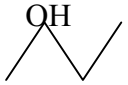
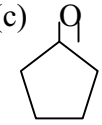
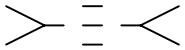
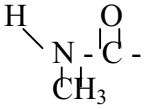
Review of Organic Chemistry

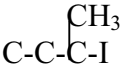
N.B. Any pair of vertical bars represent a double bond. Sometimes the lines are spread out. The same follows for angled and horizontal multiple bonds.

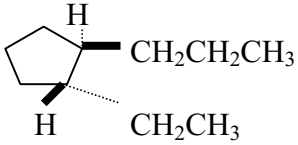
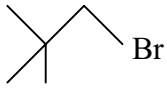
1. Circle and identify by name each of the functional groups in the compounds below:

(a)  (b)  (c)  (d)  (e) H_3C - O -CH_3

(f) H_3C - C(=O)-OH (g)  (h) CH_2CH_2-C≡N

2. Name the following molecules according to the IUPAC.

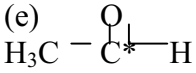
(a) C-C-C(-C-H)-C (CH_3 CH_3) (b)  (c) 

(d)  (e)  (f) 

3. Rank the following in order of increasing boiling point, justify your answer.

(a) 2-methylhexane (b) heptane (c) 2,2-dimethylpentane (d) 2,2,3-trimethylbutane (e) butanol (f) amine-butane

4. Determine the hybridization of each C-atom marked with a * in the following:

(a) *CH_3Cl (b)*CH_3OH (c) CH_3-*CH_2-CH_3 (d) *CH_2=*CH_2 (e) 

(f) HC≡CH

5. Explain sp^2 hybridization with an example of C_2H_4

6. Construct as many isomers as you can of C_5H_{12}.

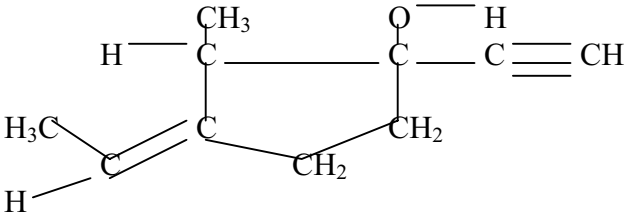
7. In the following structure below label:

(a) a highly polarized covalent bond

(b) sp carbon atom

(c) sp^2 c-atom

(d) sp^3 c-atom



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8. Draw the resonance forms of C_6H_6 and give 3 pieces of evidence for its structure.
9. Write equations, giving products, showing clearly the mechanisms for each of the following:
(a) $CH_4 + Br_2$ (b) $CH_3CH_2CH_3 + HBr$ (c) $C_6H_6 + HNO_3$
(d) $C_6H_6 + Br_2$ (e) CH_3CH_2OH + {XS conc H_2SO_4}
(f) $(CH_3)_3CBr + KOH_{(aq)}$ (g) $CH_3CH_2\text{-}CH_2Br + KOH_{(aq)}$
(h) $(CH3)_3CBr$ + KOH {hot, conc}
10. Which would you expect to be the stronger acid? Explain your reasoning.
(a) $CH_2ClCOOH$ vs $CHCl_2COOH$
(b) CH_2FCOOH vs $CH_2BrCOOH$
(c) CH_2FCOOH vs CH_2FCH_2COOH
11. Predict the major product and mechanism (S_N1, S_N2) for the reaction of:
(a) 2-bromo-butane (b) 1-bromopropane
with aqueous, dilute KOH
12. Explain how altering the conditions can affect the major product of the reaction of C_2H_5OH with
(a) conc H_2SO_4
(b) $Cr_2O_7^{2-}/H^+$
13. Explain why C_2H_5OH is neutral, C_6H_6OH is a very weak acid, CH3COOH is a weak acid and NO_2CH_2COOH is quite a strong acid.
14. The combustion of 0.146 g of compound B gave 0.374 g of CO2 and 0.154g H2O. Assuming B contains C, H, and oxygen only, determine the empirical formula of B.
15. How could you distinguish between members of the following pairs using a simple chemical test? In each case give the reagent and state the results that you would expect in both cases.
(a) Hexan-1-ol and cyclohexene
(b) C_2H_5OH and CH_3COOH
(c) C_2H_6 and C_2H_4
(d) CH_3CHO and CH_3COCH_3
(e) CH_3CHO and CH_3CH_2OH
(f) CH_3COCH_3 and CH_3CH_2COOH

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