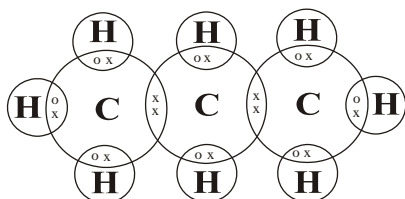


Structure and bonding

1. (a) reduce wear of metal ie don't get damaged 1
or other sensible answer
- or** stop / reduce friction
accept stop metal heating up
accept move more smoothly
ignore make it slippery / rub more smoothly
- or** prevent seizing
accept can move freely
- (b) (i) carbon 1
(ii) layers (of atoms) 1
can slide / slip over each other 1
allow slip off
- or** weak forces of attraction / weak bonds (between layers)
allow no bonds
accept there are weak forces of attraction for mark even when there is no reference to layers
accept atoms slide over each other (for 1 mark)
*an answer which **only** states there are weak bonds would gain 0 mark when there is no reference to layers*
weak covalent bonds = 0 marks

[4]

2. (a) 1



*allow all dots **or** all crosses **or** combination **or** all e / e⁻ **or** –
or other suitable symbols*

*centre of symbols must be on **or** inside overlapping areas within reason*

- (b) (i) any **two** from: 2
- no change initially **or** stays constant at the beginning
 - increase
 - slowly at first and then more rapidly
- accept converse arguments*
allow vapour pressure is 0 at any temperature < -100°C for 1 mark
accept positive correlation; accept explanation based on kinetic theory eg particles have more kinetic energy
allow reasonable attempt at using numbers
- (ii) -44 (using graph) accept -43 to -45 1

- (c) intermolecular forces / bonds **or** forces / bonds between molecules 1
- bonds / forces are weak 1
- covalent bonds are weak = 0 marks**
if they do not gain either of the marks on the left then allow simple covalent / molecular / made of small molecules for 1 mark
- [6]**
3. (a) $2 \text{Na} + \text{Cl}_2 \rightarrow 2 \text{NaCl}$ allow $2 \text{Na}^+ \text{Cl}^-$ 1
- for 1 mark (allow $\text{Na} + \frac{1}{2}\text{Cl}_2 \rightarrow \text{NaCl}$)*
- (b) (i) idea that 1
- it has strong (attractive) forces/bonds between ions / charged particles
for 1 mark
- (not ‘..it has a rigid structure’- this defines a solid or ‘...particles close together’ - they are in a liquid)*
- (ii) ideas that 2
- there is increased vibration of ions / particles on heating
 - ions have sufficient energy to overcome attractive forces / to break out of the
 - rigid structure / to move about
- (must be in terms of increased energy of particles ions)*
each for 1 mark
- (iii) ions can go to electrodes / ions are free to move 1
- for 1 mark*
[do not credit ‘ions carry charges’]
- (c) ideas that 2
- it has stronger attractive forces between atoms/particles (*not ‘ions’*)
 - each carbon atom forms covalent bonds with neighbouring atoms
each for 1 mark
- [7]**
4. (a) idea that 2
- copper has free electrons / electrons that move throughout the structure
gains 1 mark
- but**
- in copper, electrons from the highest (occupied) energy level /outer shell, are free / can move throughout the structure
gains 2 marks
- (b) idea that 3
- in graphite, only three bonds are formed by each carbon atom *for 1 mark*
 - one outer electron (per atom), free to move *for 1 mark*
 - an electric current is a flow of (free) electrons* *for 1 mark*
- (* this mark to be given in **either** (a) **or** (b) but not in both)*
- [5]**

5. (a) nanoparticles / they are small(er) 1
accept 1–100 nm or a few atoms in size
- so can easily pass through pores / skin / cell / membranes /
 arteries / veins / capillaries / into blood stream owtte 1
must be a comparative statement
can be inferred from smaller particles
allow absorbed for pass through
- (b) any **one** from: 1
- may be toxic (to cells / specific cells)
allow may harm / damage / kill cells / organs / tissues or may cause cancer
 - to ensure safety **or** reduce risk **or** risk of litigation
allow may cause allergies / side effects
ignore harmful / dangerous unqualified eg harmful to body / people
 - nanoparticles may have different properties
 - to see if they pass into the body
- (c) any **two** sensible ideas from eg: 2
- testing is expensive **or** testing costs money
allow it costs money
ignore litigation
 - testing is time consuming
 - don't see any reason to test since normal sized particles
 (of titanium oxide) do not cause harm
*accept normal sun cream does **not** cause harm owtte*
 - don't want to risk not producing a popular product (owtte)
*eg if unsafe will have to stop production **or** have to remove product if toxic*
 - testing process / unfavourable results might cause alarm /
 reduce sales / reduce profit (less money)
 - do not want to be seen doing animal testing

[5]