Question	Answer	Marks
1(a)(i)	$^{+}$ / sodium **and** O^{2} / oxide;	**1**
1(a)(ii)	$^{2+}$ / calcium;	**1**
1(a)(iii)	/ phosphorus;	**1**
1(a)(iv)	/ silicon;	**1**
1(b)(i)	• *number of protons* = 29; • *number of neutrons* = 35; • *number of electrons* = 27; three correct = [2]; two correct = [1]	**2**
1(b)(iii)	*number of nucleons* = 45; *number of charged particles* = 42;	**1** **1**
1(c)(i)	have same proton number / same element / same atomic number; different number of neutrons / nucleons / mass number;	**1** **1**
1(c)(ii)	m / Mg;	**1**
1(c)(iii)	any two from: • treating cancer or radiotherapy; • biological tracer; • thickness (of paper or foil); • (checking for) leaks / cracks (in pipes); • (carbon) dating; • (generating) energy / electricity; • smoke detectors; • fill levels in packages; • sterilising surgical instruments;	**2**

2 **(a** foodstuffs or drugs [1]

(b) (i) simple distillation
fractional distillation **or** diffusion
fractional distillation
filtration **or** evaporation
chromatography [5]

(ii) M1 dissolving
M2 filtration
M3 evaporation or heat (to crystallisation point)
M4 crystallisation or allow leave to cool [4]
or
M3 crystallisation
M4 filtration

OR: Adding to H_2SO_4 method

M1 Add excess mixture to acid (or until no more dissolves)
M2 Filtration
or
M1 Add excess acid to mixture
M2 With heat

M3 evaporation or heat (to crystallisation point) Stop marking if heated to dryness.
M4 crystallisation or allow leave to cool
or
M3 crystallisation
M4 filtration

[Total: 10]

3 **(a) (i)** contains carbon and hydrogen [1]
cond: only / just [1]

(ii) (different) boiling points [1]
cond: separate [1]

(b) bitumen-making roads / roofs / water-proofing, etc. [1]

lubricating fraction – waxes / vaseline / grease, etc. or machinery example, e.g. (oil a) bike / hinges / reducing friction [1]

paraffin fraction – jet fuel / (home) heating or tractors or cooking or lighting [1]

gasoline fraction – petrol or fuel for cars / vans / trucks [1]

[Total: 8]

4 **(a** diffusion or fractional distillation;

(b) fractional distillation;

(c) simple distillation;

(d) crystallisation;

(e) filtration;

(f) chromatography;

[Total: 6]

5	**(a)**	F **or** B	diffusion / <u>fractional</u> distillation	[1]
	(b)	A	simple distillation	[1]
	(c)	D	chromatograph	[1]
	(d)	E	filtratio	[1]
	(e)	C	evaporatio	[1]
	(f)	B	<u>fractiona</u> distillation	[1]

6 **(a)** repeat experiment <u>without indicator</u> **or** use carbon to remove indicator [1]
(partially) evaporate **or** boil **or** heat [1]
allow to cool **or** crystallise **or** crystals [1]
dry crystals [1]
MUST be in correct order
NB evaporate to dryness, marks one and two **ONLY**

(b) number of moles of NaOH used = 0.025 x 2.24 = 0.056 [1]

maximum number of moles of $Na_2SO_4.10H_2O$ that could be formed = 0.028 [1]

mass of one mole of $Na_2SO_4.10H_2O$ = 322g

maximum yield of sodium sulphate – 10 - water = 9.02g [1]

percentage yield = 42.8% [1]
mark **ecf** but NOT to simple integers
if **ecf** marking, mark to at least one place of decimals
if percentage > 100% then 3/4 maximum

[Total: 8]