KNOWLEDGE EXPECTATIONS FOR PEST CONTROL ADVISERS:
WEED CONTROL

I. WEED ID

1. Recognize the major plant characteristics used to identify weeds. Define and locate:
   a. cotyledons;
   b. first true leaf;
   c. collar;
   d. leaf blade;
   e. node;
   f. internode;
   g. leaf sheath;
   h. petiole;
   i. auricle;
   j. ligule;
   k. awn;
   l. hypocotyl;
   m. inflorescence;
   n. coleoptile;
   o. tuber;
   p. rhizome;
   q. stolon.

2. Recognize the key features used to identify:
   a. grass seedlings;
   b. broadleaf seedlings.

3. Identify 50 common weed species or genera in mature stages of development by common name, see list on pages 8 & 9.

4. Identify 25 common weed species or genera in seedling stage by common name, see list on pages 9 & 10.

5. Classify the 50 common weed species in #3 above as generally a(n):
   a. annual (summer or winter);
   b. perennial;
   c. biennial;
   d. dicot;
   e. monocot.

6. Recognize that the following weeds are poisonous to animals:
   a. jimsonweed;
   b. nightshades;
   c. common groundsel;
   d. coast fiddleneck;
   e. yellow starthistle.

7. Know that the California Department of Food and Agriculture is the best source to find information about ‘A’ rated weeds in California (www.cdfa.ca.gov/phpps/ipc/weedinfo/winfo_list-pestrating.htm).

8. Identify types of vegetative propagules.
9. Recognize unique seed or vegetative growth structures that plants have which aid in dispersal and provide examples of weeds which have them:
   a. plants with burs or spiked seeds that catch in animal fur (filaree, puncturevine, wild oat, foxtail barley, hare barley)
   b. plants that disperse their seed with tumbling plant parts (Russian thistle);
   c. plants with seed that are pappus-bearing for dispersal by wind (hairy fleabane, common groundsel, cattails);
   d. plants which spread with vegetative propagules (Johnsongrass, yellow nutsedge, field bindweed);
   e. plants that produce prolific small seed (purslane, pigweed, smallflower umbrella sedge).

10. List information that should be taken when collecting weed samples.
11. Describe how to take and prepare a weed sample to assure correct identification.
12. List resources to assist in weed identification.

II. WEED BIOLOGY
   1. Describe the function of the following plant parts:
      a. xylem (apoplast);
      b. phloem (symplast);
      c. chloroplast;
      d. membranes;
      e. endodermis;
      f. epidermis;
      g. cuticle;
      h. apical meristem;
      i. root hairs;
      j. root tip (meristem);
      k. stomata.

A. Germination requirements
   1. Describe the conditions necessary for weed seeds to germinate.
   2. Compare how differing weed germination requirements affect management decisions.
   3. Define seed dormancy.
   4. Differentiate between primary and secondary dormancy.
   5. Describe some factors that regulate or break seed dormancy:
      a. scarification/penetration of the hard seed coat;
      b. chemical inhibition;
      c. temperature.
   6. Describe the effect of seed size on dormancy and the depth from which a weed seed can successfully germinate.
B. Life cycles and growth habits
1. Define:
   a. annual;
   b. perennial;
   c. biennial;
   d. summer annual;
   e. winter annual;
   f. dicot;
   g. monocot.

C. Growth rates/competition
1. Describe the influence of:
   a. seasonal changes on the weed spectrum;
   b. weed growth on water and nutrient availability to the crop.
2. Recognize the importance of light and space in plant growth and development.

D. Reproduction
1. Describe the reproductive capability of weeds.
2. Describe the mechanisms by which weed seeds are disseminated.
3. Describe how the following factors contribute to regulating the seed bank and seed longevity:
   a. biotic factors of the environment, such as natural decay;
   b. loss of seed viability;
   c. production practices, such as applications of preemergence herbicides;
   d. cultural practices.
4. Describe how different types of vegetative propagules spread.

III. WEED MANAGEMENT
A. Using sampling and recordkeeping in weed management decisions
1. Describe how to map a field in relationship to weed management considerations.
2. List information necessary to document a field’s weed history.
3. Identify methods and patterns for sampling weeds (IPM in Practice chapter 6);
   a. absolute vs. relative sampling;
   b. random, systematic and stratified sampling patterns.
4. Identify essential times during which monitoring should be done.

B. Biological Control Methods
1. Define biological control.
2. Describe examples of biological weed control.
3. Describe instances when nontarget plants were affected by weed biological control.
4. Know that the county agricultural commissioner may be involved with biological control of weeds.
5. Describe and give an example of biological weed control using:
   a. arthropods;
   b. pathogens;
   c. grazing animals.
5. Identify the factors that would limit the use of biological control for weeds.

C. Crop Culture
1. Describe the impact of the following practices on weeds:
   a. seedbed preparation;
   b. irrigation method;
   c. irrigation timing;
   d. time of seeding;
   e. soil nutrition;
   f. seed/plant spacing;
   g. crop variety;
   h. crop rotation;
   i. pre-irrigation; [irrigating before planting a crop so that weed seeds germinate and seedlings are controlled]
   j. synthetic mulches;
   k. organic mulches;
   l. sanitation methods.

D. Mechanical/Physical Controls
1. List and describe common cultivation/tillage methods.
2. Describe how weeds (seed germination/vegetative propagation/spread) are affected by:
   a. depth of tillage;
   b. timing of tillage;
   c. no-tillage.
3. Describe cultivation techniques used in perennial crops.
4. Compare the advantages/disadvantages of different cultivation methods.
5. Identify the proper timing for cultivation and hand weeding.
6. Describe the use of the following methods for weed control:
   a. burning;
   b. flaming;
   c. steaming;
   d. solarization.
8. Describe how control measures using heat affect weed and crop growth.
9. Describe some preventative measures that can be used to manage weeds (certified seed, quarantines, clean equipment).
10. Know that cultivation and burning may harm native bees.
E. Chemical Control Methods

1. List the various methods used to classify herbicides.
2. Define mode of action and the results of using an herbicide with a given mode of action.
3. List the mode of action for the following herbicide types and recognize these common herbicides:
   a. amides (propanil);
   b. bipyridiliums (paraquat, diquat);
   c. dinitroanilines (trifluralin, pendimethalin);
   d. diphenylethers (oxyfluorfen);
   e. glycine (glyphosate);
   f. phenoxy carboxylic acids (auxinic herbicides, 2,4-D);
   g. phosphinic acid (glufosinate);
   h. sulfonyleureas (chlorsulfuron, rimsulfuron);
   i. thiocarbamates (EPTC, thiobencarb);
   j. triazines (atrazine, simazine);
   k. ureas (linuron, diuron).

4. Define:
   a. phytotoxicity;
   b. preemergence herbicide;
   c. preplant incorporated herbicide;
   d. postemergence herbicide;
   e. adjuvant;
   f. herbicide resistance;
   g. cross-resistance;
   h. multiple resistance;
   i. soil persistence;
   j. plantback restrictions.

5. Describe factors that can cause herbicide injury symptoms on a crop.


7. Describe how the following factors affect preemergence and preplant soil incorporated herbicide activity:
   a. incorporation depth;
   b. herbicide rate;
   c. soil type and amount of organic matter;
   d. irrigation type and amount;
   e. irrigation/rainfall timing.

8. Describe how the following factors affect postemergence herbicide activity:
   a. plant size and vigor;
   b. plant growth stage;
   c. temperature;
   d. soil moisture and type;
   e. time of day;
   f. wind;
   g. rainfall;
h. overhead irrigation.


10. Describe ways:
   a. herbicides are taken into the plant;
   b. some herbicides move within the plant.

11. List the common formulations of herbicides and their properties.

12. List reasons for adding an adjuvant to an herbicide formulation.

13. Describe how soil microbes may enhance degradation of herbicides.


15. Describe how knowledge of the herbicide mode of action/group number aids in resistance management.

16. Differentiate between herbicide tolerance and herbicide resistance in weeds.

17. Describe methods used to prevent and manage herbicide resistance.

18. Describe the importance of crop rotation in managing herbicide resistance.

19. Describe how the following conditions increase persistence/availability of most herbicides in the soil:
   a. cool weather;
   b. dry soil;
   c. low organic matter.

20. Describe how the following factors affect herbicide movement in the soil (including offsite movement away from the application area):
   a. herbicide solubility;
   b. soil texture;
   c. organic matter;
   d. time to next irrigation or rainfall event.

22. Define pesticide drift and describe some of the harmful consequences.

23. Describe methods to manage pesticide drift.

24. Define the following chemical application methods and identify situations when they are used:
   a. chemigation;
   b. wick/wiper;
   c. incorporation;
   d. banded;
   e. broadcast;
   f. directed;
   g. shielded;
   h. layby.

F. Economic Evaluation of Weed Management Actions

1. List the economic factors to be considered in a weed management program.

2. Describe how the cost of weed management can be compared with the benefit of management.
G. Environmental Considerations
1. Identify the factors that contribute to herbicide leaching to groundwater.
2. Describe what a ground water protection area (GWPA) is and how it relates to herbicide use and water quality. [www.cdpr.ca.gov]
3. List factors that affect the behavior of herbicides in the soil and the environment.
4. Describe the impact of the following factors on drift:
   a. weather (wind, fog, temperature);
   b. temperature inversion
   c. spray pressure;
   d. droplet size.
5. Describe what volatile organic compounds (VOCs) are and how they relate to herbicide use and air quality. [DPR’s Reducing VOC Emissions from Agricultural Pesticide Applications]
6. Know that control of flowering weeds removes a food source for wild bees.

H. Integrated Weed Management
1. Define integrated weed management.
2. Describe how the following practices can be used in integrated weed management:
   a. field selection;
   b. crop rotation;
   c. use of cover crops and green manures;
   d. land and seedbed preparation;
   e. irrigation and fertilization management;
   f. mechanical control;
   g. sanitation;
   h. weed identification;
   i. herbicide selection.
3. Describe the benefits of an integrated weed management approach.
### Lists of Mature and Seedling Weeds from Page 1

#### I. WEED ID

3. Identify these 50 common weed species or genera in **mature stages** of development by common name:

**Broadleaves**

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amaranthaceae</td>
<td>Redroot pigweed</td>
<td><em>Amaranthus retroflexus</em></td>
</tr>
<tr>
<td>Asteraceae</td>
<td>Yellow starthistle</td>
<td><em>Centaurea solstitialis</em></td>
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<td></td>
<td>Hairy fleabane</td>
<td><em>Conyza bonariensis</em></td>
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<tr>
<td></td>
<td>Horseweed</td>
<td><em>Conyza canadensis</em></td>
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<tr>
<td></td>
<td>Prickly lettuce</td>
<td><em>Lactuca serriola</em></td>
</tr>
<tr>
<td></td>
<td>Common groundsel</td>
<td><em>Senecio vulgaris</em></td>
</tr>
<tr>
<td></td>
<td>Annual sowthistle</td>
<td><em>Sonchus oleraceus</em></td>
</tr>
<tr>
<td>Boraginaceae</td>
<td>Coast fiddleneck</td>
<td><em>Amsinckia menziesii</em> var. intermedia</td>
</tr>
<tr>
<td>Brassicaceae</td>
<td>Black mustard</td>
<td><em>Brassica nigra</em></td>
</tr>
<tr>
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<td>Shepherd’s-purse</td>
<td><em>Capsella bursa-pastoris</em></td>
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<tr>
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<td>London rocket</td>
<td><em>Sisymbrium irio</em></td>
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<td><em>Stellaria media</em></td>
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<tr>
<td>Chenopodiaceae</td>
<td>Common lambsquarters</td>
<td><em>Chenopodium album</em></td>
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<tr>
<td></td>
<td>Russian thistle</td>
<td><em>Salsola tragus</em></td>
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<tr>
<td>Convolvulaceae</td>
<td>Field bindweed</td>
<td><em>Convulvulus arvensis</em></td>
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<tr>
<td></td>
<td>Morningglories</td>
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<tr>
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<td>Spotted spurge</td>
<td><em>Euphorbia maculata</em></td>
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<tr>
<td>Fabaceae</td>
<td>Black medic</td>
<td><em>Medicago lupulina</em></td>
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<tr>
<td>Geraniaceae</td>
<td>Filaree</td>
<td><em>Erodium</em> spp.</td>
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<tr>
<td>Lamiaceae</td>
<td>Henbit</td>
<td><em>Lamium amplexicaule</em></td>
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<tr>
<td>Malvaceae</td>
<td>Velvetleaf</td>
<td><em>Abutilon theophrasti</em></td>
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<td></td>
<td>Mallow</td>
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<tr>
<td>Oxalidaceae</td>
<td>Bermuda buttercup (Buttercup oxalis)</td>
<td><em>Oxalis pes-caprae</em></td>
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<td>Polygonaceae</td>
<td>Common knotweed</td>
<td><em>Polygonum arenastrum</em></td>
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<td>Portulacaceae</td>
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<td><em>Portulaca olearcea</em></td>
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<tr>
<td>Solanaceae</td>
<td>Jimsonweed</td>
<td><em>Datura stramonium</em></td>
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<td></td>
<td>Groundcherries</td>
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<td></td>
<td>Nightshades</td>
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<tr>
<td>Typhaceae</td>
<td>Cattails</td>
<td><em>Typha</em> spp.</td>
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<td>Nettles</td>
<td><em>Urtica</em> spp.</td>
</tr>
<tr>
<td>Zygophyllaceae</td>
<td>Puncturevine</td>
<td><em>Tribulus terrestris</em></td>
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<tr>
<th>Family</th>
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<tr>
<td>Poaceae</td>
<td>Wild oat</td>
<td><em>Avena fatua</em></td>
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<td><em>Digitaria sanguinalis</em></td>
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<tr>
<td></td>
<td>Junglerice</td>
<td><em>Echinochloa colona</em></td>
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<tr>
<td></td>
<td>Barnyardgrass</td>
<td><em>Echinochloa crus-galli</em></td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>Foxtail barley</td>
<td><em>Hordeum jubatum</em></td>
</tr>
<tr>
<td></td>
<td>Hare barley</td>
<td><em>Hordeum murinum ssp. leporinum</em></td>
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<td></td>
<td>Sprangletops</td>
<td><em>Leptochloa spp.</em></td>
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<td></td>
<td>Italian ryegrass</td>
<td><em>Lolium multiflorum</em></td>
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<td></td>
<td>Witchgrass</td>
<td><em>Panicum capillare</em></td>
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<td></td>
<td>Dallisgrass</td>
<td><em>Paspalum dilatatum</em></td>
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<td></td>
<td>Canarygrass</td>
<td><em>Phalaris canariensis</em></td>
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<td>Annual bluegrass</td>
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<td></td>
<td>Yellow foxtail</td>
<td><em>Setaria pumila</em></td>
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<td>Johnsongrass</td>
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<td>Purple nutsedge</td>
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4. Identify 25 common weed species or genera in seedling stage by common name:

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