Foundations

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1. Calculate to 2 significant figures the amount, in moles, of oxygen necessary to fully combust $10\,\mathrm{g}$ of $\mathrm{C_4H_{10}}$.

2. A student is establishing the concentration of a solution of sulfuric acid by using titration. The titration is carried out against a standard $0.210\,\mathrm{mol\,dm^{-3}}$ solution of sodium hydroxide which a burette is filled with. $25.0\,\mathrm{cm^3}$ of the acid are then transferred into a conical flask each time and an indicator is added.

The student observes titres of $31.00\,\mathrm{cm^3}$, $30.65\,\mathrm{cm^3}$, $30.55\,\mathrm{cm^3}$ and $30.60\,\mathrm{cm^3}$.

Calculate the concentration of the sulfuric acid.

3. How many electrons in total (not just valence electrons) are there in a nitrate ion?

4. What is the single-word term used to refer to different versions of an atom of an element, differing in the number of neutrons?

5. What is the empirical formula of glucose, $\mathrm{C_6H_{12}O_6}$?

The following symbols may be useful: `C, H, O`

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Inorganic Chemistry

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6. What is the shape of $\mathrm{SiCl_4}$?

7. Which of the following statements is/are correct?

- [ ] The melting point of elements generally decreases going down a group.
- [ ] The ionisation energy of elements generally increases going from left to right across a period.
- [ ] The ionisation energy of elements generally increases going down a group.
- [ ] The size of atoms generally increases going from left to right across a period.

8. What is the oxidation state of phosphorus in phosphoric acid, $\mathrm{H_3PO_4}$?

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Physical Chemistry

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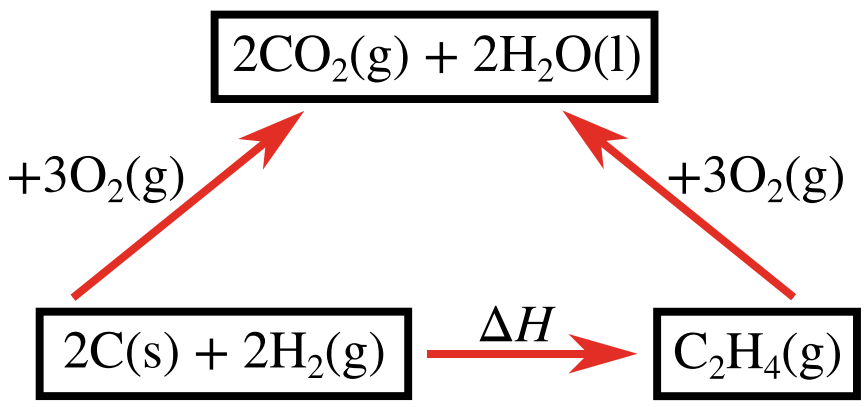
9. What is the single-word term used to describe a reaction with a positive enthalpy change?

10. For which of the following reactions, carried out at RTP, can we not estimate the enthalpy change using bond enthalpies only?

- [ ] $\mathrm{H_2 + O_2}$
- [ ] $\mathrm{H_2 + N_2}$
- [ ] $\mathrm{Mg + H_2O}$
- [ ] $\mathrm{Na + Cl_2}$

11. Express the enthalpy change of formation of ethene in terms of the relevant enthalpy changes of combustion in terms of $x = \Delta H_c(\mathrm{C})$, $y = \Delta H_c(\mathrm{H_2})$ and $z = \Delta H_c(\mathrm{C_2H_4})$.



The following symbols may be useful: `x, y, z`

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