1. Define germination as per AOSA Rules for Testing Seeds.
2. What percentage of a single species in a mixture allows you to test only 200 seeds for the germination test?
3. Describe four instances when you would retest a sample as per AOSA Rules for Testing Seeds.
4. When reporting results of a germination test, how many decimals shall be used?
5. Select three species with special procedures and alternate methods for germination and briefly describe the special procedure for each.

c.

1. How wet should substratum be?
2. What does "moisture on the dry side" mean in reference to wetting substratum?
3. List three procedures that promote germination of dormant seed.

a.

b.

c.

1. Define hard seed and briefly describe how their presence is reported at the end of a germination test.
2. Define the following substrata.

P=

B=

TB=

C=

S=

TCS=

OT=

A=

RB=

1. Outline the prechill procedure for tree and shrub seeds, as per AOSA rules.
2. What is the recommended illumination for dormant seed *(please report in foot candles or lux)* and how many

hours per day should the seed be exposed to light?

1. The use of ethylene gas for testing peanut seed requires that what occurs for the first 5 days *(time until first*

*count)* of testing?

1. From what source is the seed for a germination test obtained when only a germination test is required?
2. What are the principles of the garden pea conductivity test?
3. Briefly describe how a non-representative sample can affect the germ results.
4. The following formula may be used as a guide in the preparation of sand for germination tests:

***118.29 cc (1gill) sand x 20.2 - 8.0 = the number of mls of water added to its weight in grams each 100 grams of air-dried sand***

If a gill of sand weighs 177.9 grams, how much water would you need to add to 300 grams of air-dried sand? *(Please show your work.)*

1. List five crops used to test for toxicity in substrata.

a.

b.

c.

d.

e.

1. During germination evaluation, how are multiple seed units, such as beets, handled?
2. Define epigeal and hypogeal.
3. Name the three essential factors necessary for germination to occur.

a.

b.

c.

1. Describe the appearance of the abnormalities occurring for each of the following:

Mineral deficiencies in soil

Frost damage

Heating

Mechanical damage

Insect damage

Chemical treatment

Pathogenic infections

1. How are seedlings with secondary infection classified at the end of the germination test?
2. Name three abnormalities common to all dicotyledonous seedlings.

a.

b.

c.

1. In general, what are the six structures considered to be essential in a seedling?

a.

b.

c.

d.

e.

f.

1. Briefly describe the special procedures and alternate methods for germination in crownvetch.
2. When should sand, organic growing media, and/or soil tests be considered a guide for evaluating seedlings?
3. You have received a sample of seed, and have noted a heavy fungal infection on the first count. At what interval

shall you now count/evaluate this sample between the first and final count?

1. Table 6A, Methods of Testing for Laboratory Germination, has a column labeled "specific requirements and

notes". Name four recommendations that appear in this column and describe their function.

a.

b.

c.

d.

1. How do you obtain a germination sample, when only germination is required and the pure seeds portion is less than 98% pure?
2. Define a pure seed unit.
3. Describe how seed moisture could affect germination results.
4. Describe the two ways in which a submitted sample may be divided into a working sample.

a.

b.

1. What abnormalities should you watch for in counting tests of the following kinds of seed?
2. Radish:
3. Watermelon:
4. Corn:
5. Sweet Clover:
6. Onion:
7. Red Clover:
8. Give special testing procedures for the following:
9. Alyceclover
10. Bahiagrass
11. Beets
12. Bufflegrass
13. Cotton
14. Endive
15. Lettuce
16. Rice
17. You have just finished a germination test, and the results from the four 100-seed replicates are as follows: 92, 88, 74, and 86. Determine if the replicates within this test are within tolerance of each other. *(Please show your work.)*
18. A sample of beans has been received by your laboratory labeled with a 94% germination. You test the sample and find the germination to be 82%. Are these two tests within tolerance of each other? *(Please show your work.)*
19. You have received a sample of seed in your laboratory for germination only. It looks to contain approximately 96% pure seed. Explain how you would prepare this sample for germination testing.
20. At the end of a germination test, if all the component values are rounded down and the total is less than 100% how should the percentage(s) be adjusted?
21. Briefly describe what you would do if you found several seedlings that had been infected by a neighboring seed at a final germination count.
22. Explain the difference between monocots and dicots.
23. List if the following species are monocots or dicots:

Species Monocots/Dicots

|  |  |
| --- | --- |
| Allium cepa |  |
| Asparagus officinalis |  |
| Avena sativa |  |
| Bromus inermis subsp. Inermis |  |
| Cyperus esculentus |  |
| Dactylis glomerata |  |
| Fagopyrum esculentum |  |
| Festuca rubra |  |
| Glycine max |  |
| Gossypium hirsutum |  |
| Helianthus annuus |  |
| Lactuca sativa |  |
| Linum usitatissimum |  |
| Lolium perenne |  |
| Medicago sativa |  |
| Ricinus communis |  |
| Setaria faberi |  |
| Solanum lycopersicum var. lycopersicum |  |
| Spinacia oleracea |  |
| Zea mays |  |

1. When both purity and germination tests are required, seed for the germination test can be taken from which two sources?

1. When only a germination test is required, seed for the germination test can be taken from which two sources?

1. You are given a sample estimated to be less than 98% pure seed. If only a germination test is required, how do you obtain a representative portion for your seed source?
2. A germination test is conducted on Gossypium spp. At the end of the germination period, there are swollen

seeds present. How should you proceed with the test?

1. Explain the difference between dead, dormant and swollen seeds.
2. List four methods to break dormancy.

a.

b.

c.

d.

1. Explain the difference between primary, secondary and adventitious roots.
2. What is the formula to determine pure live seed?
3. Circle the letter(s) of the information that **must** be listed on the label of a bag of seed:
4. Normal 80%
5. Abnormal 15%
6. Dead 1%
7. Hard 4%
8. A germinating seedling that has been seriously damaged by fungi from any source other than the specific seed shall be considered \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if it is determined that as essential structures are present.
9. The AOSA rules specify that we should plant at least \_\_\_\_\_\_\_\_\_ number if seeds in conducting a germination

test. In mixtures, 200 seeds of those kinds present to the extent of \_\_\_\_\_\_\_\_\_ % or less may be used.

1. Seeds for germination should be taken from the \_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_ component of the purity

analysis; OR indiscriminately from a representative portion divided from the bulk if the \_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_ *(same two words)* is determined or estimated to be at least \_\_\_\_\_\_\_\_\_\_\_ % of the sample.

1. You are requested to test soybean and barley. The AOSA Rules for Testing Seed, Table 6A., Methods for testing for laboratory germination, provides the information below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Substrata** | **Temperature °C** | **First Count Days** | **Final Count Days** | **Specific Requirements and Notes** |
| *Glycine max* **soybean** | B,T,S,TC,TCS | 20-30;25 | 5 | 8 | Hard seeds: see sec. 6.2d and 6.9m(6) |
| *Hordeum vulgare subsp. Vulgare* **Barley** | B,T,S | 20,15 | 4 | 7 | Dormant seed: Prechill 5 days at 5 seg. C. or  10 °C or predry (refer to sec. 6.2) |

1. When testing soybeans, your options of media are: *(please spell out names)*

B \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ T \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TC \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ TSC \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. When testing soybeans under alternate temperatures, how many hours should the temperature remain at

20 °C \_\_\_\_\_\_\_\_\_\_\_\_\_\_? How many hours at 30 °C \_\_\_\_\_\_\_\_\_\_\_\_\_?

If you provide light, it should be on when the temperature is \_\_\_\_\_\_\_\_ °C

1. If a customer submits a sample of freshly harvested barley, and it is planted on the same day it arrives in the lab, when can he/she expect to know the germination percentage of the submitted sample\_\_\_\_\_\_\_\_\_\_\_ Days.
2. Methods of Testing *(reference: table above from AOSA Rules)*

List the scientific name and all testing information

1. Common name: **Barley**
2. Scientific name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Substrata: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Temperature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. First count: \_\_\_\_\_\_\_\_\_\_\_\_

6. Running a germ test with a pre-chill period would make the total number of days tested:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_days (*assume normal first count*)

1. Methods of Testing *(reference: table above from AOSA Rules)*

List the scientific name and all testing information

1. Common name: **Soybean**
2. Scientific name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Substrata: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Temperature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Final count: \_\_\_\_\_\_\_\_\_\_\_\_
6. How many days can swollen soybean seed be extended?\_\_\_\_\_\_\_\_\_\_\_\_
7. For the listed alternating temperatures, what temperature coincides with light?\_\_\_\_\_\_\_\_\_\_\_
8. How many hours are without light?\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. How many normal seedlings have to grow from a multiple unit of multiple floret for the analyst to consider that it has germinated? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
10. The pure seed components of a prairie grass mixture are 85% Little Bluestem; 12% Big Bluestem*.* How many

seeds of each component are you required to test?

Little Bluestem\_\_\_\_\_\_\_\_\_\_\_\_Big Bluestem \_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate if the replicates are in tolerance?

Normal 99 89 88 79 Average: \_\_\_\_\_\_\_\_\_\_\_\_

Abnormal 1 11 10 14 Tolerance: \_\_\_\_\_\_\_\_\_\_\_\_\_

Dead 0 0 2 7 Difference: \_\_\_\_\_\_\_\_\_\_\_\_\_

In tolerance? \_\_\_\_\_\_\_\_\_\_\_

Normal 84 86 92 98 Average: \_\_\_\_\_\_\_\_\_\_\_\_\_

Abnormal 13 11 5 0 Tolerance: \_\_\_\_\_\_\_\_\_\_\_\_\_

Dead 3 3 3 2 Difference: \_\_\_\_\_\_\_\_\_\_\_\_\_

In tolerance? \_\_\_\_\_\_\_\_\_\_\_\_

1. Calculate if the tests are within tolerance. Original test: 91% Second test: 82%

Average: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Tolerance: \_\_\_\_\_\_\_\_\_\_\_\_\_

Difference: \_\_\_\_\_\_\_\_\_\_\_\_\_

In tolerance? \_\_\_\_\_\_\_\_\_\_\_\_

1. Briefly explain paired testing and when should it be used for testing seeds.

1. Draw a graph showing the three phases of water uptake and briefly explain each phase and how it affects seed germination.

1. An analyst is evaluating *Phaseolus vulgaris* at 8 days and they notice all the seedlings are very stunted, what

could of caused this to happen and why? Should the sample be replanted?

1. There are swollen seeds, at the end of the prescribed testing period, that belong in the Convolvulaceae, Geraniaceae, Malvacaeae and Fabaceae families what should the analyst do?

1. Briefly explain quiescent seeds and how they affect germination.
2. According to the AOSA Rules the required temperature for a species is 20-30C.
   1. What duration of time during a 24 hour period should each temperature be used?

b. If light is required, during which portion of the 24 – hour cycle should the seed be illuminated?

1. How long does the root have to be in Kentucky bluegrass to be classified as normal?
2. Mark the following N – normal or AB – abnormal

a. Onion – a defined bend or “knee”\_\_\_\_\_\_\_\_\_

b. Garden bean – epicotyl missing \_\_\_\_\_\_\_\_\_

c. Sweetcorn – leaf extending less than halfway up the coleoptile \_\_\_\_\_\_\_\_\_

d. Alfalfa – root trapped in seed coat \_\_\_\_\_\_\_\_\_

e. Soybeans – more than 50% of total cotyledon tissue decayed \_\_\_\_\_\_\_\_\_

f. Beets – seedlings separated from the cluster \_\_\_\_\_\_\_\_\_

1. What is the difference between exogenous and endogenous dormancy?
2. Explain the difference between primary and secondary dormancy.
3. How does chemical injury/seed treatment and mechanical damage differ when determining the cause of

abnormal seedlings?

1. What are the four classes of non-germinated seeds that may be observed at the end of a germination test?

Also, write the definition of each of the four classes.

a.

b.

c.

d.

1. You are evaluating a crop from the Poaceae family and you notice grainy coleoptiles, spirally twisted leaves as well as decay at the point of attachment to the scutellum, what type of damage are you seeing?
2. What causes negative geotropism in seedlings?
3. What are the two primary purposes for testing for seed health?

a.

b.

1. Name the two solution concentration of tetrazolium chloride most commonly used for TZ testing.

a.

b.

1. Why was TZ testing developed?
2. List the three steps of tetrazolium testing.

a.

b.

c.

1. During a TZ evaluation, what are the three categories used to estimate vigor.

a.

b.

c.

1. List four advantages of TZ testing.

a.

b.

c.

d.

1. List four disadvantages of TZ testing.

a.

b.

c.

d.

1. In general, what kind of seed tissue stains when exposed to TZ?
2. Name five vigor tests as listed in the AOSA Seed Vigor Testing Handbook.

a.

b.

c.

d.

e.

1. What vigor test(s) is (are) used on cotton?
2. How is vigor testing and germination testing different?
3. Name four crops for which the Accelerated Aging test is suggested, according to the AOSA Seed

Vigor Testing Handbook.

a.

b.

c.

e.

1. Briefly explain the term “hybrid”.
2. Name five pieces of information that must appear on a report of analysis.

a.

b.

c.

d.

e.

1. How much seed must be kept for a reference for interstate shipments?
2. Explain “Truth-in-Labeling” law and why it is important in seed testing.
3. List three main purposes of the Federal Seed Act.

a.

b.

c.

1. The Federal Seed act requires a germination test to be completed within \_\_\_\_\_\_ months, exclusive of the calendar month in which the test was completed, immediately prior to transportation in interstate commerce.
2. The Federal Seed Act requires that all agricultural seed containers be labeled with the following:

a.

b.

c.

d.

f.

g.

h.

i.

j.

k.

l.

m.

n.

o.

p.

1. Explain the difference between the AOSA Rules and ISTA Rules.
2. Briefly explain one way that Canada Methods and Procedures differ from the AOSA Rules for Testing Seeds.

1. What is the basic purpose (or philosophy) of seed laws in the United States?
2. Why is it important that the seed analyst be familiar with the scientific name of any given kind of seed?
3. What does accreditation mean as it pertains to a seed laboratory?
4. What do Standard Operating Procedures outline?
5. The Association of Official Seed Analyst produced the first Rules for Testing Seeds in what year?

1. Over the last decade, how has seed technology changed seed testing?
2. Who is known as the “father of modern taxonomy”?
3. Who is currently the Secretary of Agriculture?
4. Write out the description of each acronym as it relates to seed testing:

AASCO \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AMS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AOSA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AOSCA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

APHIS \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ASTA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CFIA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CSA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CSA-G \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CSA-P \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CSAAC \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CGT \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CPT \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

CVT \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

FSA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

GRIN \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ISTA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

OECD \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

RGT \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

RST \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

RUSSL \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_