QUESTION 1
MC28b

Which is the correct IUPAC name for the following structure?

A. 2,3-dimethyloct-(2Z)-en-6-yne
B. 6,7-dimethyloct-6-en-2-yne
C. 2,3-dimethyloct-2-en-6-yne
D. 6,7-dimethyloct-(6E)-en-2-yne

alkene takes priority over alkyne in this example because the lowest # the alkene and the alkyne can get when numbering is 2, in a tie the alkene "wins"
Which is the most exothermic reaction?

A \[ \text{H}_2 \rightarrow \text{H}_2 \]  
B \[ \text{H}_2 \rightarrow \text{H}_2 \]  
C \[ \text{H}_2 \rightarrow \text{H}_2 \]  
D \[ \text{H}_2 \rightarrow \text{H}_2 \]

Each reaction is obviously exothermic since they all convert 3 π-bonds (higher energy electrons) into σ-bonds (lower energy electrons) by reduction with hydrogen to give the same product octane. The product energy is the same in each case, it is the energies of the reactants that are different. From the notes you know that reaction X below is more exothermic than reaction Y:

X \[ \text{H}_2 \rightarrow \text{H}_2 \]  \[ \Delta H = -37 \text{ kcal/mol} \]  
Y \[ \text{H}_2 \rightarrow \text{H}_2 \]  \[ \Delta H = -28 \text{ kcal/mol} \]

The easiest way to answer this question then is simply to say that reduction of alkynes is more exothermic than alkenes, thus A and C must be more exothermic than B and D. Structure A contains a higher energy cis-alkene compared to the trans alkene in C, thus reaction A must be overall more exothermic.
QUESTION 3
MC271

Which best describes the product of the following reaction sequence?

1. NBS, hv
2. $\text{K}^+ \text{-O-t-Bu}/\text{DMF}$
3. HBR/HOOH
4. NaOH/DMF

A  B  C  D

(SN2)
QUESTION 4
MC26p

Which is the correct IUPAC name for the following structure?

A  1-bromo-9-chloro-4-propyl-(4E,7E)-nonadiene
B  9-bromo-1-chloro-6-propyl-(2E,5E)-nonadiene
C  1-bromo-9-chloro-4-propyl-(4Z,7E)-nonadiene
D  9-bromo-1-chloro-6-propyl-(2E,5Z)-nonadiene

first point of difference, Br vs. H, Br wins!

priority 1

priority 2
QUESTION 5
MC27ab

Use the pKa values given in your notes to decide which best describes the following acid/base equilibrium

\[ \text{Na}^+ \text{–NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{Na}^+ \text{–OH} \]

A NH\(_3\) is the stronger acid and the equilibrium lies on the LEFT

B NH\(_3\) is the stronger acid and the equilibrium lies on the RIGHT

C H\(_2\)O is the stronger acid and the equilibrium lies on the LEFT

D H\(_2\)O is the stronger acid and the equilibrium lies on the RIGHT

faster

\[ \text{Na}^+ \text{–NH}_2 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_3 + \text{Na}^+ \text{–OH} \]

pKa \(\sim 15\) slower pKa \(\sim 35\)

stronger stronger weaker weaker

base acid acid base

equilibrium on

THIS (RIGHT) side
QUESTION 6
the correct answer to this question is (Z)-2,3-diphenyl-2-pentene, which was NOT one of the answers, this question is deleted from the quiz, sorry!

Which is the product of reaction of (2R, 3R)-diphenyl-3-bromopentane with sodium hydroxide in a polar aprotic solvent?

A  1,1-diphenyl-2-methyl-1-butene
B  (Z)-1,1-diphenyl-2-methyl-2-butene
C  (E)-2,3-diphenyl-2-pentene
D  (E)-1,1-diphenyl-2-methyl-2-butene

(2R, 3R)-diphenyl-3-bromopentane =

\[
\begin{align*}
\text{H} & \quad \text{Ph} \\
\text{Ph} & \quad \text{Me} \\
\text{Et} & \quad \text{R} \\
\text{Br} & \quad \text{1} \\
\text{C} & \quad \text{2} \\
\text{4} & \quad \text{Et} \\
\text{H} & \quad \text{R}
\end{align*}
\]

\[
\begin{align*}
\text{Ph} & \quad \text{Ph} \\
\text{Me} & \quad \text{Et}
\end{align*}
\]

= (E)-2,3-diphenyl-2-pentene

a benzylic bromide can undergo any elimination or substitution reaction, so we can't decide on a mechanism from the structure, except that it is also a 3° bromide, so SN2 is unlikely, and anyway, only alkenes are given as the products, so it must undergo elimination

we are given –OH to react with the bromide, which is a strong base and nucleophile, for the reasons above we choose elimination with the strong base in an E2 mechanism

the base is not bulky or sterically hindered, so we expect to make the most stable, substituted alkene and the reactive conformation for an E2 is as shown above
2° halide, which is mechanistically ambiguous, but the t-butoxide anion is a strong base but weak nucleophile due to steric effects, the solvent acetone is also polar aprotic, this all favors an E2 reaction, which requires an anti-coplanar conformation for reaction.

Only this H is anti-coplanar to the Br.

Remember that the leaving group and proton must be anti-coplanar for E2. In a chair conformation, this can only occur when the leaving group is in an axial position. Let's look at Newman projections for the molecule above in the other chair, where the Br is equatorial.
QUESTION 8

MC26f

Which is the product of the following reaction sequence? It includes BOTH an E2 elimination and an SN2 reaction.

1. \( \text{Br}_2/\text{hv} \)
2. \( \text{t-BuO}^- \cdot \text{K/acetone} \)
3. \( \text{HBr/peroxides} \)
4. \( \text{CH}_3\text{O}^- \cdot \text{Na/acetone} \)

A \[ \text{C} \]
B \[ \text{D} \]

\[ \text{(remember, \( \text{Br}_2/\text{hv} \) works as well as NBS/\text{hv} for simple alkanes)} \]

\[ \text{E2 conditions, but remember, bulky base and 3Y halide does NOT give Sayetzeff product} \]

\[ \text{CH}_3\text{O}^- \text{ is a strong base and nucleophile, but SN2 favored over E2 for 1Y halide} \]