1. Indicate all possible alkenes that may result when 3R-bromo-2,3-dimethylpentane is reacted with potassium hydroxide.

Don’t forget possible cis/trans isomers. These are different products.

Give proper IUPAC names for all alkene products.

Rank the alkenes obtained in order of stability.

Which alkene is the favored product?

2,3-dimethylpent-2-ene is the favored product because it is the most stable (most substituted double bond).
2. Draw the preferred monoalkene products when the following alkyl bromides are reacted with sodium methoxide.

In the case with two bromines present, explain why one reacts faster than the other.

Need to consider conformation of compound. In order to allow elimination to occur by E2, an anticoplanar arrangement is required. The bromines must therefore be in the axial position to allow an anticoplanar elimination. The bromines that are axial will react, while the bromines that are equatorial will have a much slower rate.

In the fused-ring decalin structure there is no conformational flexibility, while in the cyclohexane structure there is a large energy difference to keep the t-butyl group in the equatorial position.

3. Indicate a method to synthesize 3-bromo-3-methylbut-1-ene in high yield starting with 2-methylbutane. You may use any other reagents.

One possible route:

Radical generated in second bromination will be resonance stabilized and the 3° radical will be more stable to yield the desired product.