2 1. Draw the mechanism of the following reaction showing all intermediates and electron-pushing arrows. Draw the transition state $^\ddagger$ of the rate-determining (slow) step.

```
transition state of rds
```

4 2. Give the products of the following reactions including all stereoisomers and showing stereochemistry in 3-D.

```
(a) [Mechanism and products]
(b) [Mechanism and products]
(c) [Mechanism and products]
```

3 3. Give the starting material and reagents over the arrow for the following reactions. No credit for hydrogenations.

```
a) [Chemistry]
b) [Chemistry]
c) [Chemistry]
```

1 4. Circle the alkyl halide which would undergo the most rapid $S_N2$ reaction with NaOCH$_2$CH$_3$.

```
[Alkyl halides]
```