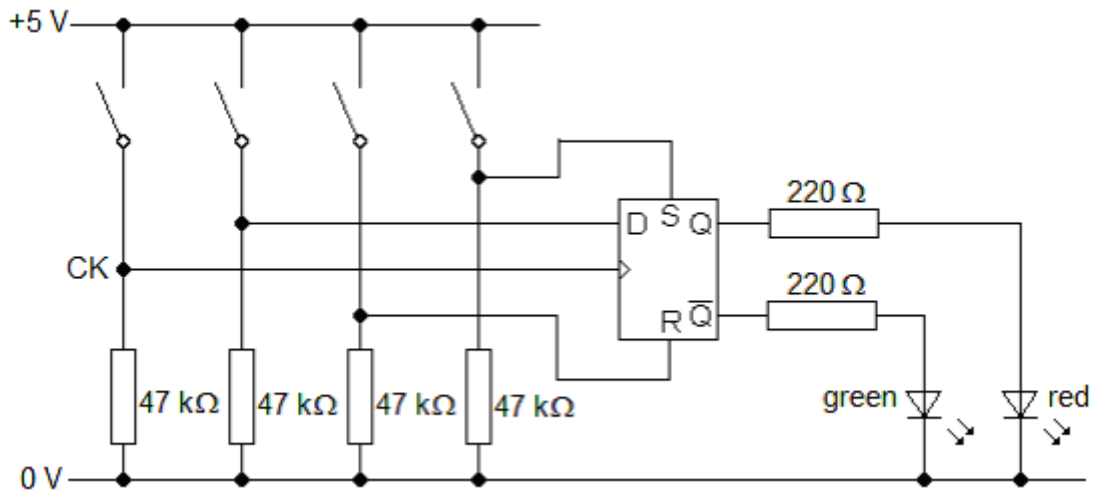
D flip-flops

You are going to investigate the behaviour of one of the D flip-flops on a 4013 i.c.

1 Assemble the circuit shown below.



2 Open all of the switches. Investigate what happens to Q and $\overline{Q}$ when S and R are pulled high in turn. Summarise your findings with a timing diagram for S, R, Q and $\overline{Q}$.

3 Hold both S and R low. Verify that

- the state of D is copied to Q when CK is raised from low to high
- the flip-flop is frozen while CK is high
- lowering CK from high to low has no effect on Q
- the flip-flop is frozen while CK is low

Summarise your findings with a timing diagram for D, CK, Q and $\overline{Q}$.

4 Study the circuit shown below. Predict the effect of pressing X, followed by Y or Z. Then assemble the circuit and see if you were right.