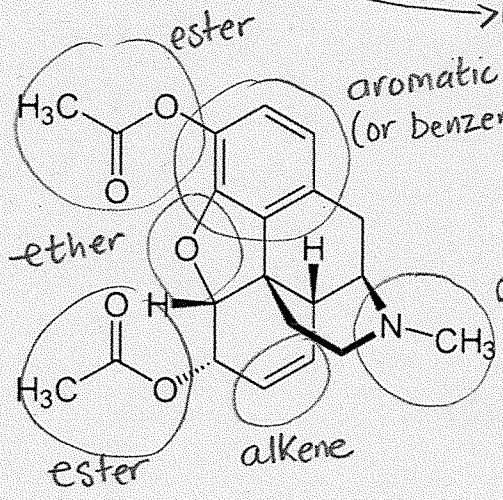
MARKING GUIDE

* Versions X & Y are identical except for sequencing / numbering *

1. The structure of heroin, a simple derivative of morphine, is shown below. Identify (**draw a circle around it**) and **name** the five (5) **distinct** functional groups present. [5 MARKS]

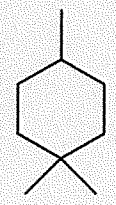
→ (1) mark each (5 distinct answers)



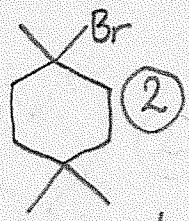

MAX. (5) marks

2. For the reactions shown below, draw the structure of the expected product. [8 MARKS]

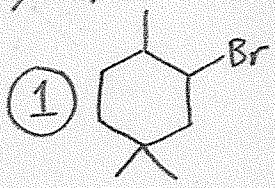
(a)



$h\nu$, $Br_2$ → ? (major substitution product)




(2)



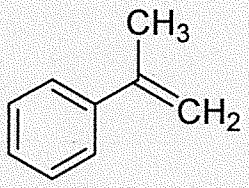

(1)

(b) $CH_3CH_2—Br$ $\xrightarrow{Na^+ \bar{O}CH_3}$ ? (substitution product) + NaBr

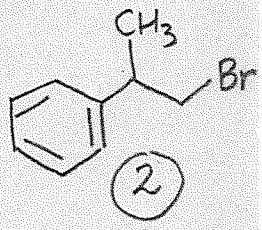


(2)

(c)

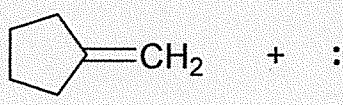



HBr, peroxides → ? (major addition product)

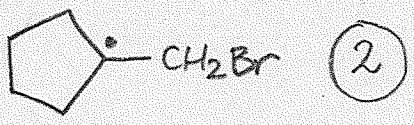



(2)

(d)

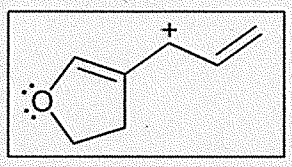



→ ? (product is a 3° radical)



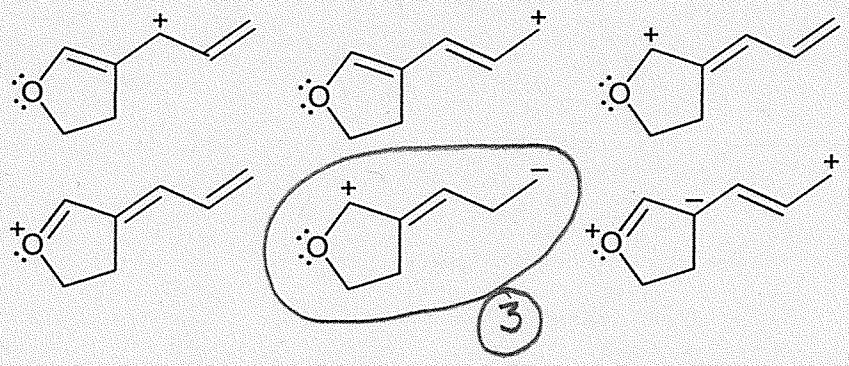

(2)

3.



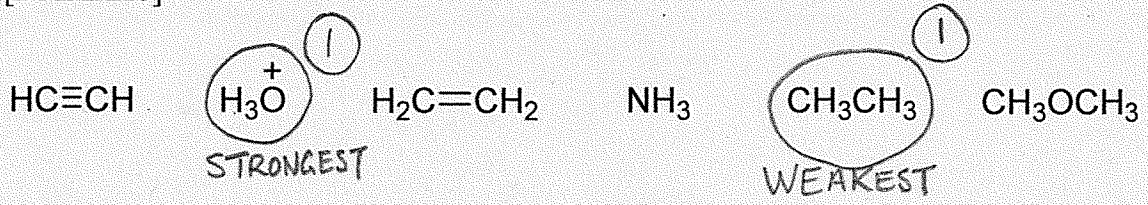
Circle **one** (1) of the structures below that is **not** a resonance structure of the above structure shown in the box. If you circle more than one, you will not receive any marks. *
[3 MARKS]

*

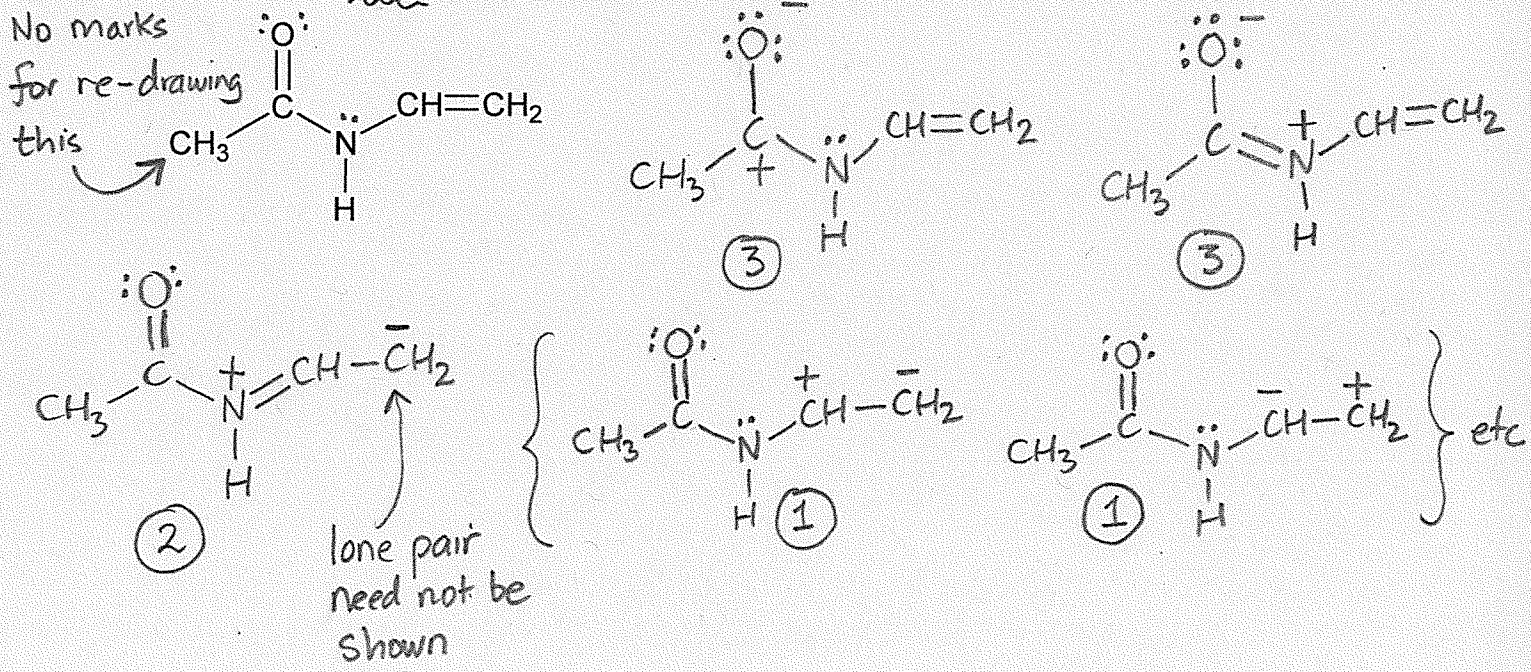



No marks if two or more are circled.

4. Circle and identify the **STRONGEST** acid and the **WEAKEST** acid from the list below.
[2 MARKS]

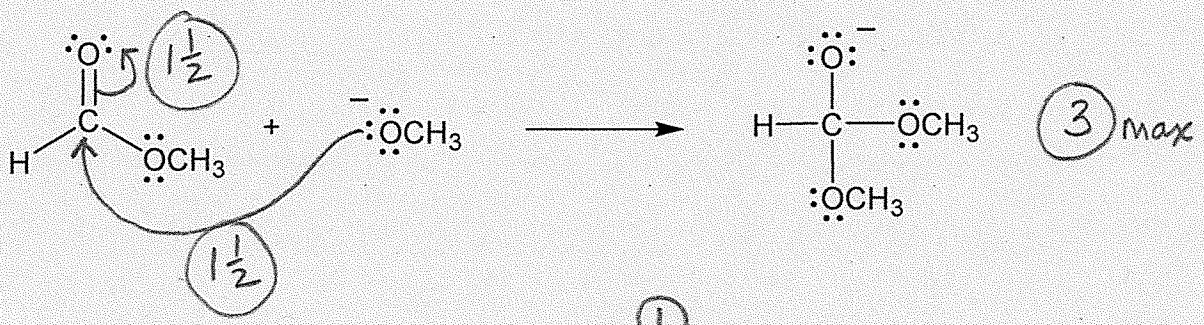



5. Draw **THREE (3)** valid and distinct resonance structures for the amide shown below (not counting the structure already shown). Show all **non-bonding** electrons and all non-zero **formal charges**. You **do not** have to show "movement" of electrons to generate the resonance structures.
[8 MARKS] max = 8 marks (deduct ½ mark for minor errors)

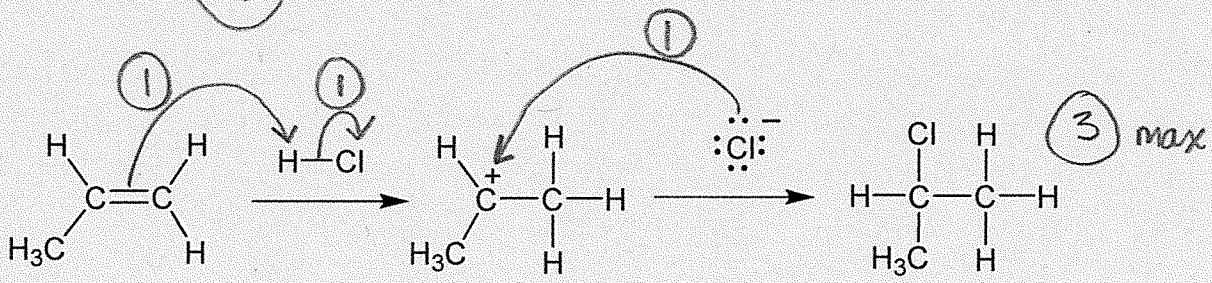


6. Using **curved arrow** notation, show the required electron flow(s) for **each step** of the reactions below. [6 MARKS]

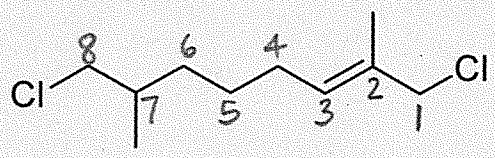
(a)




(b)




7. Provide an acceptable IUPAC name for the compound shown below. [3 MARKS]

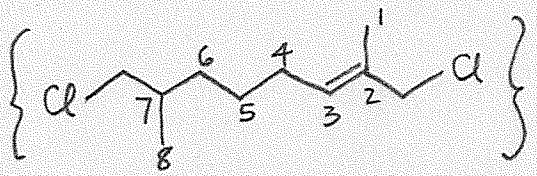


3 marks

1,8-dichloro-2,7-dimethyl-2-octene

[NO NEED FOR CIS or TRANS designation]

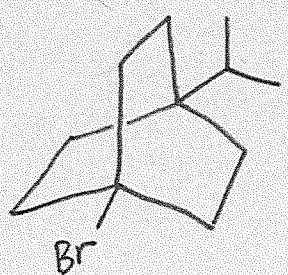
(½ deduction for minor errors)



numbering this way → max. (2) marks

2,7-di(chloromethyl)-2-octene

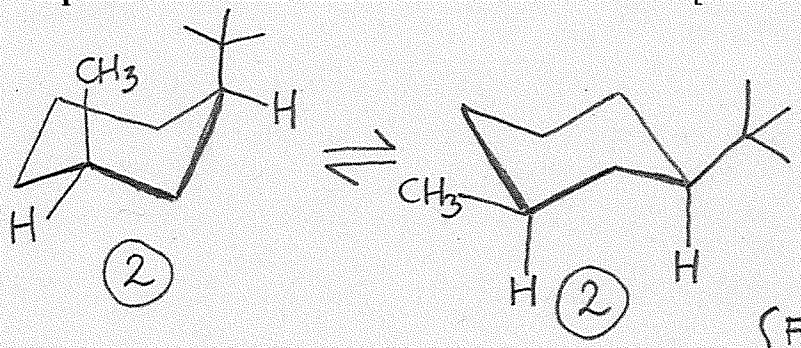
8. Draw the correct structure for 1-bromo-4-isopropylbicyclo[2.2.2]octane. [3 MARKS]



3 marks

(numbering not required)

9. Draw the **two distinct** chair conformations of *cis*-1-*tert*-butyl-3-methylcyclohexane and **identify and explain** which chair conformation is **more stable**. [6 MARKS]




more stable (1)
both of the large groups are equatorial (1)

{FULL MARKS FOR MIRROR IMAGES & ROTATED STRUCTURES}

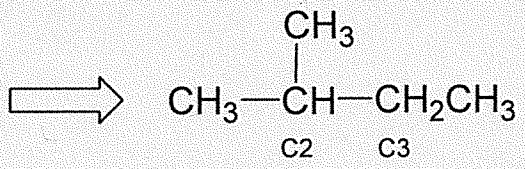
Max. (4) marks for trans-isomer → more stable isomer has tert-butyl equitorial

{Max. (3) marks for cis-1,2 or cis-1,4 isomers or trans-1,2 or trans-1,4 isomers}

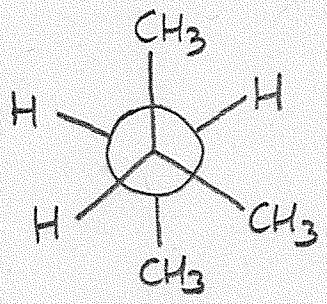
10. Draw 2-methylbutane [$(CH_3)_2CHCH_2CH_3$)] in its (a) **most** stable, and (b) **least** stable **staggered** conformations using Newman projections, viewing down the **C2-C3 bond axis**. [6 MARKS]

(**NOTE:** You need to draw **TWO** (2) Newman projections to get full marks, one being the most stable, and the other being the least stable **staggered** conformation. You **do not** need to show how one is converted to the other)

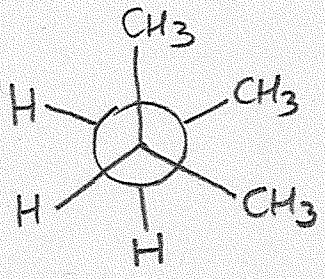
view from this end of molecule; front carbon of Newman projection is labelled C2




Max. (4) marks if viewed from this direction in Newman projection




most stable
(or mirror image or ROTATED STRUCTURE)
(3)




least stable staggered
(or mirror image or ROTATED STRUCTURE)
(3)

**END**