

# [Cellular respiration (experimental design)](https://assignbuster.com/cellular-respiration-experimental-design/)

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Research Question Investigate the effect of temperature on the rate of respiration of various parts of plants (germinating seeds and dormant (non-germinating) seeds), by measuring the oxygen consumption and change In gas volume of restlessness containing either germinating or non-germinating seeds at different temperatures to measure the rate of respiration of these beans at different temperatures. Hypothesis 1 . Germinating seeds have a higher rate of respiration as compared to non- germinating seeds and the glass beads. 2.

As temperature Increase, rate of respiration increase, greater increase in volume of roisterers. Materials 2 thermometers 120 germinating seeds 120 non-germinating seeds 120 glass beads the size of germinating seeds Absorbent and non-absorbent cotton 6 washers 6 calibrated ml pipettes A bath of ice water A bath of water at room temperature Masking tape A bath of hot water Stopwatch 6 glass tubes with screw on lids, an external diameter of mm and a height of mm, the lids with a hole in the center, covered with a rubber seal through which pipettes can be inserted Variables

Independent Variables: Incubation temperature Type of seed used (germinating or non-germinating) Dependent Variables: Rate of respiration Constants: Time allowed for beans to respire Volume of KOCH added to absorbent cotton Type of glass tube used Volume of contents in each tube- the purpose of adding the beads along with the non-germinating seeds is to ensure that each restrooms Is uniform In volume. Controls: Respirator with only beads in it because it does not undergo any respiration Approach Two sets of three roisterers will be assembled during this lab exercise.

Each set 019 ruminated seeds, one will contain a mix of non-germinating seeds and glass beads, and a third will contain only glass beads. In each set of experiment, the rate of cellular respiration will be measured by measuring the oxygen gas consumption by using a respirator in water. This experiment measures the consumption of oxygen by germinating and non- germinating at room temperature and at ice water temperature. During cellular respiration, oxygen and carbon dioxide are simultaneously changing in volume.

Oxygen gas is being consumed by the respiring cells and carbon dioxide gas is diffusing out of the cells. The respirator, therefore, has to be able to deal with two simultaneously changing gas volumes. Introducing KOCH, which absorbs carbon dioxide, following this equation (CA + KOOK -?+ CHECK + H2O), converts the gas into Potassium carbonate (CHECK), a solid precipitate, therefore no longer governed by gas laws. This allows the respirator to measure only one variable, the consumption of oxygen gas by living cells.

The change in the volume of gas in the respirator will be directly proportional to the amount of oxygen consumed. The respirator with glass beads alone will not show any changes in volume due to atmospheric pressure changes or temperature changes. As oxygen is used up by the respiring seeds, the gas pressure inside the respirator will decrease and the water will flow into the pipette down its pressure gradient (a region of higher pressure to a region of lower pressure) Experimental Procedure I. Making a respirator 1 . Count 30 germinating seeds and place them into a measuring cylinder.

Add ml of water and record down the volume of the seeds and the water. The recorded volume has to be constant with the other 2 tubes. Filter the contents and discard the filtrate. The reiterate will be transferred into a glass tube labeled " Tube la" later 2. Count 30 dormant seeds and place them into a measuring cylinder. Add 30 ml of water. Add in glass beads slowly until the volume reads the same as the recorded volume measured in tube 1 . This is to ensure that the contents of each cylinder has the same volume. Filter the contents and discard the filtrate.

The reiterate will be transferred into a glass tube labeled " Tube AAA" later on. 3. Add ml of water into a measuring cylinder. Add glass beads until the volume reads the same as the recorded volume measure in tube 1 . Filter the contents and discard the filtrate. The reiterate will be transferred into a glass tube labeled " Tube AAA" later on. 4. Add a piece of non-absorbent cotton onto each tube and pack the cotton towards proper protective gear, into each tube. Ensure that the cotton is packed at the bottom of each tube using a glass rod. 5.

Add a piece of non-absorbent cotton onto each tube and pack the cotton towards the bottom of the tube as well. The non-absorbent cotton functions as a separator to separate the seeds from the KOCH as the KOCH is caustic and can cause contamination f the seeds, affecting the germination of the germinating seeds. 6. Transfer the reiterate from previous into each tube respectively. 7. Screw on the lids onto the tubes and insert a ml pipette through the center hole and prevent leaking of air with a rubber seal. 8. Make 2 more of each tubes and label them b, LLC, b, c, b, c respectively. I. Setup of experiment 1 . Set up three different water baths with differing temperatures: a. Room temperature (25 degrees Celsius) b. Cold (10 degrees Celsius) c. Warm (40 degrees Celsius) 2. Now submerge the roisterers (1 a, AAA, AAA) on their sides into the room enrapture water bath and let them sit for 7 minutes so their temperature becomes equal to the water bath temperature. Ensure that the roisterers are tilted at the same angle by laying them on a line of masking tape across the breadth of the bath.

Tilting the tubes allows for water to enter by gravity, allowing a reading. 3. Do the same for the other roisterers, placing roisterers b, b and b into the cold water bath and placing roisterers LLC, c and c into the warm water bath. 4. Record the position of the water at O, 5, 10, 15, 20 min. Experimental Set-up Figure A: Roisterers Figure B: View of overall set-up Expected Results DATA TABLE : Calculation of Oxygen Consumption Time interval (min): O min 5 min 10 min 15 min 20 min Reading, ml 0. 20 0. 39 0. 43 0. 52 0. 9 A Volume, ml(reading - time O) 0. 19 0. 23 0. 32 Respirator AAA: Room Temperature, Dormant Seeds & Glass Beads Time interval (min): Reading (volume of pipette), ml 0. 31 0. 36 0. 38 0. 40 0. 11 0. 16 0. 18 Respirator AAA: Room Temperature, Glass Beads 0. 00 Respirator 1 b: CHIC, Germinating Seeds 0. 30 0. 44 0. 10 0. 24 Respirator b: CHIC, Dormant Seeds & Glass Beads 0. 28 0. 35 0. 04 0. 08 0. 15 Respirator b: Coo, Glass Beads 0. 21 0. 22 0. 01 0. 02 Respirator 1 c: CHIC, Germinating Seeds 0. 49 0. 57 0. 66 0. 72 0. 29 0. 37 0. 6 Respirator c: CHIC, Dormant Seeds & Glass Beads 0. 55 0. 61 0. 41 Respirator c: CHIC, Glass Beads 0. 17 -0. 02 -0. 03 Figure LLC Figure b Figure AAA Discussion Oxygen is used up in the process of respiration. When oxygen is consumed, (since carbon dioxide is absorbed and removed so it is not taken into account for gas laws), the volume of gas in the respirator set-up decreases. This decrease in gas pressure, causes water to flow into the pipette down a pressure gradient (further died by gravity) to fill the space once occupied by oxygen.

From the graphs, comparing roisterers la against b (Figure la), AAA against b (Figure AAA) and AAA against b (Figure c), where temperatures are the same in both tubes -? a and -? b respectively, we can observe that there is a greater increase in volume of water in the roisterers -? a, containing germinating seeds. Since the amount of oxygen consumed for respiration is proportional to the increase in volume of water in the pipette, we can thus conclude that greater amounts of oxygen are consumed in the roisterers containing germinating seeds.

Germinating seeds hence have higher rate of respiration than non-germinating (dormant seeds). As germination, or sprouting, occurs, the mug bean plant consumes more energy as it undergoes growth, so a greater amount of respiration is required to fulfill the energy Comparing tables for roisterers la, AAA and AAA, with la being at room temperature (approximately CHIC), AAA at a lower temperature of 1 CO and AAA at a higher temperature of CHIC, we observe that there is a greatest overall change in volume for respirator AAA and then following by la then the smallest overall hanged in volume is observed in respirator AAA.

Likewise, comparing the 'bi's and 'co's, the respirator under the water bath conditions with the highest temperature showed the greatest change in volume of water in the respirator. From the graphs, Figure AAA, the change in volume of water in the respirator is greatest for AAA, at CHIC and Figure b, the change of volume of water in the respirator over time is also greatest in c, at CHIC. Since the rate of change in volume increases as temperature, we can conclude rate of oxygen consumption increases as temperature increases. Thus, as temperature increases, rate of respiration increases.

Data shows that at any given time, whether dormant or germinating, respiration is always occurring, however, the conditions determine the rate of respiration. The most optimal conditions for growth will induce a greater rate of respiration because metabolic rate will increase and thus more energy needs to be produced for expenditure. In cold temperatures, metabolic process slow down thus, not as much energy is required thus rate of respiration slows down. For respirator c, there is a slight increase in volume of water in the respirator.

This is attributed to the contraction of gas in the respirator due to the set up being at a lower temperature of CHIC. Likewise for respirator c, the higher temperature of CHIC causes expansion of the gas thus a negative change in volume of water is observed. Risk assessment and precautions taken Wear safety goggles as KOCH causes severe eye burns. Wear gloves as KOCH cause skin burns. Clean glassware before and after use for scratches, cracks, and sharp edges. Handle the glassware carefully by placing them away from the edge of the workbench.