All questions are for separate science students only

Q1.

This question is about titanium dioxide (TiO_2).

(a) Self-cleaning windows are coated with a layer of nanoparticles of titanium dioxide.

Titanium dioxide:

- helps sunlight break down dirt particles
- attracts water, so dirt is washed away by rain.

Nanoparticles of titanium dioxide are used instead of fine particles of titanium dioxide for coating self-cleaning windows.

Suggest **two** reasons why.

1 _____

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2 _____

_____

(2)

(b) Titanium is extracted from titanium dioxide in a two-stage process.

The equation for the first stage in the process is:

$$TiO_2 + 2\ Cl_2 + 2\ C \rightarrow TiCl_4 + 2\ CO$$

Calculate the volume of chlorine gas needed to react completely with 100 kg of titanium dioxide. **(chemistry only) (HT only)**

Relative atomic masses (A_r): O = 16 Ti = 48

The volume of one mole of gas = 24 dm^3

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Volume = _____ dm^3

(6)

(Total 8 marks)