*Data*..................................

*Imię i nazwisko*.........................................

*Grupa*.......................................................

*Ocena*.......................................................

***PĘCZNIENIE***

*Ćwiczenie 1*. **Zmiana wagi i objętości nasion podczas pęcznienia**

***Wykonanie***

50 nasion grochu i 50 ziarniaków kukurydzy dokładnie zważyć. Następnie dokonać pomiaru objętości nasion. W tym celu do cylindra o objętości 100 ml nalać 50 ml wody, wsypać nasiona i szybko odczytać poziom wody w cylindrze (**wzrost objętości cieczy ponad 50 ml równy jest objętości nasion**).

Następnie przenieść nasiona wraz z wodą do osobnych zlewek o pojemności 250 ml. Jeśli zajdzie taka potrzeba uzupełnić poziom wody w zlewkach tak, aby nasiona pozostawały przykryte wodą. Po 30, 60, oraz 90 minutach przeprowadzić pomiary masy i objętości nasion. W tym celu nasiona należy odsączyć na sitku, osuszyć dokładnie ręcznikiem papierowym, zważyć, a następnie dokonać pomiaru objętości w sposób opisany powyżej.

Wyniki kolejnych pomiarów zestawić w *tabeli 1*.

*Tabela 1*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Gatunek** | **Czas**  [min] | **Masa**  [g] | | | **Czas**  [min] | **Objętość**  [ml] | | |
| **suche** | **spęczniałe** | **różnica** | **suche** | **spęczniałe** | **różnica** |
| **groch** | **30** |  |  |  | **30** |  |  |  |
| **60** |  |  | **60** |  |  |
| **90** |  |  | **90** |  |  |
| **kukurydza** | **30** |  |  |  | **30** |  |  |  |
| **60** |  |  | **60** |  |  |
| **90** |  |  | **90** |  |  |

***Wnioski***

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*Ćwiczenie 2*. **Wpływ temperatury na szybkość i stopień pęcznienia**

***Wykonanie***

Odważyć 3 porcje nasion grochu po 10 g, wsypać do trzech zlewek i zalać wodą destylowaną. Jedną porcję umieścić w lodówce, drugą w temperaturze pokojowej, trzecią w termostacie w temperaturze ok. 37 oC. Po 15, 30 oraz 45 minutach zmierzyć zmiany masy i objętości nasion jak w ćwiczeniu 1. Obliczyć zmiany masy i objętości w procentach. Wyniki kolejnych pomiarów zestawić w *tabeli 2*.

*Tabela 2*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Temperatura**  [ºC] | **Czas**  [min] | **Masa** | | **Objętość** | |
| [g] | [%] | [ml] | [%] |
| **5** | **0** |  |  |  |  |
| **15** |  |  |  |  |
| **30** |  |  |  |  |
| **45** |  |  |  |  |
| **25** | **0** |  |  |  |  |
| **15** |  |  |  |  |
| **30** |  |  |  |  |
| **45** |  |  |  |  |
| **37** | **0** |  |  |  |  |
| **15** |  |  |  |  |
| **30** |  |  |  |  |
| **45** |  |  |  |  |

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*Ćwiczenie 3*. **Wpływ stężenia roztworu na pęcznienie**

***Wykonanie***

Przygotować roztwory NaCl o różnych stężeniach (podanych w kolumnie 4 tabeli) mieszając podaną w kolumnie 2 ilość ml roztworu wyjściowego z wodą (kolumna 3).

|  |  |  |  |
| --- | --- | --- | --- |
| **1** | **2** | **3** | **4** |
| **Stężenie roztworu wyjściowego NaCl** [M·dcm-3] | **Ilość roztworu wyjściowego**  **NaCl**  [ml] | **Ilość H2O**  [ml] | **Stężenie końcowe roztworu NaCl**  [M·dcm-3] |
| 3 | 100 | 0 | 3 |
| 3 | 66 | 134 | 1 |
| 1 | 20 | 180 | 0,1 |
| 0,1 | 20 | 180 | 0,01 |
| 0 | 0 | 100 | 0 |

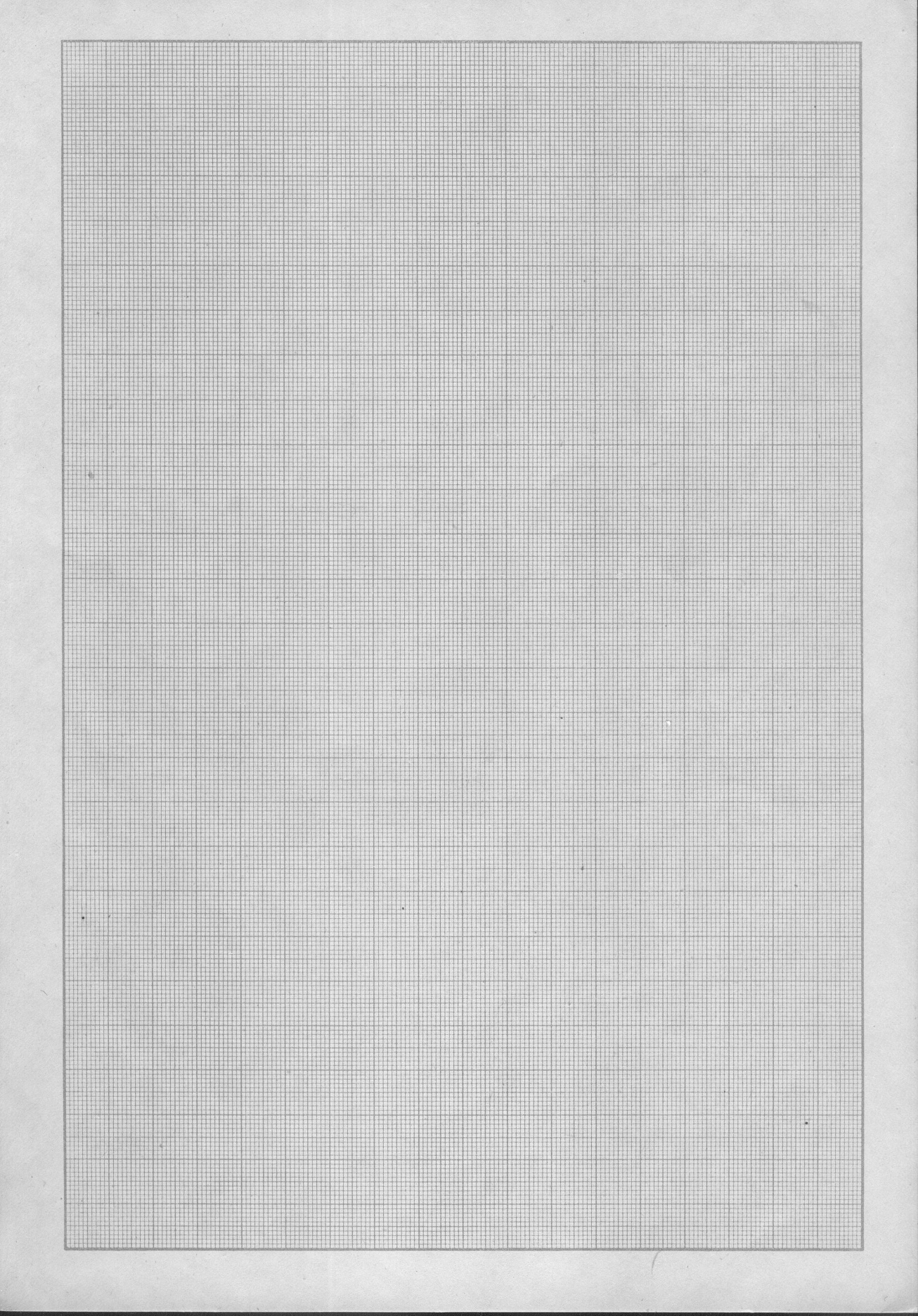
Odważyć 5 porcji nasion grochu po 10 g, zanotować ich początkową masę i umieścić w powyższych roztworach. Po 30, 60 oraz 90 minutach zważyć osuszone bibułą nasiona i zmierzyć ich objętość. Obliczyć zmiany masy i objętości w *tabeli 3 i 4* oraz przedstawić na wykresie.

*Tabela 3*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Masa nasion**  [g] | **Stężenie NaCl**  [M·dcm-3] | | | | |
| **0** | **0,01** | **0,1** | **1** | **3** |
| **Początkowa** |  |  |  |  |  |
| **Po 30 min** |  |  |  |  |  |
| **Po 60 min** |  |  |  |  |  |
| **Po 90 min** |  |  |  |  |  |
| **Różnica mas**  [g] |  |  |  |  |  |

*Tabela 4*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Objętość nasion**  [ml] | **Stężenie NaCl**  [M·dcm-3] | | | | |
| **0** | **0,01** | **0,1** | **1** | **3** |
| **Początkowa** |  |  |  |  |  |
| **Po 30 min** |  |  |  |  |  |
| **Po 60 min** |  |  |  |  |  |
| **Po 90 min** |  |  |  |  |  |
| **Różnica objętości** [ml] |  |  |  |  |  |



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*Ćwiczenie 4*. **Wpływ pH na pęcznienie**

***Wykonanie***

Odważyć 3 porcje nasion grochu po 10 g i umieścić w roztworach buforowych o **pH:**

**5, 7** oraz **9.**

|  |  |  |
| --- | --- | --- |
| **Bufor fosforanowy pH 5** | **Bufor fosforanowy pH 7** | **Bufor węglanowy pH 9** |
| 97,5 ml roztworu KH2PO4 | 30 ml roztworu KH2PO4 | 85 ml roztworu NaHCO3 |
| 2,5 ml roztworu Na2HPO4 | 70 ml roztworu Na2HPO4 | 15 ml roztworu Na2CO3 |

**Uwaga! Skład roztworów buforowych podano w odniesieniu do 100 ml. Sporządzić w ilości koniecznej do całkowitego zalania nasion w zlewce.**

Po 2 godzinach osuszyć, zważyć nasiona i obliczyć przyrost masy w procentach. Wyniki zanotować w *tabeli 5*.

## Tabela 5

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **pH** | **Masa suchych nasion**  **ms**  [g] | **Masa nasion spęczniałych**  **mz**  [g] | Różnica mas **mk=mz-ms**  [g] | **Przyrost masy** [%] |
| **5** |  |  |  |  |
| **7** |  |  |  |  |
| **9** |  |  |  |  |

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*Ćwiczenie 5*. **Ciśnienie wywołane przez pęczniejące nasiona**

###### *Wykonanie*

Lejek szklany o średnicy 15 cm wyłożyć bibułą filtracyjną i napełnić do połowy papką gipsową (mieszanina gipsu z wodą w stosunku wagowym *5* ***:*** *2*). Na powierzchni umieścić 15 nasion grochu i dopełnić lejek papką gipsową. Gdy stożek gipsowy stwardnieje, wyjąć go z lejka i umieścić w szalce Petri’ego zawierającej warstwę wody o grubości 0,5 – 1 cm. Co 30 minut obserwować stożek gipsowy. Wyniki zanotować w *tabeli 6*.

*Tabela 6*

|  |  |
| --- | --- |
| **Czas** [min] | **Obserwacje** |
| **0** |  |
| **30** |  |
| **60** |  |
| **90** |  |

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