1.

(a) 8

(b) $1s^2\ 2s^2\ 2p^6$

(c) They are stable because they have full valence shells.

(d) Only specific wavelengths (lines) are visible, and each line is due to a particular transition between energy levels. Since there is a limited number of possible transitions there must be distinct energy levels.

(e)

(1) $m = nM = 2.0\times10^{-8} \times 20.18 = 4.0\times10^{-7}$ g

(2) $10\times2.0\times10^{-8} = 2.0\times10^{-7}$ mol
$N = nN_A = 2.0\times10^{-7} \times 6.02\times10^{23} = 1.2\times10^{17}$

(f)

(1) Each isotope of neon has the same number of protons but a different number of neutrons (different mass of nucleus).

(2) Mass number: 20
Atomic number: 10

(3) (there may be other possible answers, these are just examples)
Use mass spectrometry (or a centrifuge). If the mixture of gases is ionised and accelerated around a curve, the lighter gas (helium) will turn more quickly and therefore can be collected at a different point to the heavier gas (neon).
-or-
Using distillation. If the mixture of gases is cooled, the one with higher boiling point (neon) can be collected before the other (helium) condenses.

2.

(a)

(1) 29

(2) d

(b) Tungsten is a metal. Its low elecronegativity means it shares delocalised electrons throughout its structure. These electrons are charges which are free to flow (conduct electricity).

3.

(a) 

(b)

(1) 3

(2) Linear. There are two groups (clouds) of negative charge around the central atom. These will repel each other to form a straight line (the furthest angle in 3D).

(3) Carbon monoxide is polar. The C=O bond is polar due to electronegativity difference between C and O and there are no other bond dipoles to prevent the molecule from having partial negative charge at one end and partial positive charge at the other.

(c)

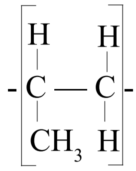
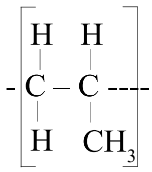
(1) 3

(2) C_2H_5

(3) but-1-ene: $CH_2 = CH - CH_2 - CH_3$
but-2-ene: $CH_3 - CH = CH - CH_3$
methylpropene: $CH_3 - C(CH_3) = CH_2$

(4) The compounds with higher molar mass have a greater number of electrons. This increases the partial charges formed by a temporary dipole during dispersion forces. Stronger secondary forces require more energy to separate the molecules.

(e)

(1)  -or- 

(2) -48°

(3) 26.98 + (2×12.01 + 5×1.008)×2 + 35.45 = 120.55 g/mol

(4) $n = \frac{m}{M} = \frac{6.93}{120.55} = 0.0575 \text{ mol}$

(5) $m = nM = 0.0575 \times 26.98 = 1.55 \text{ g}$

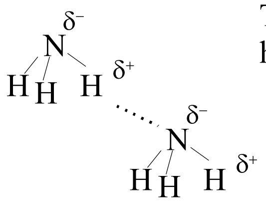
4.

(a) oxyen gas (O_2)
(b) Ag_2O
(c) It increases the rate of reaction therefore more can be sold per time.
(d) Power plants and vehicles produce carbon monoxide pollution. Silver nanoparticles convert this into CO_2 therefore reducing pollution.
(e) Silver nanoparticles transport transport anticancer drugs to the site of cancerous tumours. This means less drug will need to be used, reducing cost.
(f) By binding to important molecules to inhibit cell divison.
(g) They have a higher surface area to volume ratio.
(h) Reduces the need for hot water.
(i) Disrupt helpful bacteria / endanger aquatic organisms / possible effects on human health

5.

(a) Na^+ Cl^- Na^+ Cl^-
Cl^- Na^+ Cl^- Na^+
Na^+ Cl^- Na^+ Cl^-
Cl^- Na^+ Cl^- Na^+
Large continuous lattice of positive and negative ions.

(b) Solubility in water

(c) 
The dotted line represents hydrogen bonding

(d)

(1) Cl^-
NH_4^+
OH^-

(2) 2

(e)

(1) To break bonds in $CaCO_3$

(2) Calcium oxide is an ionic substance with 2+ and 2- charged ions. These are strongly attracted to each other and therefore require a large amount of energy to break apart.

(f) Recycle the CO_2 produced in the second equation for use as a reactant in the first equation.