Ag Systems Management 373
Test 1 1. What type of material is commonly used for rod and main bearings?
   A. cast iron  B. steel  C. copper  D. babbit
2. Why are cylinder head gaskets used on tractor engines?
   A. to equalize the clearance volume
   B. to seal the water jacket
   C. to hold the pressure in the combustion chamber
   D. to make torquing the head bolts less critical
3. The conventional units for BMEP is:
4. An engine that has no heat transferred is called:
   A. polytrophic  B. isothermal  C. adiabatic  D. absolute temperature
5. What engine part is most susceptible to breakage under high speed operation?
   A. connecting rods  B. wrist pins  C. pistons  D. crankshafts
6. A two cycle engine has __________________ instead of valves to allow intake air into the combustion chamber.
   A. valves  B. turbocharger  C. supercharger  D. ports
7. The turning effort that an engine produces is called ____________.
8. At the same compression ratio, which would have a higher theoretical efficiency, a gas or a diesel engine? ________________
9. What are two methods of making connecting rods or crankshafts?
10. What are three parts of an engine's valve train?
11. What are two things that are tested or found in an OECD test?
12. What are two methods used today for accomplishing the steering of 4WD tractors?
13. What are three types of power that are typically measured in today's tractors?
14. What are two physical methods of balancing a crankshaft?
15. Fuel equivalent power is the measure of theoretical power output from a fuel. What do the two variables in the formula stand for?
16. A dynamometer is used to measure power. What are three of the four things it must do to determine power?
17. If a farmer or mechanic wanted to change the power an engine outputs, what are four things he could change? (Refer to the fuel equivalent or the indicated power formulas, don't use symbols or abbreviations.)
18. Give one advantage and one disadvantage of a two cycle engine.
   advantage _____________________ disadvantage______________________
19. List the people who are credited with the invention/idea of the following.
   The theory of the engine cycles ________________
   A working gas engine ________________
   A working steam engine ________________
   A working diesel engine ________________
20. Why are tricycle type tractors not as typical as they once were?
21. What is the importance of the Winnipeg Tractor Trials and the Nebraska Tractor Test?
22. How did the World Wars affect farm machinery technology?
23. Why isn't solar power an acceptable form of energy for tractor engines?
24. How can the firing order of an engine be changed?
25. What is the difference between IMEP and BMEP?
26. Why did OECD testing replace the Nebraska tractor test?
27. Why are hydraulic shop type dynamometers used over electric dynos?
28. What is valve overlap?
29. Why must a piston ring have an end gap?
30. What is the purpose of an engine governor?
31. How does valve duration affect an engine?
32. What is meant by torque rise or lugging ability?
33. Why is it important to keep volumetric efficiency so high?
34. Why is it so hard to be sure of the firing order of a V8 engine? (Give one reason.)
35. What is the advantage of keystone type piston rings?
36. Why are piston pins not centered in the pistons of some engines?
37. What is the average firing interval (number of degrees between power strokes) of a V10 engine, 4 stroke cycle engine?
38. Draw the theoretical PV diagram for a diesel cycle engine, labeling the pressure, volume, clearance volume, atmospheric pressure, TDC, BDC, intake, compression, power, exhaust, total displacement. (12 pts)
39. If a V8 engine has a total engine displacement of 289 in.3 and a clearance volume of 4.25 in.3/cylinder. What is the compression ratio at 2500 rpm?
40. If an engine has a fuel equivalent power of 100 hp., an indicated power of 55 hp., and a brake horsepower of 40 hp.:
   A. What is the friction power? __________________
   B. What is the mechanical efficiency? __________________

Test 2
1. Which of the following combustion chamber designs is most commonly used in ag tractors?
   A. indirect injection B.energy cell C. swirl chamber D.direct injection
2. What is the richest air fuel ration that an engine can ignite and burn?
   A. 4 to 1 B. 8 to 1 C. 16 to 1 D. 20 to 1
3. As the load on a gas engine increases at full throttle, what happens to the vacuum in the intake manifold?
   A. increases (lower pressure, higher vacuum) B.stays the same, does not change
   C. decreases (higher pressure, lower vacuum) D.depends on whether it is fuel injected or carbureted
4. The secondary windings of an ignition coil:
   A. has fewer turns or wraps then the primary.
   B. has more turns or wraps then the primary.
   C. has the same number of turns or wraps as the primary.
   D. has the same number on standard ignitions and more on electronic ignitions.
5. What type of current is used to make an electromagnet?
   A. DC B. AC C. either AC or DC D. polarized AC
6. The hydrogen gas given off by batteries is from what source in the battery?
   A. the positive plate B. the negative plate C. the grid work D.the electrolyte
7. The switch used in a starting circuit to switch battery power directly to the starter from the battery is a:
8. What term describes the volatility of a fuel?
   A. specific gravity B. flash point C. BTU D. Reid vapor pressure
9. When a diesel fuel filter plugs because of cold weather, which of the following is the probable cause?
   A. cloud point B. pour point C. reid vapor pressure D. ash content
10. A ______________________ allows current to flow in only one direction.
11. The process of expelling the air from a diesel system is called
12. The direction the air is flowing when it passes through the venturi is called carburetor ________________________.
13. The creation of a voltage in a secondary winding by a changing voltage in the primary is called ________________________.
14. What are two cold starting aids for diesel engines?
15. What are two types of high pressure pumps used in ag diesels?
16. What are two systems within a carburetor?
17. What are two advantages of a high cetane fuel?
18. List two differences between gas and diesel engines, either in physical or operational differences.
19. List one part from the primary and secondary parts of an ignition system.
   Primary _____________________ Secondary ___________________
20. What is the cracking pressure as it refers to diesel injectors?
21. What is the difference between where the fuel is injected on gas and diesel engines?
22. What is one reason fuel injected gas engines get so much better gas mileage than carbureted?
23. How is LP or liquified petroleum gas liquified?
24. Why did automotive and small engines switch to solid state ignitions?
25. What is an advantage of a magneto system?
26. On a molecular level, what is the difference between a conductor and an insulator?
27. What is meant by the stoichiometric air fuel ratio?
28. What is the purpose of a spark plug?
29. What is the difference between summer and winter gasoline?
30. What is one of the most common causes of battery failure?
31. What is the physical difference between a hot and cold spark plug?
32. What is the purpose of the centrifugal advance in an ignition system?
33. What is the battery rating system that is the number of amps a battery can deliver for 30 seconds while maintaining 1.2 volts/cell at -20?F?
34. The rating system of gasoline is octane, which measures what?
35. What is one reason an alternator can generate more output at a low engine speed?
36. Why does the standard lead acid battery output 2.2 volts/cell?
37. What does the specific gravity of a battery indicate?
38. How is crude oil separated and purified?
39. What instrument is used to determine the heat value of a fuel?
40. White smoke from a diesel is cold smoke, what is a cause of this problem?
41. Balance the following combustion equation:
   C6H14 + ____O2 + ____N2 = ____H2O + ____CO2 + ____N2
42. If a tractor starter draws 325 amps at 10.75 volts, what is the power it is outputting in watts?  

Test 3  

1. Where are hydraulic filters usually placed in the system?  
a. between the reservoir and the pump  
b. between the pump and the actuators  
c. after the actuators in the return line  
d. anywhere, doesn’t make any difference  

2. The pour point of a hydraulic oil should be lower than the lowest operating temperature.  
a. 50 - 100°F higher  
b. 150 - 200°F lower  
c. 350 - 400°F lower  
d. 450 - 500°F lower  

3. The automatic transmission is technically called a/an  
a. hydrostatic  
b. fluid drive  
c. power shift  
d. hydrokinetic  

4. What approximate percent of fine air dust does a good oil bath air cleaner remove?  
a. 50%  
b. 75%  
c. 98%  
d. 110%  

5. If there is a vacuum in the intake manifold, the volumetric efficiency will:  
a. be greater than 100%  
b. be less than 100%  
c. depends on the condition of the engine  
d. depends on whether the engine is gas or diesel  

6. A radiator has a 6 psi radiator cap. How much is the boiling point of water raised by the increase in pressure?  
a. 20°F  
b. 60°F  
c. 120°F  
d. 180°F  

7. What is the approximate fuel energy lost to the cooling system?  
a. 5%  
b. 10%  
c. 30%  
d. 60%  

8. What percentage ethylene glycol has the lowest freezing point when combined with water?  
a. 58%  
b. 68%  
c. 78%  
d. 98%  

9. An emulsion of mineral oil and soap is:  
a. grease  
b. transmission fluid  
c. engine oil  
d. crude oil  

10. What organization sets the standards for the numbering system used for oil viscosity?  
a. ASAE  
b. ASTM  
c. API  
d. SAE  

11. Which of the following oils would be satisfactory for use in a modern turbocharged diesel tractor engine?  
a. SD  
b. SE-CA  
c. CB  
d. SE-CE  

12. What are three of the six basic principles of hydraulics?  

13. What 2 parameters do valves in a hydraulic system control?  

14. What are two purposes of a hydraulic reservoir?  

15. What are two purposes of an engine clutch?  

16. What are two things that affect clutch or brake capacity?  

17. What are the two purposes of a muffler?  

18. Using the same basic engine, many companies make several different horsepower engines by adding turbos and changing fuel input. What is an advantage and disadvantage of this procedure?  
a. advantage:  
b. disadvantage:  

19. Operating at too low an engine temperature has what two bad effects on engine performance and life?  

20. What are two of the five functions of an engine oil?  

21. What is an advantage and a disadvantage of air cooling over water cooling engines?  

22. Why does a pressure-flow compensated system lengthen
the life of the hydraulic system?
23. What organization sets up standards for three point hitches on tractors?
24. What is an advantage of a draft control three point hitch?
25. What type of gears are used to make a square corner as in a differential?
26. Why was the RPM of the PTO shaft increased from 540 RPM to 1000 RPM?
27. Why don't power shift transmissions grind gears when shifted on the move?
28. What is the purpose of synchronizers in a manual transmission?
29. Why shouldn't high pressure air be used to clean dry type air filters?
30. How do the intake manifolds on diesel and gas engines differ in construction?
31. What part of the cooling system is used to automatically control engine temperature and speed warmup on modern engines?
32. Why aren't methyl alcohol or ethyl alcohol used as antifreeze anymore?
33. What affect does a higher percentage of ethylene glycol antifreeze have on the boiling point of the coolant?
34. What is the difference between full film lubrication and boundary lubrication?
35. What does it mean if an oil has a high viscosity index?
36. Why should oils be changed on a regular basis if the oil is still "good", has not lost its lubricating properties?
37. Give one advantage of a splash and a pressure feed oil system.
   a. Splash
   b. Pressure
38. What is one reason why transmission oil or grease is different form the engine oil?
39. Give one advantage of synthetic engine oil.
40. A tractor hydraulic system operates at a maximum pressure of 2250 PSI and 14 gal/min. It operates a 3 inch diameter cylinder and a motor with a 1.5 cubic inch/revolution displacement.
   a. What is the maximum weight the cylinder will lift?
   b. How many rpm will the motor turn? (1 gal = 231 in 3)
   c. What is the theoretical horsepower? \( P \times Q \)
41. What is the rpm of each of the shafts of a gear set, if shaft #1 has a 13 tooth gear running at 400 rpm and turns a 42 tooth gear on shaft #2, this gear turns a 20 tooth gear on shaft #3?
   RPM shaft #2                                RPM shaft #3