<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1 a</td><td>
<table>
<tr><th></th><th>Chlorine atom</th><th>Oxide ion</th></tr>
<tr><td>Number of protons</td><td>17</td><td>8</td></tr>
<tr><td>Number of neutrons</td><td>20</td><td>8</td></tr>
<tr><td>Number of electrons</td><td>17</td><td>10</td></tr>
</table>
chlorine - number of protons and number of neutrons correct (1)

oxide ion – number of neutrons correct (1)

- number of electrons correct (1)
</td><td>3</td><td></td></tr>
<tr><td>b</td><td>J J Thomson - discovered the electron (1)

Bohr suggested - that electrons occupy orbits / electrons in shells / electrons in energy levels (1)</td><td>2</td><td>ignore reference to plum pudding model

allow discovered that atoms have electrons

not electrons were found in the nucleus / discovered that electrons orbit the nucleus / reference to ions

not discovered neutrons or protons

negative particles in shells is not sufficient

allow reference to orbitals

ignore reference to other aspects of atomic structure e.g. protons and neutrons</td></tr>
<tr><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2 a</td><td>relative mass of neutron (1)

relative charge of electron (1)</td><td>2</td><td>
<table>
<tr><th>Particle</th><th>Relative charge</th><th>Relative mass</th></tr>
<tr><td>proton</td><td>+1</td><td>1</td></tr>
<tr><td>neutron</td><td>0</td><td>1</td></tr>
<tr><td>electron</td><td>-1</td><td>0.0005</td></tr>
</table>
</td></tr>
<tr><td>b i</td><td>molecules (1)

high (1)</td><td>2</td><td>
<table>
<tr><th></th><th>Sodium chloride</th><th>Carbon dioxide</th></tr>
<tr><td>Formula</td><td>NaCl</td><td>CO_2</td></tr>
<tr><td>Type of particles present</td><td>ions</td><td>molecules</td></tr>
<tr><td>Melting point</td><td>high</td><td>low</td></tr>
</table>
</td></tr>
<tr><td>ii</td><td>weak forces between molecules / weak intermolecular forces (1)</td><td>1</td><td>allow weak forces between particles, but not weak forces between ions or between atoms
allow weak intermolecular bonds / weak bonds between molecules

not weak intermolecular forces between atoms / weak covalent bonds

weak forces and weak bonds on their own are not sufficient</td></tr>
<tr><td></td><td>Total</td><td>5</td><td></td></tr>
</table>

Question	Answer	Marks	Guidance
3 a	**Level 3** **Deduce the number of protons, neutrons and electrons and the electronic structure for the atom of aluminium** **AND** **Identifies both the group and period for aluminium** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **Level 2** **Deduce the number of protons, neutrons and electrons in the aluminium atom or the electronic structure and identifies the group or the period of aluminium** **OR** **Deduce the number of protons and neutrons in the aluminium atom and the electronic structure of aluminium** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **Deduce the number of protons and neutrons** **OR** **Deduce the electronic structure for aluminium** **OR** **Identifies the group or the period of aluminium** Quality of written communication impedes communication of the science at this level. (1 – 2 marks)	6	**This question is targeted at grades up to A*.** **Indicative scientific points may include:** • number of protons is 13 / bottom number is number of protons • number of neutrons is 14 / difference between mass number and atomic number • number of electrons is 13 / same as number of protons • electronic structure is 2.8.3 – this also shows 13 electrons • Al is in the 3rd period / the number of (occupied) shell electrons is the period number • Al is in Group 3 / the number of electrons in the outer shell is the group number **Allow** row for period and column for group **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**

Question	Answer	Marks	Guidance
	Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		

Question	Answer	Marks	Guidance
b	**Any two from:** Fired alpha particles at gold foil (1) Geiger and Marsden's experiment gave unexpected results / some alpha particles rebounded (1) led to theory of nuclear atom / idea of atoms having a nucleus (1)	2	 **Allow** wrong particle rebounded if mentioned already at MP1 **Allow** reflected rather than rebounded **Ignore** reference to electrons, protons and shells Atoms have a dense centre is **not** sufficient
		8	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>$^{32}_{15}$P (1)

18 electrons (1)</td><td>2</td><td>
<table>
<tr><th>atom or ion</th><th colspan="3">number of</th></tr>
<tr><th></th><th>electrons</th><th></th><th>protons</th></tr>
<tr><td>$^{1}_{1}$H</td><td>1</td><td></td><td>1</td></tr>
<tr><td>$^{2}_{1}$H</td><td>1</td><td></td><td>1</td></tr>
<tr><td>$^{31}_{15}$P</td><td>15</td><td></td><td>15</td></tr>
<tr><td>$^{32}_{15}$P</td><td>15</td><td></td><td>15</td></tr>
<tr><td>$^{32}_{16}S^{2-}$</td><td>18</td><td>16</td><td></td></tr>
</table>
allow ^{32}P

not $_{32}$P</td></tr>
<tr><td></td><td>(b)</td><td></td><td>same atomic number and different mass number (1)</td><td>1</td><td>allow same proton number or number of protons and different number of neutrons or atomic mass
allow same element but different mass number / same type of atom and different number of neutrons
ignore same number of electrons
not different relative atomic mass</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)		**any two from:** so results can be replicated / so work does not need to be duplicated (1) so further evidence can be collected (1) idea of peer review / work can be checked (1) to provide information to other scientists or public or other organisations / AW (1) so he can get recognition for his work (1)	2	 allow work can be developed further (1) allow so work can be evaluated (1) allow idea that information can be used by other scientists (1) allow idea of to increase the sum of human knowledge / to educate people (1) allow so other scientists cannot take credit (1)
			Total	**5**	

Question	Answer	Marks	Guidance
5 a	C_2H_6 / H_6C_2 (1)	1	the numbers must clearly be subscripts **not** C^2H^6 / C2H6
b	**B** contains carbon and hydrogen (1) only / AW (1)	3	**allow** (formula) has only (1) H and C (1) the only is **not** an independent mark and must be linked to the carbon and hydrogen **not** contains carbon and hydrogen molecules / contains a mixture of carbon and hydrogen **not** hydro atoms but **ignore** for the third marking point
	C contains oxygen / has oxygen in the formula / does not contain only carbon and hydrogen (1)		**allow C** has three elements / **C** has three different atoms (1) **not C** contains oxygen molecules
c	**A** and **F** (1)	1	**both needed**
	Total	**5**	