

NOTE-TAKING WORK SHEET ANSWERS

October 2002

I. Integrated Pest Management in Agriculture (video)

A. Define IPM

1. IPM is a pest **population** management system that anticipates and prevents pests from causing damage.
2. IPM is an **ecological** approach to pest control.

B. Components of IPM

1. Pest **identification**
2. **Monitoring**
3. Use of natural enemies (**biological** control)
4. Pest-**resistant** plants
5. **Cultural** and structural changes
6. Judicious use of **least** - toxic pesticides

C. Intent of IPM

1. To use tactics that include pesticide **alternatives** that reduce the total amount of pesticide chemicals used thereby lessening the opportunity for pests to develop resistance.

II. Laws and Regulations (Chapter 1, pp. 1-6, *Laws and Regulations Supplement*)

1. How is a pesticide defined by law? (page 1, paragraph 3; §76.001 definitions)
Any substance or mixture of substances intended for preventing, destroying, repelling or mitigating my pest, and any substance intended for use as a plant growth regulator, defoliant or desiccant.
2. Which state and federal agencies register pesticides? (page 2, paragraph 1; §76.001 definitions)
Texas Department of Agriculture (TDA) and the U.S. Environmental Protection Agency(EPA).
3. What is the federal law that regulates the sale and use of pesticides? (page 2, paragraph 2; §76.001 definitions)
The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).
4. What is a state-limited-use pesticide? (page 2, paragraph 3; §76.003)
A pesticide or pesticide use on which additional restrictions are placed by the Texas Department of Agriculture
5. As defined by law, what is a private pesticide applicator? (page 2, paragraph 4; §76.112)
A person who uses or supervises the use of a restricted-use or state-limited use pesticide or a regulated herbicide for the purpose producing an agricultural commodity.

6. When supervising pesticide use, must the private applicator be physically present? Is the applicator responsible for actions of the supervised workers? (page 3, paragraph 2; §7.31)
The applicator need not be physically present, unless required by the label or other conditions of use, but must be available if and when needed. The licensed applicator and the supervised person may keep in touch by phone, radio, etc. The applicator is responsible for actions of individuals being supervised.
7. Who is responsible for assuring that any person working under the licensee's direct supervision is knowledgeable of the label requirements and rules and regulations governing the use of the particular pesticide being used by the individual? (page 3, paragraph 2; §7.31)
The licensed applicator (may be private, commercial, or noncommercial)
8. What practical knowledge and skills should a private applicator have? (page 3, items listed 1-5)
The applicator should know how to: recognize common pests and pest damage; read and understand the label; apply pesticides according to label instructions and warnings; recognize environmental conditions and avoid contamination; and recognize poisoning symptoms and perform first-aid.
9. What is the significance of pesticide label directions with regard to the law? (page 3, paragraph 5; §7.71)
The label has the force of law and includes a statement stating that the use of any chemical inconsistent with the label directions is a violation of the law.
10. What types of laws are violated when the applicator uses pesticides inconsistent with label directions? Examples: Is it ever legal to use more than the labeled rate? Is it ever legal to allow the pesticide to DRIFT off of the target site? (page 3, paragraph 5; §7.71)
Both federal and state law prohibits uses pesticides inconsistent with label directions. It is NEVER legal to use more than the labeled rate of a pesticide. It is NEVER legal to allow the pesticide to DRIFT off of the target site.
11. What role do Texas counties have in regulating pesticides? (page 4, paragraph 1; §7.50)
Sale and use of certain herbicides are regulated in some counties where a permit must be obtained to use such products during certain times of the year.
12. What is a spray permit? (page 4, paragraph 1; §7.50)
*A spray permit is a document issued by TDA that must be issued before application that authorizes a person to apply **regulated herbicides** in a regulated county.*
13. When does a spray permit expire? (§7.50)
*All **permits expire** when the acreage for which the permit was granted has been sprayed, or 180 days after issuance, whichever occurs first.*
14. List some applications that would require a spray permit and some that would not require a spray permit and some that are prohibited from having a spray permit. (§7.50)
*Spraying with standard **ground application equipment** would require a permit. Applications of regulated herbicides to lawns and by brush, mop, wick, basal treatment, or injection methods are **exempt** from obtaining a permit. The use of any **turbine or blower-type ground application equipment** to apply regulated herbicides is **prohibited**.*
15. What Continuing Education Units (CEUs) are required to renew the private applicator's license?

(page 5, paragraph 3; §7.24)

*Private applicators are required to recertify every **five (5)** years by obtaining **fifteen (15)** continuing education units (CEUs) including at least **two** credits in **laws and regulations** and **two** credits in **integrated pest management**.*

16. What late fees are added to the renewal fee if a private applicator does not renew the license by February 28th? (page 5, paragraph 5; §7.25)
The renewal fee is \$50.00 due by February 28. After February 28 to May 31, there is a \$25.00 late fee - total cost \$75.00. After May 31 the late fee is \$50.00 - total cost \$100.00. After 12 months the license is lost. After a license is lost, the applicator must wait one year before they can train and retest. TDA will NOT issue a new license until one full year elapses.
17. If an applicator fails to inform TDA of a change in mailing address, what can happen to the license? (§7.20)
Failure to provide such information may be grounds for denial, suspension or revocation of the license.
18. When can a person request prior notification? (§7.37)
Prior notification can be requested when pesticides are being applied with air-blast, mist blowing or aerial equipment by people on adjoining property living within 1/4 mile or by persons in charge of day-care centers, hospitals or nursing homes, and schools within 1/4 mile of the application.
19. Name an excepted method of giving prior notification of a scheduled application to a neighbor who has requested prior notification. (§7.37)
The notification may be made by raising an EPA WPS flag/sign in or about the field to which pesticides are scheduled to be applied.
20. How long are licensed pesticide applicators required to keep records? What types of pesticides are required to be included in these records? (§7.33)
A person licensed or certified as a private applicator must maintain records of each application of a restricted-use pesticide, state-limited-use pesticide, or regulated herbicide. Records of pesticide use must be maintained for a period of two (2) years.
21. Explain what is needed when the regulations require that the **total volume** of spray mix, dust, granules, or other materials applied per unit be recorded. (§7.33) Give an example of what is meant here. *Record the rate/area. Examples - 1 gallon per 1000 square feet or 30 gallons per acre this would include water, pesticide, surfactant and any other additive put into the tank.*
22. List locations that are covered by WPS and others that are exempt. (see **Laws and Regulations Supplement** WPS - 40 CFR Subpart A §170.1).
WPS applies to most agricultural production such as field crops (cotton, corn, sorghum, etc. also turfgrass production for sod, and greenhouse plant production). Pastures and rangeland are exempt from WPS.

23. Compare the terms “Agricultural Employer” and “Handler Employer” as used in the WPS. (see ***Laws and Regulations Supplement*** WPS - 40 CFR Subpart A §170.3).
When reading the WPS Laws and Regs the term “Agricultural Employer” is used when they discuss the employer of “workers” and the term “Handler Employer” is used when they discuss employers of “handlers”. These two may well be the same person so don’t let the terminology confuse you.
24. What is an agricultural employer? (see ***Laws and Regulations Supplement*** WPS - 40 CFR Subpart A §170.3).
*The **agricultural employer** is the person ultimately responsible for insuring worker compliance with WPS restricted entry intervals before entering treated fields.*
25. How often is a supervisor required to monitor a handler who is using a highly toxic pesticide marked with a skull and cross bones and how can they be monitored? (see ***Laws and Regulations Supplement*** WPS - 40 CFR Subpart C §170.210).
*Handlers handling highly toxic pesticides: The handler employer shall assure that any handler who is performing any handling activity with a product that has the **skull and crossbones** symbol on the front panel of the label is **monitored** visually or by voice communication at least **every 2 hours**.*
26. What items are necessary at the decontamination site(s) and who is responsible for providing these items? (see ***Laws and Regulations Supplement*** WPS - 40 CFR Subpart C §170.250).
*The **handler employer** must provide enough water for routine washing, for emergency eye flushing, and for washing the entire body, soap and single-use towels in quantities sufficient to meet handlers’ needs, and one clean change of clothing, such as coveralls in case of an emergency.*

Some of the above questions may be repeated in a later section due to specific subject matter.

III. How to Read Pesticide Labels (Video, **Labels and Labeling**, Chapter 2, pp. 7-12)

1. Look for the **brand** name on the front of the label. (page 7, paragraph 2)
2. **Active** ingredients are the ones that kill or control the pests. (page 7, paragraph 3)
3. **Signal** words tell you how poisonous the pesticide is. (page 8-9, paragraph 3 & 1-4)
CAUTION : least poisonous pesticides - low toxicity
WARNING : more poisonous or irritating - moderately toxic
DANGER : very poisonous or irritating; may also have skull and crossbones - highly toxic
4. When handling pesticides with the DANGER signal word, someone should check on you every **two (2)** hours. (video)
5. The **precautionary** statements section tells you which parts of your body need special protection and what kind of personal protective equipment to wear. (page 9-10, paragraph 7 & 1-2)

6. The **environmental** hazards section tells you if you must take extra care to protect bees and wildlife or to keep the pesticide out of groundwater and surface water. (page 10, paragraph 3)
7. A **restricted use pesticide** is classified as restricted use by EPA because it may, without additional regulatory restrictions, cause unreasonable adverse effects to the environment or to human health (including injury to the applicator). Labels say for sale to and for use by certified applicators or persons under their direct supervision and only for uses covered by the Licensed Applicator's license. (page 10, paragraph 4)
8. The **directions** for use section lists information on mixing, loading and application. (page 10, paragraph 5)
9. All agricultural pesticides have a **restricted entry interval**, or an REI. The REI is the time immediately after the pesticide application during which entry into the treated area is restricted. (While the REI is in effect certain PPE is required for entry into the area; after the REI has expired workers and handlers can enter the area without PPE.)(page 11, paragraph 1-2; WPS - 40 CFR, Subpart A, §170.3)
10. The **preharvest** interval is the number of days between when the pesticide is applied and when the crop is harvested. (page 11, paragraph 3)
11. Using a little MORE pesticide than the label recommends is **never** legal since it is a use inconsistent with label directions. (**§7.71 - Use Inconsistent with Label Directions**)
12. The label **never** allows drift off of the intended spray target. (**§7.71 - Use Inconsistent with Label Directions**)

IV. Groundwater

1. What are some consequences of groundwater contamination? (page 14. paragraphs 2 & 3)
Potentially prohibitive clean-up expenses; possible cancellation of registered pesticides; health effects, ect.
2. List some routes by which pesticides may reach groundwater. (page 14, paragraphs 4-5)
By leaching with recharge water and via spills, abandoned wells, sinkholes, back-siphoning into wells, and improper rinsate and container disposal.
3. What site features contribute to a greater potential for chemical movement through soil? (page 15, paragraph 3)
Coarse (sandy) soil, low in organic matter, a shallow depth to groundwater and highly permeable materials between soil and groundwater.
4. What chemical and physical properties contribute to a pesticide's potential for leaching? (page 15, paragraph 4)
A Pesticide is more likely to leach if it is very soluble in water, if it does not strongly adsorb onto soil, and if it persists in the soil (does not readily break down) over time.

5. What pesticide application practices help minimize the potential for groundwater contamination? (page 16, paragraph 1)
In general, the same practices that you follow to obtain the most efficient and economical pest control, such as accurate measuring and mixing, proper equipment calibration, etc.
6. List some ways to minimize direct contamination of groundwater. (page 16, paragraph 2)
Protect well heads and other water sources, move needed water to the field for mixing and loading, conduct all water using activities away from well heads and other water sources.
7. How can back-siphoning be prevented? (page 16, paragraph 3 and also page 26, paragraph 3)
By keeping the discharge end of the water delivery hose above the level of the liquid in the tank (referred to as an air-gap), by using check valves and anti-backflow devices on pumping equipment.
8. What procedures should be used to clean out pesticide containers? (page 16, paragraph 6)
Triple rinse or pressure rinse the containers and return rinse water to the spray tank.

V. Endangered Species Protection

1. What are the benefits of biological diversity? (page 17, paragraphs 1-2; page 18, paragraphs 1-3)
Many properties of plants, animals and microorganisms are used for food, clothing, medicine and shelter were found in nature. For example, nearly half of pharmaceutical drugs were developed from substances found in nature. Most crops produced in this country originated elsewhere in the world.
2. What is an endangered species? (page 18, paragraph 5)
*A species in danger of extinction throughout **all** or a **significant portion** of its range.*
3. What responsibility does the Environmental Protection Agency have with regard to endangered species protection? (page 18, paragraph 7)
To ensure that EPA registration of pesticides does not harm an endangered or threatened species or its critical habitat.
4. How can the label help protect endangered species? (page 18, paragraph 8)
By including statements of limitations on the label, by prohibiting chemical use at certain times or within certain areas, by referral to a County Bulletin with additional information and instructions.
5. Name two government agencies that can provide information on endangered species. (page 19, paragraphs 2)
Texas Parks and Wildlife Department (state agency) and U.S. Fish and Wildlife Service (federal agency)

VI. Pesticide Record-Keeping (refer to RULE §7.33 - - - Records of Application)

- A. The 1990 Farm Bill and subsequent amendments require you to record basic information about a pesticide application. The required information includes:
 1. applicator **name** and certification/license number
 2. the **month**, day and year of application
 3. product or brand name and EPA **Registration** number
 4. total amount applied of **undiluted** pesticide
 5. **crop**, commodity, stored product or site that received the application
 6. the **size** of the area treated, in acres, number of trees or other measurement
 7. the location of application (using maps, county field numbers or legal descriptions so that the exact area can be identified **2** years later if requested)

- B. If you make a **spot** application to an area that is less than one-tenth of an acre over a 24-hour period, then you only need to record:
 1. date of application
 2. brand or product name
 3. EPA registration number
 4. total amount applied
 5. the location (designated as spot application, followed with short description)

- C. Greenhouse and **nursery** applications are not considered spot applications and therefore do NOT qualify for the shorter list of required data.

- D. Records must be recorded within **14** days of the application and then kept for **2** years.

- E. The regs require that the **total volume** of spray mix, dust, granules, or other materials applied per unit be recorded - Give an example of what is meant here. *Example - 30 gallons per acre this would include water, pesticide, surfactant and any other additive put into the tank.*

VII. Personal Protection and Proper Use (video and review Chapter 5, *Pesticide Safety*, pp.21-24)

- A. Protecting Yourself from Pesticides
 1. When handling pesticides, watch out for spills and splashes. Avoid sprays and dusts from pesticide applications. Also avoid **residues**, which are pesticides that remain on the plants, soil, water, equipment, clothing or in the air after an application.
 2. Pesticides can poison or injure you if you: swallow or **breathe** them or get them into your eyes or on your **skin**.
 3. The most common route for pesticides to enter the body during use is through the **skin**. (page 21, paragraph 5)
 4. Applicators are more likely to receive high levels of skin exposure when they are **mixing** and **loading**. (page 22, paragraph 1)
 5. Signs and symptoms of organophosphate poisoning include: **fatigue**, **headache**, **dizziness**, **blurred vision**, **excessive sweating**, **nausea** and **vomiting**, **stomach cramps**, and **diarrhea**. (page 23, paragraph 8)

- B. Personal Protective Equipment (PPE)

1. Chemical-resistant PPE can be made of a variety of chemical-resistant material, including PVC and **rubber**.
 2. Gloves that are made of **cotton** and leather should NOT be worn when handling pesticides.
- C. Follow these easy rules for wearing PPE correctly:
1. Keep pant legs **over** the top of boots.
 2. Wear chemical-resistant **gloves** that reach at least half-way to elbow.
 3. If applying pesticides toward the ground, wear sleeves over the **outside** of gloves.
 4. If working above your shoulders, wear sleeves **inside** your gloves. Make sure you choose gloves with cuffs.
 5. Wear **coveralls** over your regular work clothes to give your body good protection against most pesticides.
 6. Use a chemical-resistant **apron** to keep splashes and spills from soaking your coveralls while you are mixing and loading pesticides or cleaning equipment.
- D. Respirators (best protection against gases and vapors) (page 23, paragraph 3)
1. The **National Institute for Occupational Safety and Health (NIOSH)** is the federal agency that evaluates and approves **respirators**. In addition, since 1998, the **Occupational Safety Health Administration (OSHA)** requires that before employees can use respiratory protection equipment they must be trained and have a medical evaluation.
 2. Styles of respirators include:
 - **Dust-mist** filtering respirators
 - Chemical **cartridge** respirators
 - **Canister** respirators
 - **Air-supplying** or **self-contained** breathing apparatus (when using highly toxic pesticides or during fumigation) (page 23, paragraph 4)
 3. Every time you put your respirator on, make sure that you do a **fit** check.
 4. If there are no instructions, then replace filters, cartridges and canisters at the end of each work day or after **8** hours whichever comes first.
 5. When and how should the face piece be cleaned? (page 23, paragraph 6)
Remove filters and cartridges and wash the face piece with soap and warm water after each use. Rinse thoroughly to remove traces of soap. Dry and keep in a well ventilated area.
- E. Transporting and Storing Pesticides
- F. Mixing and Loading Pesticides
- G. Cleaning Up Pesticide Spills -- The three 'C's of spill management:
1. **Control**
 2. **Contain**
 3. **Clean up**
- H. Cleaning and Disposing of Pesticides and Pesticide Containers
- I. Applying Pesticides
- J. Cleaning Up. When washing contaminated work clothes, follow these washing procedures:

1. Keep work clothes **separate** from other laundry.
 2. Wash only a few items at a time.
 3. Use the **highest** water level.
 4. Use heavy-duty detergent and **hot** water.
 5. Use **two** rinse cycles and use warm water if possible for the rinse cycles..
 6. Use two complete washer cycles for items moderately to heavily contaminated.
 7. Hang washed work clothes **outside** .
 8. Run washer without clothes for **one** additional cycle using hot water and detergent to clean machine.
 9. Try NOT to use a **dryer**; or use highest setting.
- When clothing is heavily contaminated it should be **destroyed**. (page 22, paragraph 6)

Environmental Considerations (Chapter 6, pg. 25-26; *Laws and Regulations Supplement §7.34*; and pesticide label.)

1. Empty pesticide containers should be triple rinsed prior to disposal, what should the applicator do with the rinse water from the triple rinsing? (page 26, paragraph 6; §7.34 - including storage and disposal language from the pesticide label)
*All “empty” pesticide containers should be **rinsed three times (triple rinsed)**. This rinse water should be **added to the spray tank** and applied to the labeled site.*
2. What can be done with empty, rinsed, pesticide containers? (page 26, paragraph 5; Rule §7.34 including storage and disposal language from the pesticide label)
*DO NOT reuse empty container. Triple rinse (or equivalent) and offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill. Empty rinsed containers must be **punctured** then stored in a secure area until they can be **recycled** or **disposed of** properly.
NOTE: Burning is NOT allowed in Texas.*

VIII. The Worker Protection Standard (Video; 40 CFR §170)

1. To conduct worker training, you must use: **written** or audio-visual training materials (EPA approved).
2. You can deliver the information yourself or rely on **audio-visual** programs to deliver content (or enlist another approved trainer).
3. The training must be presented so that it can be **understood** by the workers: use trainee's language, use non-technical terms, respond to questions.
4. List locations that are covered by WPS and others that are exempt. (see *Laws and Regulations Supplement* WPS - 40 CFR Subpart A §170.1).
WPS applies to most agricultural production such as field crops (cotton, corn, sorghum, etc. also turfgrass production for sod, and greenhouse plant production). Pastures and rangeland is exempt from WPS.
5. Compare the terms “Agricultural Employer” and “Handler Employer” as used in the WPS. (see *Laws and Regulations Supplement* WPS - 40 CFR Subpart A §170.3).
*When reading the WPS Laws and Regs the term “**Agricultural Employer**” is used when they*

discuss the employer of “workers” and the term “**Handler Employer**” is used when they discuss employers of “handlers”. These two may well be the same person so don’t let the terminology confuse you.

6. What is an agricultural employer? (see **Laws and Regulations Supplement** WPS - 40 CFR Subpart A §170.3).
*The **agricultural employer** is the person ultimately responsible for insuring worker compliance with WPS restricted entry intervals before entering treated fields (and more).*
7. How often is a supervisor required to monitor a handler who is using a highly toxic pesticide marked with a skull and cross bones and how can they be monitored? (see **Laws and Regulations Supplement** WPS - 40 CFR Subpart C §170.210).
*(b) Handlers handling highly toxic pesticides. The handler employer shall assure that any handler who is performing any handling activity with a product that has the **skull and crossbones** symbol on the front panel of the label is **monitored** visually or by voice communication at least **every 2 hours**.*
8. What items are necessary at the decontamination site(s) and who is responsible for providing these items? (see **Laws and Regulations Supplement** WPS - 40 CFR Subpart C §170.250).
*The **handler employer** must provide enough water for routine washing, for emergency eye flushing, and for washing the entire body, soap and single-use towels in quantities sufficient to meet handlers’ needs, and one clean change of clothing, such as coveralls in case of an emergency.*

IX. Application, Equipment, and Calibration

1. Rank the roller, centrifugal and piston pumps in order from lowest to highest pressure. Which has the highest volume capacity? (page 28, paragraphs 4-6)
From lowest to highest pressure: centrifugal pump, roller pump, piston pump. The centrifugal pump has the higher volume capacity.
2. When considering pump size, what capacity should a pump have? (page 28, paragraph 7)
Enough capacity to supply all nozzles on the spray boom plus capacity for agitation if necessary.
3. What guideline should you follow for selecting a pressure gauge? (page 28, paragraph 8)
Select a gauge to read in the range of pressures to be used, with a range twice the maximum reading expected.
4. What kind of nozzle tip should be avoided when spraying wettable powders? (page 29, paragraph 3)
Brass tips.
5. With flat spray tips, what must be adjusted to change the amount of overlap in spray pattern? (page 29, paragraph 4) (Note: error correction)
The boom height.
6. Which spray tips can be used at an operating pressure of 20 to 40 pounds per square inch? (page

29, paragraphs 4-5)

Flat and even spray tips.

7. You can change the output of any nozzle by changing the operating **pressure** . Changing pressure is only good for small changes; for larger changes it is best to change the nozzle tips to deliver the correct volume.
8. To double nozzle flow rate (without changing the nozzle), you must increase pressure **four (4)** times. (This is NOT a practical thing to do. For example if you are using 30 psi you would have to increase pressure to 120 psi and nozzle tips generally are designed to work best at pressures between 20 and 40 psi.)
9. What kind of material should be used to clean nozzles? (page 30, paragraph 1)
A soft brush, such as a tooth brush, NOT a knife or wire.
10. What is a specific precaution you should take to prevent drift related to wind? (page 30, paragraph 3)
Weather conditions affect the direction, amount, and distance of drift. DO NOT apply chemicals when the wind is blowing toward a susceptible crop.
11. What hours of the day are usually best for spray applications? (page 30, paragraph 3)
During early morning and late evening hours, when there is less difference between air temperatures at and above ground level.
12. How often should equipment be calibrated? (page 31, paragraph 3)
Before every use.
13. What material should be used in the tank to check nozzle discharge or calibrate a sprayer? (page 31, paragraph 4)
Water.
14. When should a nozzle tip be replaced? (page 31, paragraph 4)
When it has a flow rate of 10 percent more or less than the average of the nozzles in the system.
15. What kind of application method has a rate per acre of land that is different from its rate per treated acre? (page 31, paragraph 6)
Band applications (versus broadcast applications).
16. How is swath width in feet determined when broadcast spraying? when band spraying? (page 32, no. 7)
*Broadcast - the number of nozzles on the boom X the nozzle spacing in inches, divided by 12.
Band - the number of bands X the bandwidth in inches, divided by 12.*
17. What does the formula for GPA enable you to determine? (page 32, no. 8)
Application rate in gallons per acre.

CALIBRATION - examples are covered in a separate handout.

X. Pests and Pest Damage

Pest and Pest Damage - Introduction and Insect Pests

- 8-1. What is the first step in managing a pest problem? (page 39, paragraph 1)
Pest identification; knowledge of the pest and its damage
- 8-2. What is the difference between an insect that undergoes NO metamorphosis (like silverfish) and an insect that undergoes COMPLETE metamorphosis (like butterflies)? (page 40, paragraphs 4 & 5)
Insects without metamorphosis do not change form as they mature; they only increase in size. Insects with complete metamorphosis change form from immature to adult stages, with considerable difference in appearance, as well as habitat and food preferences in many cases.
- 8-3. What do all adult insects have in common? (pages 40, paragraph 6) - Name six examples of types of insects:
*Three pairs of jointed legs and three body regions (head, thorax, abdomen)
Grasshoppers, lice, beetles, fleas, butterflies, and silverfish - and many more !*
- 8-4. What differences exist between insects and the group that includes mites, ticks and spiders? (page 41, paragraph 2)
Mites, ticks and spiders have eight legs, only two body regions and are wingless while insects have six legs, three body regions and are usually winged (some may be wingless).
- 8-5. Into what categories are insects grouped, according to their impact on humans? What proportion of all insects does each category contain? (page 41, paragraphs 4, 5, & 6).
Insects with no detrimental or beneficial impact - about 90 percent; beneficial insects - about 7 percent; and economically important or destructive insects - about 3 percent.
- 8-6. Natural processes control **more than 99 percent** of potential damage caused by insects (page 41, paragraphs 8).
- 8-7. Give examples of natural factors and artificial techniques that control insect pests. (page 41-42, paragraphs 8-9 & 1-5)
*Natural: climate, physical barriers/dominant competitors. predators/parasites, diseases
Artificial: mechanical/physical, cultural, biological, legal, genetic, chemical*
- 8-8. Among insects, what are key pests, occasional pests and secondary pests? (page 42, paragraphs 6-7)
*Key pests: cause constant economic loss almost annually.
Occasional pests: infrequently cause economic losses, generally under certain weather or cropping conditions.
Secondary pests: occasional pests or non-pests which cause economic losses due to human disruption.*

- 8-9. Define 'economic threshold'. (page 42, paragraph 8) (page 43, paragraph 1 - note this may apply to both plants and animals.)
A point in the development of a pest population or the damage level caused by a pest which warrants application of a control measure; the largest number of insects or amount of damage that can be tolerated before economic injury occurs.
- 8-10. The economic threshold for greenbug (a sorghum aphid) depends on what two factors? (page 43, paragraph 4).
The economic threshold for greenbug depends on plant size and maturity.
- 8-11. The private applicator must decide what is the pest, if or when to treat and finally, what? (page 44, paragraph 2)
Determine which combination of control methods will be most effective and return the greatest profit.

Plant Disease Control

- 9-1. Without the aid of a microscope, how can plant diseases be recognized? (page 46, paragraph 1) - Name three factors required for infection to occur.
From the symptoms that appear in the field, such as leafspots, blights, wilts and sudden plant death.
 1) *susceptible host*
 2) *presence of the organism*
 3) *favorable environment*
- 9-2. What plant disease symptoms are indicative of blight? (page 46, paragraph 4)
Rapid discoloration and death of tissue over certain portions of the plant, usually resulting in death of leaves, flowers and stems.
- 9-3. Why are protectant fungicides used to prevent fruit rots? (page 46, paragraphs 5 to pg. 47, para.1)
Fruit infected with a rot fungus is not edible, so initial infection must be prevented. Fungicides prevent spore germination and stop the infection process if it is applied evenly on the foliar surface. For example brown rot of peaches is caused by a fungus and is controlled by applying preventive fungicides.
- 9-4. What is the difference between powdery mildew and downy mildew? (page 47, paragraph 1)
Mildews are caused by fungi that infect cells on the leaf surface. Powdery mildew is seen on ornamentals and vegetables, plants lose vigor and may die. Downy mildew attacks squash, cantaloupe, and cucumbers and also corn and sorghum where infected leaves become stripped in appearance and may become sterile.
- 9-5. What are nematodes? What potential harm can they cause to plants? (page 47, paragraph 3)
Nematodes are microscopic roundworms that live in soil. Certain types are parasitic and feed on living plants, causing stunted, uneven growth and chlorotic foliage.
- 9-6. Besides chemical control, what methods may be used to prevent plant disease from occurring? (page 47, paragraph 6)
Cultural practices such as crop rotation; planting disease-resistant varieties; certain land

preparation practices.

Weed Control

- 10-1. Describe the life cycles of annual, biennial and perennial weeds - Give examples of each. (page 50, all)
Annuals: 1-year life cycle - winter varieties germinate in the fall (henbit, sowthistle); summer varieties germinate in the spring (goosegrass, barnyardgrass)
Biennials: 2-year life cycle -form basal leaves and tap root the first year., flowers, matures and dies the second year (common mullein).
Perennials: live for many years - divided into simple (dandelion) and creeping varieties (purple nutsedge).
- 10-2. List 4 weed control methods and give examples of each. (page 51, paragraphs 1-4)
Biological: flea beetles other insects or diseases
Mechanical: hoeing, mowing, cultivating, tilling
Cultural: crop rotation, competition, good management
Chemical: cautious herbicide treatment
--- READ and FOLLOW ALL LABEL DIRECTIONS ---
- 10-3. How do seedling grass plants and seedling broadleaf weeds differ in the location of their growing point? (page 51, paragraphs 5-6)
The growing point of a seedling grass plant is below the soil surface, where it is more difficult to control, while the growing points of a broadleaf weed is exposed at the top of the young plant and at the nodes.
- 10-4. What kind of underground structure is found on purple nutsedge and wild onion? (page 51, paragraph 7)
A tuber or bulb that is capable of sending up new growth.
- 10-5. Many perennial weeds have buds on creeping roots, rhizomes or stolons. What is necessary for a herbicide to be effective on these weeds? (page 51, paragraph 5-6)
To be effective, herbicides must translocate into the below ground parts.
- 10-6. What variation occurs in the effectiveness of herbicide for control of annual weeds during the seedling, vegetative, flowering and mature stages of growth? (page 51, paragraph 8-11)
Herbicides are almost 100 percent effective at the seedling stage, 75 percent effective at the vegetative stage, less than 40 percent effective at the flowering stage, and least effective at the mature stage.
- 10-7. In general, during which stage of growth should herbicides be applied for the best control of perennial weeds? (page 52, paragraph 2)
During the bud stage, unless the product is labeled differently. (This is important - be sure to read the label)
- 10-8. What is the benefit of adding a surfactant to a foliar spray mix? (page 52, paragraph 3-4)
A surfactant reduces surface tension of the water droplet and allows the water to spread over the leaf surface. The surfactant increases the spread of the spray, particularly on leaves with hair

or thick cuticle and wax.

- 10-9. What type of pesticide is used to control vegetation (plants)? (page 52, paragraph 2,3 & 5)
Herbicides
- 10-10. What type of soil will herbicides move through most easily? (page 52, paragraph 6)
Sandy soil
- 10-11. When using soil-applied herbicides, why is a higher rate needed on soil that is heavy in clay and organic matter? (page 52, paragraph 6-7)
The herbicide tends to bind with clay and organic matter, making less of the herbicide available for weed control.
- 10-12. What is the effect of temperature and humidity on herbicide effectiveness? (page 53, paragraph 2-3)
Herbicide effectiveness increases as temperature increases and herbicide uptake increases as humidity increases so herbicides are most active when both temperature and humidity are high.

COMMENT: As humidity increases from 0 to 100 percent, more herbicide is **absorbed** by the leaf surface. This is talking about **UPTAKE** (absorption) not activation. (page 53, paragraph 3)

Brush Control

- 11-1. What characteristic of some brush species makes them particularly hard to control? (Page 58, paragraph 2 & 3)
When tops are removed, many woody brush plants have buds that sprout from the top of the root about 4 to 8 inches below the soil surface or they may be root sprouters.
- 11-2. With chemical brush control, what factor should be considered in choosing between broadcast application methods and individual plant treatment? (page 58, paragraph 4)
Plant density - the number of unwanted brush plants per acre. In general, use broadcast methods only on areas with at least 125 plants or more per acre and individual plant treatments when under 125 plants per acre.
- 11-3. How can physical spray drift from the target area be reduced during herbicide application on grasslands or croplands? (page 59, paragraph 2)
By spraying when wind speed is 5 mph or less and temperatures are under 95 degrees F. (This manual says 5 mph while others may say 10 mph - always check the herbicide label for precautions to follow when spraying to reduce drift.)

Aquatic Vegetation Control

- 12-1. List and describe the four types of aquatic plants. (page 61, paragraph 2)
- 1) Emersed: grow up out of the water or along the water's edge (cattails, bulrushes)*
 - 2) Submersed. grow mainly under the water (bushy pond-weeds, coontail, milfoil)*
 - 3) Floating: most of the plant or leaves rest on the water's surface (water hyacinth & waterlilies)*
 - 4) Algaes: plants without true stems, leaves or vascular systems (phytoplankton, muskgrass)*

- 12-2. What is the most important factor in controlling or preventing aquatic weeds in ponds? (page 62, paragraph 1)
Proper design and construction of the ponds, including adequate slope.
- 12-3. When would a granular herbicide formulation be used for aquatic weed control? (page 62, paragraph 5)
For spot treatments, when it's necessary to reach the root of the plant and build up a herbicide concentration in a localized area.
- 12-4. When calculating chemical treatment for aquatic weed control, what is the difference in treating submersed weeds rather than floating and shoreline vegetation? (page 62, paragraphs 6-7)
For submersed weeds, calculation is based on the total water volume in acre feet (one acre of water one foot deep for each foot of depth). The other treatments use a per acre (surface acre) basis.
- 12-5. How can you, the applicator, prevent contamination of water intended for other uses after the water leaves the treated area, when an aquatic pesticide is used? (page 63, paragraphs 1 & 2)
READ and FOLLOW all label instructions, check for specific use restrictions regarding water treatment and use.

Wildlife Damage Control

- 13-1. What is the objective of wildlife damage control? (page 65, paragraph 1)
To prevent or reduce conflicts caused by the presence of wildlife, NOT to destroy wildlife.
- 13-2. Before beginning any wildlife damage control program, what should you do? (page 66, paragraph 2)
Check on the legal status of the target animal and current laws dealing with wildlife protection.
- 13-3. Give an example of a fish that may cause problems at certain times but is also a protected game fish. (page 66, paragraph 7)
Largemouth black bass.
- 13-4. Give examples of nonchemical methods that could be used to control fish. (page 66, paragraph 7)
Draining ponds and using physical barriers, such as traps, nets and dams.
- 13-5. What is a nutria? (page 66, paragraph 8)
A large rodent that can be a valuable fur resource. It also has denning habits that can damage levies and dams.
- 13-6. What is the first step in solving a wildlife damage problem? (page 67, paragraph 2)
Identify the species causing the problem
- 13-7. What physical evidence contributes to proper identification of wildlife species? (page 67, paragraph 5) What would you look for if you suspected roof rats? (page 67, paragraph 5)
Tracks, fecal material or scats, rubs, hair, tooth marks, feathers, etc.

Roof rats are indicated by dark crescent-shaped markings near the rafters.

- 13-8. What constitutes environmental control of wildlife? (page 68, paragraph 1)
Altering environmental sources of food, cover, water or space so an area becomes inhospitable to the target pest. This could be as simple as building proper fences.

Feral Hogs: In areas with major problems with feral hogs, you may want to check out the video “**Feral Hogs in Texas: The Good, the Bad, and the Ugly**” 16 minutes available from the Extension A-V Library as VHS-2373.

- 13-9. If an animal population must be reduced, what factors should be considered in choosing the control method? (page 71, paragraph 1)
*The pesticide applicator must know an animal’s behavior and feeding habits.
The method chosen is determined by its legality, efficiency, economy and ability to affect only target animals.*
- 13-10. When should carcasses of target animals be collected and destroyed? (page 72, paragraph 2)
When the pesticide used poses a secondary poisoning hazard to other animals.

Photo ID: Note that there are photos of pest damage or pests on pages 55, 56, 64, 73, and 74. This represents an extremely small sample of all of the possible pests that you may encounter but certain photos will be selected from this group for you to identify on the Exam. For each question a photo will be shown with 4 possible answers so it should be fairly easy if reviewed carefully before going into the Exam. Not all photos will be used.

Remember the continuing education requirements for license renewal:

15 hours every **5** years,
with 2 in laws and regulations and **2** in IPM.

Complete paperwork (Extension form D-1411 or TDA form Q565C)
You will need this to take your Exam and apply for your license.