structure & Bonding**

**Revision PPQ Answers**

50 marks

**Q1.**

(a)     (i)      1.6734 × 10−24 (g)

*Only.*

1.6734 × 10−27 kg

*Not 1.67 × 10−24 (g).*

**1**

(ii)     **B**

**1**

(b)    (i)       = 10.8

**OR** ratio 10:11 = 1:4 **OR** 20:80 etc

*Allow idea that there are 5 × 0.2 divisions between 10 and 11.*

**1**

abundance of 10B is 20(%)

**OR**

**** = 10.8

10x + 1100 − 11x = 1080

∴ x = 1100 − 1080 = 20%

*Correct answer scores M1 and M2.*

**1**

(ii)     Same number of electrons (in outer shell or orbital)

*Ignore electrons determine chemical properties.*

Same electronic configuration / arrangement

*Ignore protons unless wrong.*

**1**

(c)     Range between 3500 and 10 000 kJ mol−1

**1**

(d)     B+(g)  B2+(g) + e(−)

B+(g) − e(−)  B2+(g)

B+(g) + e(−)  B2+(g) + 2e(−)

*Ignore state symbol on electron even if wrong.*

**1**

(e)     Electron being removed from a positive ion (therefore needs more energy) / electron being removed is closer to the nucleus

*Must imply removal of an electron.*

*Allow electron removed from a + particle / species or from a 2+ ion.*

*Not electron removed from a higher / lower energy level / shell.*

*Not electron removed from a higher energy sub-level / orbital.*

*Ignore electron removed from a lower energy sub-level / orbital.*

*Ignore ‘more protons than electrons’.*

*Not ‘greater nuclear charge’.*

*Ignore ‘greater effective nuclear charge’.*

*Ignore shielding.*

**1**

**[8]**

**Q2.**

(a)     [CH3OCOCOOH]+

*Allow names*

**1**

[CH3OCOCOOCH3]+

*Do not allow molecular formula*

**1**

(b)     Positive ions are accelerated by an electric field

**1**

To a constant kinetic energy

**1**

The positive ions with m / z of 104 have the same kinetic energy as those with m / z of 118 and move faster

**1**

Therefore, ions with m / z of 104 arrive at the detector first

**1**

**[6]**

**Q3.**

(a)     Covalent

*If not covalent CE = 0/2*

*If dative covalent CE = 0/2*

*If blank mark on*

*Ignore polar*

*If number of pairs of electrons specified, must be 3*

**1**

Shared pair(s) of electrons / one electron from Br and one electron from F

*Not 2 electrons from 1 atom*

*Not shared pair between ions/molecules*

**1**

(b)     (i)



*BrF3 should have 3 bp and 2 lp and correct atoms for the mark*

*Penalise Fl*

**1**

BrF3 if trigonal planar shown = 120°

*Allow 84 – 90° or 120° and ignore 180°*

or if T shape shown 84 – 90°

*Irrespective of shape drawn*

**1**

(ii)



*BrF4– should have 4 bp and 2 lp and all atoms for the mark
(ignore sign)*

*Allow Fl*

**1**

BrF4– 90°

*Only*

*Ignore 180°*

**1**

(c)     Ionic or (forces of) attraction between ions / bonds between ions

*If molecules, IMF, metallic, CE =0*

*If covalent bonds mentioned, 0/3, unless specified within the BrF4– ion and not broken*

*Ignore atoms*

**1**

Strong (electrostatic) attraction / strong bonds / lots of energy needed to break
bonds

**1**

Between K+ and BrF4– ions/oppositely charged ions / + and – ions

*If ions mentioned they must be correct*

*Strong bonds between + and – ions =3/3*

**1**

(d)     (i)     Hydrogen bonds/hydrogen bonding/H bonds/H bonding

*Not just hydrogen*

**1**

(ii)



*One mark for 4 partial charges*

*One mark for 6 lone pairs*

*One mark for H bond from the lone pair to the Hδ+*

*Allow Fl*

*If more than 2 molecules are shown they must all be correct.
Treat any errors as contradictions within each marking point.*

*CE = 0/3 if incorrect molecules shown.*

**3**

(e)     vdw / van der Waals forces between molecules

*QoL*

*Not vdw between HF molecules, CE = 0/2*

*vdw between atoms, CE = 0/2*

*If covalent, ionic, metallic, CE=0/2*

**1**

IMF are weak / need little energy to break IMF / easy to overcome IMF

**1**

**[15]**

**Q4.**

(a)     **4**LiH + AlCl3 → LiAlH4 + **3**LiCl

**1**

(b)     H – = 1s2 **or** 1s2

**1**

(c)     Tetrahedral    or diagram

*(Not distorted tetrahedral)*

**1**

(Equal) repulsion

**1**

between four bonding pairs / bonds

*(Not repulsion between H atoms loses M2 and M3)*

*(Not ‘separate as far as possible’)*

*(‘4’ may be inferred from a correct diagram)*

**1**

(d)     Dative (covalent) or coordinate

**1**

Lone pair **or** non-bonding pair of electron **or** both e–

**1**

**QoL**  Donated from H– to Al **or** shared between H and Al

*(tied to M2)*

*(Not ‘from H atom’) (Not ‘to Al ion’) (Not ‘e–s transferred’)*

**1**

**[8]**

**Q5.**

(a)     Iodine – molecular

*Not covalent lattice*

**1**

Graphite – macromolecular/giant covalent/giant atomic

**1**

(b)     Layers of (C atoms)

**1**

Connected by covalent bonds within each layer

**1**

Van der Waals forces/IMF between layers/weak forces
between layers

**1**

Many/strong covalent bonds need to be broken

*If any other element mentioned other than C, CE = 0*

*Ignore the no of covalent bonds around the C if mentioned
The first 3 marks could be scored with a labelled diagram. Need to label or state covalent bonds within the layers.
Covalent or ionic or metallic bonds between molecules CE = 0*

**1**

(c)     Van der Waals forces are weak or easily broken

*Not vdw between atoms*

**1**

Van der Waals between molecules (or implied)

*Allow weak IMF = 2*

**1**

(d)     Does not have delocalised/free electrons

*Only allow answer with respect to iodine
Not all electrons used in bonding
Ignore free ions*

**1**

**[9]**

**Q6.**

B

**[1]**

**Q7.**

D

**[1]**

**Q8.**

A

**[1]**

**Q9.**

A

**[1]**