4NA Prelim 2023 Mark Scheme

Paper 3

1	2	3	4	5	6	7	8	9	10
B	**B**	**A**	**B**	**A**	**D**	**C**	**C**	**A**	**B**
11	12	13	14	15	16	17	18	19	20
C	**D**	**B**	**D**	**A**	**C**	**D**	**B**	**A**	**C**

Paper 4

Rounding error / not to 3s.f – 1m deduction for whole paper

1

substance	description
carbon dioxide	**B**
water	**B**
bitumen	**D**
steel	**C**

1-2 correct – 1m
3 correct – 2m 2

2 **(a)** $MgCl_2$ 1

(b) A chlorine atom has 7 electrons, and **gains one electron** to **obtain a fully-filled valence shell / have 8 electrons in its valence shell.** 1

rej. "borrow"

(c)
- Magnesium chloride has a **giant (ionic) lattice structure.**
- There are **strong electrostatic forces of attraction** between **oppositely-charged ions.**
- **Large amount of energy** is needed to **overcome** these forces. 2

1-2 points – 1m
3 points – 2m

rej. larger/ higher. Need to show the amount of energy (small / large)

3 **(a)**

atmospheric pollutant	source
carbon dioxide	combustion of fossil fuels
sulfur dioxide	volcano activity OR combustion of **sulfur-containing** fossil fuels

1

(b) **(i)** sulfur dioxide + water → sulfuric acid 1

rej. Sulfur dioxide + water → acid rain (question asked for COMPOUND)

no marks awarded for chemical equation.

(ii) Acid rain will **corrode** the Eiffel Tower. 1

accept corrosion
rej. react / destroy / damage (not specific enough)

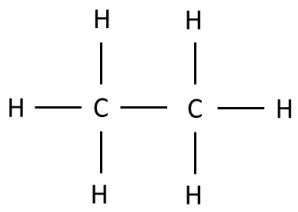
(c) Carbon dioxide. It can be found in **clean air.** 1

Name + reason – 1m

4 **(a)** alkene(s) 1

reject spelling

(b) **(i)**



1

most common error is that students drew ethene. Remind students that the **alkene becomes an alkane** after addition reaction.

(ii) Reddish-brown solution **remains reddish-brown / no visible change.** 1

accept brown
accept turns reddish-brown
accept colourless to reddish-brown

(c) water and carbon dioxide / H_2O and CO_2 1

For Section B, if all 3 questions are done, mark 1st 2 questions (Q5 and Q6).

Many students did all 3 questions. Remind students to only do 2 questions. Strike out the 3rd question that they did not do.

5 (a) (i) Mixture of compounds. The chromatogram for orangine shows **4 spots / more than 1 spot.** 1

(ii) Chromatography. 1

rej. spelling

(iii) The samples (orangine and tartazine) would **dissolve in the water** and there would be no chromatogram obtained. 1

(iv) No. **Orangine contains tartrazine** as there is a spot (3rd spot) in orangine that **travelled the same distance** as tartrazine / there is a **spot that matches that of tartrazine.** 1

(v) From the label: "1 part orangine with 4 parts water" 1

75 cm^3 is combined with (4 x 75 = 300 cm^3) of water.

Total volume of orange drink is 75 + 300 = **375 cm^3**

(vi) M_r = 16(12) + 9(1) + 4(14) + 3(23) + 9(16) + 2(32) = **534**

No units. No mark awarded if unit is given.

(b) Arrangement: (very) closely packed in an orderly arrangement.

Movement: vibrating in fixed positions

1m for each. 2

6 (a) (i) Not suitable. **pH of the soil is 6.0, which is acidic / not alkaline.** 1

(ii) Calcium hydroxide **neutralizes the excess acids** in the soil, making it **alkaline.** 1

Both underlined points – 1m

(b) (i) **2** $NaOH + (NH_4)_2SO_4 \rightarrow Na_2SO_4 + \mathbf{2}\ H_2O + \mathbf{2}\ NH_3$ 2

correct reactants + products – 1m
balanced – 1m

(ii) $M_r = 2(14+4) + 32 + 4(16) = 132$ 1

(ii) $number\ of\ moles = \frac{mass}{Mr}$

$= \frac{0.5\ g}{132}$

$\underline{= \mathbf{0.00379\ mol\ (3s.f.)}}$

allow ECF from (ii) 1

(c)
1. **Filter** to **remove sand / obtain solution/salt R as filtrate.** 1
2. **Evaporate/heat the filtrate/solution to dryness** to collect crystal R. [1] 1

OR
Carry out crystallization to collect crystal R **(all 4 steps for 2nd mark)**

- heat to saturated.
- allow to cool for crystal to form.
- filter to collect crystal.
- wash with small amt of cold distilled water and dry between sheets of filter paper.

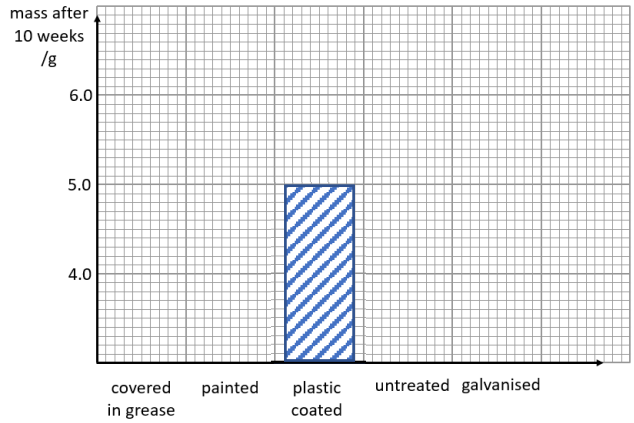
7 **(a)** The **number of electron shells** that an atom has determines its **period number.** 1

(b) **(i)** name: hydrogen 1
positive test: lighted splint extinguishes with a 'pop' sound 1

(ii) Solution changes from **green to purple/violet.**

rej. blue (LiOH is a strong alkali)

(c) **(i)**



correct height for each column + same width for each column – 1m

(ii) R was **coated with plastic, hence it did not rust.** 1
S was **untreated** and hence **rusted.**

(iii) $number\ of\ moles = \frac{mass}{Ar}$

$= \frac{5.0\ g}{56}$

$\underline{= \mathbf{0.0893\ mol}\ (\mathbf{3s.f.})}$ 1

(iv) Any 1 from: 1

- conserve finite resources
- reduces land / air / water pollution
- saves on cost of extracting metal from ores

reject. cheaper than extracting metal from ores