

Question C: Energy Materials.

(a) Both metal organic frameworks (MOFs) and covalent organic frameworks (COFs) have been investigated as hydrogen storage materials. Dr Sparkle and Dr Far cannot agree on which of their new materials the MOF (SparkleY) and the COF (FarZ) is the most promising for vehicle hydrogen storage.

- (i) Compare and contrast the chemistry and structure of MOFs versus COFs. Provide one example of both classes. [20%]
- (ii) What factors would you consider in determining whether SparkleY or FarZ was best suited as hydrogen storage material for use in vehicles? [30%]

(b) Using sunlight to split water is a crucial part of drives to create 'solar fuels'. To do this successfully, catalysts are need of both the hydrogen evolving reaction (HER) to give H_2 and the oxygen evolving reaction (OER) to give O_2 . The chemistry involved in the OER is generally regarded as more challenging than the HER. [50%]

- (i) Outline the features of the OER which make it particularly challenging in contrast to the HER, and how these are tackled by the natural catalyst for this reaction (photosystem II).
- (ii) What factors need to be considered when comparing the performance of different molecular catalysts for the OER?