1. State one difference between the seeds of monocotyledons and dicotyledons other than the number of seed leaves.

**Monocot has food store as endosperm; Dicot has no endosperm**

1. What is meant by the germination of a seed?

**Growth of seed** or **embryo**

1. State three environmental factors that are necessary for germination.

**Water / suitable temperature / oxygen**

1. Answer the following in relation to an experiment that you carried out to investigate the effect of these factors on germination. (i) What seeds did you use? (ii) Describe how you carried out the experiment; (iii) State the results of your experiment.

**(i) radish; (ii) Set up four petri dishes with a wad of cotton wool in each / Label the dishes A, B, C, D / In dish A, leave the cotton wool dry - seeds lacking water / Wet the cotton wool in each of the other dishes / Place 10 seeds in each dish / Place dish B in the fridge - seeds lacking a suitable temperature / Place dish C in the anaerobic jar, activate and seal - seeds lacking oxygen / Place dishes A, C (in the anaerobic jar) and D, in the incubator at 25 °C / Dish D has seeds with water, oxygen and a suitable temperature / Check the dishes daily for 2 – 3 days / Record the results; (iii) only seeds in D germinate**

1. What is meant by the dormancy of seeds?

**Period of very low metabolism** or **period before germination** or **period during which germination will not occur**

1. Suggest an advantage of dormancy of seeds to a plant.

**To prevent germination in unfavourable conditions** or **has longer period available for dispersal** or **(evolution has guaranteed) optimal germination conditions**

1. What is meant by germination?

**(Resumption of) growth of seed** or **explained**

1. List three factors that are essential for germination.

**Suitable temperature / oxygen / water**

1. In the case of one of the factors that are essential for germination, explain how it affects germination.

Oxygen **– needed to respire or needed for energy;** Water **– needed as medium for reactions or needed as solvent for food store or needed for formation of new tissue or needed for splitting testa or needed for absorbing minerals;** Suitable temperature **– optimal temperature for enzymes**

1. Describe an experiment to demonstrate the factors essential for germination. Include a diagram of the apparatus in your answer.

**Experiment: Diagram - set up four petri dishes with a wad of cotton wool in each / Label the dishes A, B, C, D / In dish A, leave the cotton wool dry - seeds lacking water / Wet the cotton wool in each of the other dishes / Place 10 seeds in each dish / Place dish B in the fridge - seeds lacking a suitable temperature / Place dish C in the anaerobic jar, activate and seal - seeds lacking oxygen / Place dishes A, C (in the anaerobic jar) and D, in the incubator at 25 °C / Dish D has seeds with water, oxygen and a suitable temperature / Check the dishes daily for 2 – 3 days / Record the results; Result: only seeds in D germinate**

1. True or False. Light is essential for the germination of seeds.

**FALSE**

1. What is meant by the germination of a seed?

**Growth / sprouting**

1. State one reason why water is needed for germination

**Chemical (enzyme) reactions / dissolve stored food / swell testa / a condition of germination**

1. Answer the following questions in relation to an experiment that you carried out to investigate the effects of water, oxygen and temperature on germination. (i) Describe how you carried out the experiment (ii) Describe the results of this experiment, including the result of the control.

**(i) Experiment: Set up four petri dishes with a wad of cotton wool in each / Label the dishes A, B, C, D / In dish A, leave the cotton wool dry - seeds lacking water / Wet the cotton wool in each of the other dishes / Place 10 seeds in each dish / Place dish B in the fridge - seeds lacking a suitable temperature / Place dish C in the anaerobic jar, activate and seal - seeds lacking oxygen / Place dishes A, C (in the anaerobic jar) and D, in the incubator at 25 °C / Dish D has seeds with water, oxygen and a suitable temperature / Check the dishes daily for 2 – 3 days / Record the results; (ii) Results: only seeds in D germinate**

1. In the case of starch or skimmed milk agar plates state: 1. An investigation in which you used it, 2. The precise purpose for its use in the investigation that you have indicated.

**1. digestive** or **other enzyme activity; 2. supplies substrate** or **explained** or **nutrient medium**

1. In your practical work you investigated digestive activity during germination. (i) What type of agar did you use in this investigation? (ii) Describe how you carried out the investigation. Refer to a control in your answer. (iii) Describe the results of your investigation.

**(i) Starch or skimmed milk / malt / nutrient; (ii) (Named) seeds / soak seeds / some seeds killed / split seeds / live seeds in one plate / dead seeds (or no seeds) in other plate / identical conditions / number of days / remove seeds / add iodine solution / observe / disinfect seeds; (iii) Agar stays red-brown where live seeds were placed / agar turns blue-black in other plate; N.B. If skimmed milk agar is used then protein digestion is being tested so the Biuret test will be used and the result will be blue for live seeds and purple for dead seeds**

1. Following dispersal, the seed undergoes a period of dormancy. What is dormancy?

**When it does not germinate (despite favourable conditions)** or **period of low metabolism** or **explained**

1. Suggest two advantages of dormancy.

**Germination at suitable time / time for embryo to develop / survival of plant during unfavourable conditions / increased dispersal**

1. What is germination?

**Growth / of embryo plant** or **of seed**

1. State three factors necessary for the germination of a seed.

**Oxygen / water / suitable temperature**

1. What is meant by the germination of seeds?

**Growth**

1. Seeds may remain inactive for a period before germination. What term is used to describe this period of inactivity?

**Dormancy**

1. Answer the following questions about an investigation that you carried out on the effect of water, oxygen and temperature on germination. (i) What seeds did you use? (ii) Explain how you set up a control for the investigation. (iii) How did you deprive some of the seeds of oxygen? (iv) How did you ensure that some of the seeds were deprived of a suitable temperature for germination? (v) State the results of the investigation, including those of the control.

**(i) type of seed or name of seed, e.g. cress; (ii) Provide suitable condition(s); (iii) anaerobic jar or other; (iv) put in fridge or cold environment; (v) Result: (a) no oxygen – no germination, (b) low temperature – no germination, (c) no moisture – no germination**

1. What is meant by germination?

**Growth of seed** or **embryo**

1. Why is digestion necessary in a germinating seed?

**To make (food) soluble** or **to make (food) transportable**

1. Digestive activity during germination can be demonstrated by using agar plates. (i) What is an agar plate? (ii) An extra food material is added to the agar plate for this demonstration. Give an example of such an extra food material. (iii) Outline the procedures that you carried out in setting up this demonstration. (iv) What control did you use for this demonstration? (v) What procedure did you carry out in order to show that digestive activity had taken place? (vi) Describe the results that you obtained in: 1. The experimental plate. 2. The control plate.

**(i) Petri dish containing a jelly (or solid medium); (ii) Starch or milk; (iii) Soak (seeds) / split (seeds) / how sterilised correctly / position (seeds) on agar / keep plate warm or stated temperature (max. 35°C); (iv) Boiled seeds or no seeds; (v) Starch agar: Iodine (solution) or milk agar: biuret solution; (vi) 1. No blue-black (under seeds) or no purple (under seeds); 2. Blue-black (under seeds) or purple (under seeds)**

1. Following dispersal most seeds enter a period of dormancy. What is dormancy?

**Period of no growth**

1. Give an advantage of dormancy.

**e.g. Survival / Avoid harsh winter weather**

1. Name the stage in the plant’s life cycle that follows dormancy.

**Germination** or **Growth**

1. What is meant by the dormancy of seeds?

**Period of reduced metabolism (**or **period of reduced activity)** or **period of no growth.**

1. Give one way in which the dormancy of seeds is of benefit to plants.

**Survival** or **germination delayed until conditions suitable for growth** or **greater time for embryo development (**or **greater time for dispersal)** or **reduced competition**

1. Suggest one way in which a knowledge of dormancy is useful to farmers and gardeners.

**(Optimum) storage conditions or (optimum) sowing (**or **ploughing) time** or **(maximise) the growing season** or **seed treatment before sowing (**or **examples)**

1. Water, oxygen and a suitable temperature are all required for the germination of seeds. In the case of each of these factors describe its effect on the process of germination.

Water**: for enzyme action (or example of enzyme action) or as a solvent or transport of materials or bursting the testa or washing away inhibitors;** Oxygen**: needed for (aerobic) respiration;** Suitable temp**: required for (optimum or increased) enzyme activity**

1. What term is given to the growth of an embryo into a plant?

**Germination**

1. In order for germination to be successful, certain environmental conditions must be present. Name any two of these conditions.

**Suitable temperature / moisture / O2**

1. State a use for a water bath in biological investigations.

**Keep temperature constant (**or **example) / to vary temperature (**or **example) / denaturing enzyme / heating**

1. For what purpose did you use an Anaerobic jar in the course of your practical activities?

**To see if O2 is necessary for germination / to limit** or **reduce O2**

1. From what part of a seed does the root develop?

**Radicle**

1. What type of agar plates did you use when investigating the digestive activity of seeds? How did you demonstrate that digestive activity had taken place in this investigation.

**Milk** or **starch; Does not give a positive result where digestive activity occurred** or **described**

1. How did you demonstrate the requirement for oxygen when investigating the factors necessary for seed germination?

**Anaerobic jar (**or **described)** or **boiled water + oil** or **one with O2 and one without O2 (and compare)**

1. What is the advantage of dormancy to seeds?

**To overcome adverse conditions**

1. Give three conditions necessary for seeds to germinate.

**Water / oxygen / suitable temperature**

1. When investigating digestive activity during seed germination: 1. How did you supply a substrate suitable for the digestive enzymes? 2. How did you ensure that no digestive enzymes were available on the control plate?

**1. Milk agar or starch agar; 2. Boiled seeds**

1. Name a part of a seed in which food for germination is stored.

**Cotyledon or Endosperm**

1. Name the three factors necessary for seeds to germinate.

**Water / oxygen / suitable temperature**

1. At the start of the investigation to show digestive activity during germination the seeds were sterilised. Why is this necessary?

**To kill (or inhibit) any microorganisms (or bacteria and fungi)**

1. At the start of the investigation to show digestive activity during germination the seeds were sterilised. How did you sterilise the seeds?

**Disinfectant or named disinfectant.**

1. Name the substance that is used as a medium on which to germinate the seeds in the investigation to show digestive activity.

**Agar**

1. In the investigation to show digestive activity by seeds during germination what substance, to be digested by the seeds, was added to the medium?

**Starch or milk or protein**

1. In the investigation to show digestive activity by seeds during germination what control did you use?

**Same set-up and procedure with boiled seeds**

1. In the investigation to show digestive activity by seeds during germination how did you demonstrate that digestive activity had taken place?

**Iodine (or biuret) (solution) / negative result (or described) beneath seeds / indicates the absence of (or digestion of) starch (or protein)**

1. Why is a dicotyledonous (dicot) plant so called?

**Two cotyledons or two seed leaves in each seed**

1. Name a carbohydrate you would expect to find stored in a seed.

**Starch**

1. What type of agar did you use in the investigation of the digestive activity in germinating seeds?

**Starch agar or Milk agar**

1. In the experiment to investigate digestive activity in germinating seeds the seeds were divided into two batches. One batch was used untreated. How did you treat the other batch of seeds before using them in the investigation?

**Boiled**

1. In the experiment to investigate digestive activity in germinating seeds the seeds were divided into two batches. Each batch was treated differently. Why was such treatment necessary?

**To Kill the seeds or destroy Enzymes or act as Control**

1. In the experiment to investigate digestive activity in germinating seeds describe how you carried out the investigation and indicate clearly how you showed whether or not digestion had occurred.

**Sterilised (seeds) / face down on agar / Add iodine or biuret solution to plate**

1. In the experiment to investigate digestive activity in germinating seeds the seeds were divided into two batches. Give the results of your investigation for the untreated seeds.

**The plate turns blue-black or purple except where the seeds were lying or It was clear under the seeds**

1. In the experiment to investigate digestive activity in germinating seeds the seeds were divided into two batches. Give the results of your investigation for the treated seeds.

**Treated (boiled) seeds left agar unchanged (blue-black)**