Aircraft Systems – Part 1
Engines and Fuel

1. You arrive at the airport for a flight the morning of April 1st. As a (not so funny) April Fools' day prank someone has replaced the fuel pump labels with the pictures of the three CFIs that provide instruction at your airport, each with various versions of beards, mustaches, 'Spock' ears and other modifications penciled in.
    a. Available fuel at your airport is 100LL and 100 octane Avgas and Jet A jet fuel. How can you tell which is which?
    b. 100 octane Avgas is also known as 100/130 Avgas – what do the two numbers mean?

2. On your preflight inspection, why do you take a sample of fuel from each fuel tank and fuel sump?

3. You are flying your Cessna 172 and you note that the ammeter drops below zero and stays there – a failure of the alternator (or, maybe the belt just broke, but regardless it will not be fixed until you are on the ground).
    a. What did you do at pre-flight inspection and run-up to verify the alternator was working properly?
    b. Which of these instruments, if any will stop working once the battery is drained?
    c. Approximately how long do you have until your engine stops running?

4. On run-up, you set the engine RPM at 1800, then move the ignition switch from 'Both' *quickly* two clicks to the 'Left' (ignition system) position and note the drop in RPM, you then move it back to 'Both', then you move one click to the 'Right' position and note the drop in RPM, then back to 'Both'. When you move it to the 'Left' position you note a 110 RPM drop in RPM. When you move it to the 'Right' position you note no drop in RPM.
    a. Why do you return to the 'Both' position after checking the Left before checking the RPM drop in the 'Right' ignition system? (Why not just go from 'Both' to 'Left' to 'Right' and then back to 'Both'?)
    b. A zero drop is within the allowable 'no more than 150 RPM drop' but is this normal?
    c. If this is not normal, what, if anything is wrong?
    d. What (in the situation described above) would happen if you inadvertently clicked three times (instead of two) and turned the switch to the 'Off' position?

5. With regard to engine fuel and ignition controls:
    a. What is the proper procedure for shutting down an engine on aircraft such that on the Cessna 172?
    b. Why is it done this way?

6. For an engine in a light aircraft such as the Cessna 172:
    a. What two things provide the primary means of cooling the engine?
    b. What else may also cool the engine?

7. Abnormal combustion of the fuel-air mixture can be grouped into two categories. Describe what each of these are and what are some of the conditions which make them occur:
    a. Detonation
    b. Pre-ignition

8. Carburetor icing –
    a. Under what temperature conditions is carburetor icing a potential problem?
    b. What two things are the primary contributors to carb icing in those conditions?
    c. What is the first indicator of carburetor icing in a fixed-pitch propeller aircraft? In a constant speed propeller aircraft?
    d. What do you do to resolve carburetor icing? You know this will work because you tested it during your run-up. What indicated that it would work?
    e. Once you perform the action you chose in 'c', above, what do you do if the engine starts running with even more roughness and irregularity than it did before you did this action?

9. Fuel injected aircraft engines are nearly immune (if not completely so) from carburetor icing but have at least one hot and one cold 'problem' spot:
    a. What kind of icing is a fuel injected aircraft engine ***not*** immune to?
    b. What issue is a potential problem for fuel injected engines on a hot day?

10. A typical light aircraft engine takes in the same volume of air with every cycle (equal to the engine's displacement for each 2-revolution cycle of four stroke-cycle engine).
    a. So – if the volume of air is always the same, why is there a mixture control?
    b. What does the mixture control … control?
    c. What do the terms 'lean of peak' and 'rich of peak' mean?
    d. What is the proper way to adjust the mixture in an aircraft with a fixed-pitch prop, carbureted engine and no exhaust gas temperature (EGT) gauge?
    e. What is the proper way to adjust the mixture in an aircraft with a constant-speed prop, carbureted engine and no (EGT) gauge?
    f. What is the proper way to adjust the mixture of a fuel-injected engine without an EGT gauge?
    g. If you have an EGT gauge, how is it used when adjusting mixture?

11. Your aircraft has an auxiliary (electrically driven) fuel pump. In addition to the auxiliary fuel pump, what ***two (possibly three)*** things ensure that there is uninterrupted flow of fuel from the fuel tanks to the engine?