

1. Nov/2023/Paper\_9701/22/No.3(a)

Phosphoric(V) acid,  $\text{H}_3\text{PO}_4$ , is used in both inorganic and organic reactions.

(a)  $\text{H}_3\text{PO}_4$  is made in a two-step process from phosphorus.

step 1 Phosphorus reacts with an excess of oxygen to form a white solid.

step 2 The white solid then reacts with water to form  $\text{H}_3\text{PO}_4$ .

(i) Write an equation for each step.

step 1 .....

step 2 .....

[2]

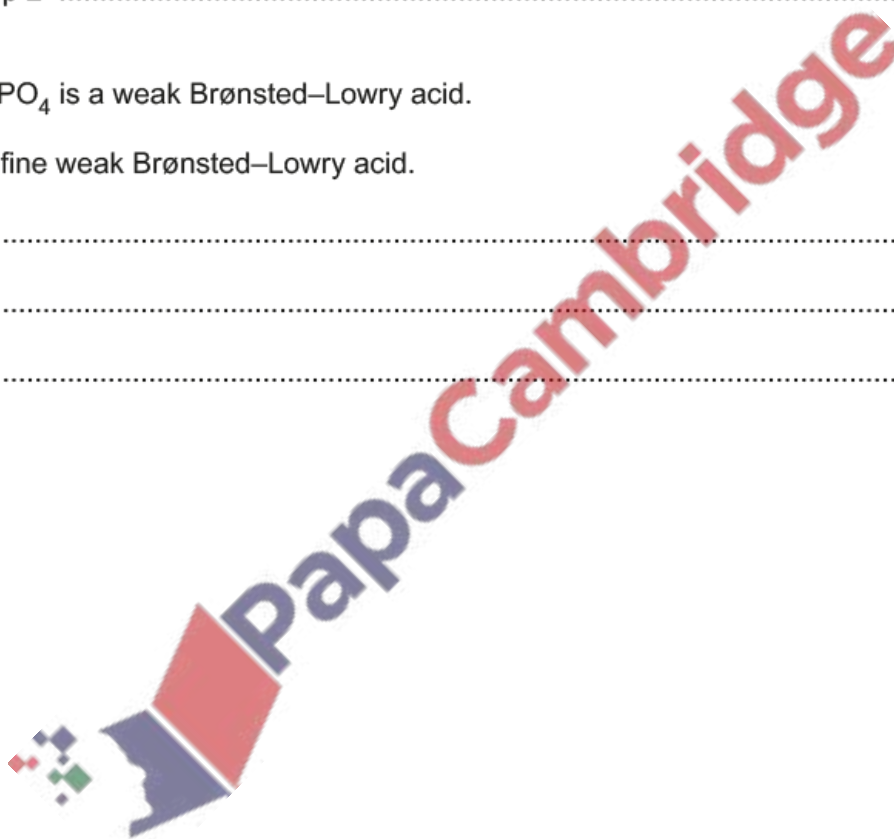
(ii)  $\text{H}_3\text{PO}_4$  is a weak Brønsted–Lowry acid.

Define weak Brønsted–Lowry acid.

.....

.....

..... [2]



2. Nov/2023/Paper\_9701/22/No.4(b)

Lactic acid,  $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$ , and pyruvic acid,  $\text{CH}_3\text{COCO}\text{OH}$ , both contain two functional groups.

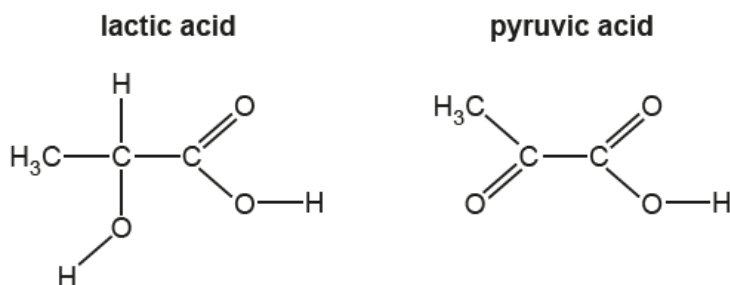


Fig. 4.1

(b) Two possible syntheses of pyruvic acid are shown in Fig. 4.3 and Fig. 4.4.

Each synthesis has a total of three steps.

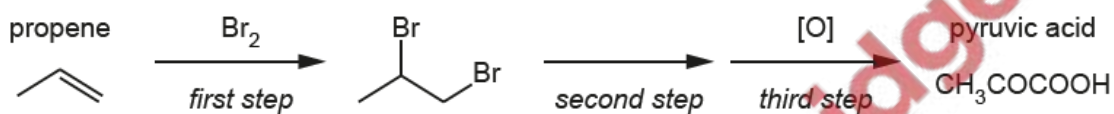


Fig. 4.3

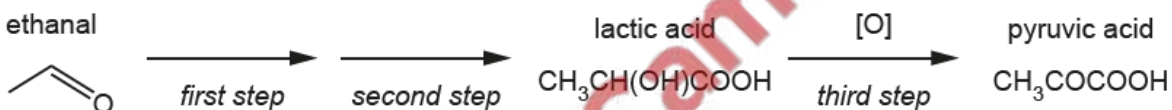


Fig. 4.4

(i) Complete the diagram in Fig. 4.5 to show the mechanism for the reaction of propene with  $\text{Br}_2$ .

Include charges, dipoles, lone pairs of electrons and curly arrows, as appropriate.



Fig. 4.5

[3]

(ii) Write an equation for the oxidation of lactic acid to pyruvic acid, the third step of Fig. 4.4.

Use [O] to represent one atom of oxygen from an oxidising agent.

