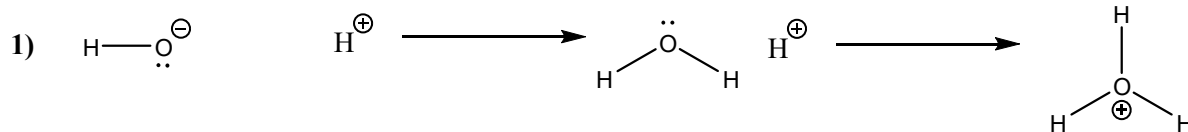


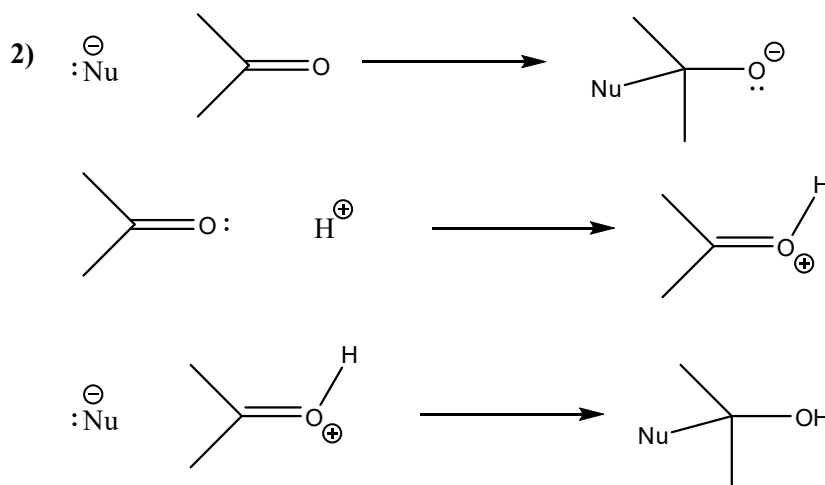
## Principles of organic synthesis worksheet

Name: \_\_\_\_\_

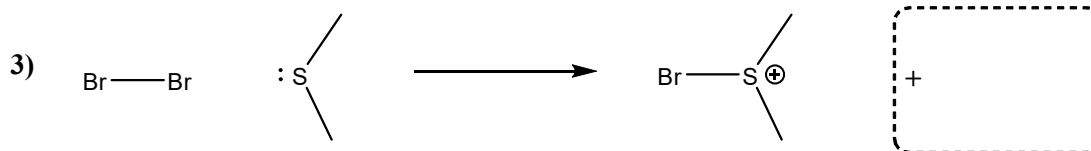
For each reaction in questions 1–3, add curly arrows to show the movement of electron pairs to produce the products shown. In question 3 add the other product of the reaction into the box.



(2 marks)



(5 marks)



(3 marks)

4) Ammonia is able to act as a nucleophile. When it reacts with a  $\text{H}^+$  ion it forms an ammonium ion.

(a) Draw the shape of ammonia and of the ammonium ion. Indicate the bond angle(s)

	Ammonia	Ammonium ion
Shape		
Bond angle(s)		

(4 marks)

(b) State how ammonia is able to act as a nucleophile

.....  
.....

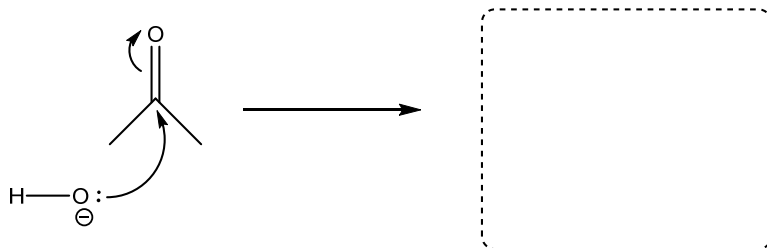
(2 marks)

(c) Outline the mechanism by which ammonia reacts with a  $H^+$  ion to form the ammonium ion

..... (2 marks)

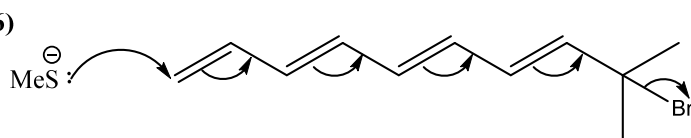
For questions 5-8 draw the structures of the products formed in the boxes.

5)



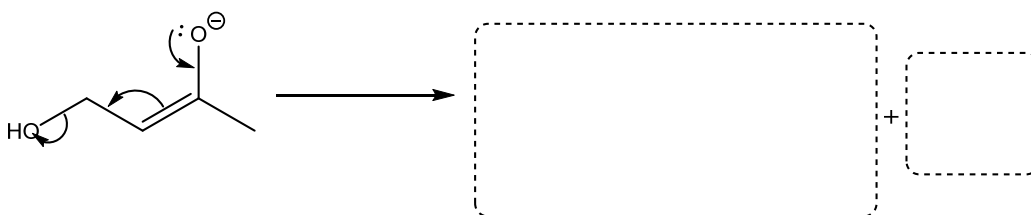
(2 marks)

6)



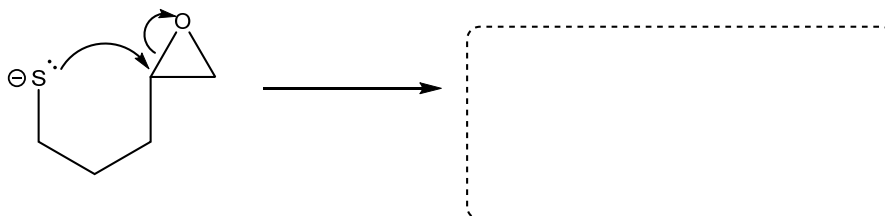
(4 marks)

7)



(3 marks)

8)



(3 marks)