1.1.1	Input question for temperature								
1.1.1. b	density given	**marking comment**							
	0.999975	Give 0.8 if density within 4 digits. Temp is only input, gets no mark							
points 1.1.1									

Dear all,

I have now given editing rights to all having a link to this document so you can see the equations included in the cells. The sheet is still protected so in case you try to introduce a change you will get a warning
I hope that you will share responsibly and make good use of the info provided here.
Best
Vasileios

1.1.2	All input questions		**marking comment**						
m_w+g	703.4	gr	no marks for any of these						
D_ice	0.098	m	are only inputs and we accept them all						
H_ice	0.02	m							
m_w+g+ice	828.5	gr							
m_g+w+ice+force	860	gr							

1.1.3	(answers filled here are not the targets but based on the inputs from the students in 1.1.2)						**answers given**	**marking comment**	
V_ice	0.0001507828	m3	0.1507828	L	150.7828	mL		each correct answer gives 0.8 points	
m_ice	125.1	gr						we accept any result as correct if it is in agreement with the calculation described in the equations in the cells B16 to B19	
rho_ice	829.6702276	kgm-3						However a density of ice higher than the density of the water will not be accepted as the students should be able to see that the ice floats	
rho_ice'	798.8306034	kgrm-3						If indeed they give a rho_ice higher than rho_water and comment on this appropriately then we give full point	
points 1.1.3									

1.1.4			**answers given**		**marking comment**				
rho_ice - rho_ice'	30.83962419	kgm-3			0.8 points for each answer				
Deltam_g+ice+w+force	30	gr			give mark for a min max calculation for a ll the Deltas				
Delta_rho'	317.725709	kgm-3							
Delta_V_ice	0.00000424654856	m3							
Delta_V_ice	0.00424654856	L							
Delta_rho_ice	23.36882337	kgm-3							
points 1.1.4									

1.2.1		**answers given**	**marking comment**						
a	FALSE		0.5 mark each						
b	TRUE								
c	TRUE								
d	FALSE								
e	TRUE								
points 1.2.1									

1.2.2									**marking comment**
z	**rho**	**interval**	**0.05**	**pressure**	**interval**	**0.05**	**density given**	**pressure given by students**	0.2 marks for each calculation
0	330	313.5	346.5	0	0	0			correct answer is the one within the
80	837	795.15	878.85	536.8	509.96	563.64			intervals given here (5% error accepted)
160	909	863.55	954.45	1220	1159	1281			
1000	917	871.15	962.85	8996	8546.2	9445.8			
points 1.2.2									

1.2.3									**marking comment**
z	**rho**	**V**	**m**	**interval**	**0.01**			**mass given**	one point each

80	837	0.0042987	3.5979784	828.63	845.37	3.562	3.634		answers within the 1% error interval
160	917	0.0042987	3.9418712	907.83	926.17	3.902	3.981		are considered correct
points 1.2.3									

1.2.4									**marking comment**
z	**rho**	**V**	**m**	**interval**	**0.01**			**mass given**	one point each
1000	917	0.0301566	27.6535655	907.83	926.17	27.377	27.930		answers within the 1% error interval
2000	917	0.0301566	27.6535655	907.83	926.17	27.377	27.930		are considered correct
points 1.2.4									

1.3.1	**marking comment**
points 1.3.1	2 points, 1 for correct data points, only markers, straight lines or curves that are not overfitting will be accepted if a line does not go through the data points we do not give marks. No regression is accepted 1 for labels and titles, proper symbols and measurement units

1.3.2	**marking comment**
points 1.3.2	same as 1.3.2

1.3.3						**marking comment**
z	**1/lamda**	**Age**	**interval**	**0.01**	**age given**	correct answer is within the 1% error interval
0	4	0	0	0		0.5 marks for every
500	5	2250	2227.5	2272.5		question
1200	10	7500	7425	7575		
1400	25	11000	10890	11110		
1500	80	16249	16086.51	16411.49		
points 1.3.3						

1.3.4		0.05						
z	**Age**	**interval**		**interval accepted for d18O**		**Age given**	**d18O given**	**marking comment**
250	1100 (1076)	1045	1155	-36	-32			1 point for ages 1 point for d18O one point for the question the "colder" sample. Accepted ages from either the age scale the students calculated based on the annual layer thickness
1450	12440 (13162)	11818	13820	-43	-36			or based on figure 1.6.
Colder sample	colder sample is sample 2							Numbers in parenthesis are from figure 1.6
points 1.3.4								We accept answers with a 5% error interval for the ages. However the isotope curve has a spread that is not easy to read therefore we give a quite wider range for the accepted values

1.3.5					**marking comment**
linear	**d18O interval from 1.3.4**		**temp interval (C)**	**answers given**	0.4 points for every temp calculation 0.2 for the difference
sample 1	-36	-32	-33.55	-27.55	1.3.5 is dependant on a correct answer in 1.3.4

sample 2	-43	-36	-44.05	-33.55		thus only temperatures that are calculated with d18O values from the correct interval will be accepted			
difference			16.5	0					
quadratic									
sample 1	-36	-32	-41.47	-32.11					
sample 2	-43	-36	-65.55	-41.47					
difference			33.44	0					
points 1.3.5									
1.3.6a	**marking comment**								
sample label correct	All the team that succesfully delivered samples within the 4-h mark have labeled them properly thus they all get 0.5 points								
points 1.3.6a									
1.3.6b		**interval 1**	**0.15**	**interval 2**	**0.3**	**value measured**	**marking comment**		
Sample 1							the plan is to accept a 0.15 and 0.3 per mile accuracy cutoff for δ18O and δD as compared to test samples we have prepared. This is as of Wed. 09.30 work in progress. Will update when the measurements are finished		
Sample 2	-43.01	-43.16	-42.86	-43.31	-42.86				
points 1.3.6b									
1.3.7		**answers given**	**marking comment**						
a	TRUE		0.25 mark each						
b	FALSE								
c	TRUE								
d	FALSE								
points 1.3.7									

Results: Task 1: Ice, Exp. 2

2.1: 19.25 mL. 1 mark for correctly calculated value of $V_{1,av}$. 3 marks for 19.25 ± 0.15 mL, 2 marks for 19.25 ± 0.30 mL, 1 mark for 19.25 ± 0.45 mL

2.2: Equation: $[Zn^{2+}] = \frac{V_{1,av} \cdot 0.0170\ M}{10.00\ mL}$ 1 mark

Result: $[Zn^{2+}] = 0.0327$ M 1 mark for correct calculation

2.3: False, false, true. 1 mark for 3 correct answers - else 0.

2.4: $[H_3O^+] = K_a[CH_3COOH]/[CH_3CO_2^-]$ (½ mark)

$[H_3O^+] = 2.09\times10^{-6}$ M (½ mark)

pH = -log$[H_3O^+]$ (½ mark)

pH 5.68 (½ mark)

2.5: Acidic (1 mark), indication that 0 < pH < 7 (1 mark)

2.6: Solution No, $[Cu(NH_3)_4^{2+}]$, A_{618}: 2, 0.0018 M, 0.114; 3, 0.00360 M, 0.228; 4, 0.00540 M, 0.342; 5, 0.00720 M, 0.456; 6, 0.00900 M, 0.570.

0.20 marks for each correctly calculated value of $[Cu(NH_3)_4^{2+}]$.

0.40 marks for each value of A_{618} ± 0.015. 0.20 marks for each value of A_{618} ± 0.025.

2.7: $A_{618} = 0.252$ (1 mark for $A_{618} = 0.232 – 0.272$)

2.8:

Good utilization of paper (1 mark)

Correct axis labels (1 mark)

Correct division of the axes (1 mark)

Correct plotting of data (0.2 marks for each)

Line of best fit (1 mark)

Calculation of slope and *y*-intercept (1 mark)

2.9: ε = slope / 1.00 cm (1 mark)

Result: $\varepsilon(Cu(NH_3)_4^{2+})$ = 63.3 $M^{-1}cm^{-1}$ (1 mark for ε in the range 60.0 – 66.6 $M^{-1}cm^{-1}$)

2.10: $[Cu^{2+}] = \frac{2 \cdot A_{618}}{\varepsilon \cdot l}$ (or with a non-zero *y*-intercept (*b*): $\frac{2 \cdot (A_{618} - b)}{\varepsilon \cdot l}$) (1 mark)

$[Cu^{2+}]$ = 0.00796 M (1 mark for correct calculation)

2.11: $Zn(OH)_2(s)$ and/or $Cu(OH)_2(s)$ (1 mark)

$Zn^{2+} + 2\ NH_3 + 2\ H_2O \rightarrow Zn(OH)_2(s) + 2\ NH_4^+$ (1 mark for 1 or 2 reactions)

$Cu^{2+} + 2\ NH_3 + 2\ H_2O \rightarrow Cu(OH)_2(s) + 2\ NH_4^+$

2.12:

Content of zinc in the ice core = $\frac{0.0327\ \text{M} \cdot 65.38 \frac{\text{g}}{\text{mol}} \cdot 2.000\ \text{L} \cdot 10^{12} \frac{\text{pg}}{\text{g}}}{10^9 \cdot 180.6\ \text{g}} = 23.7\ \text{pg/g}$

Content of copper in the ice core = $\frac{0.00796\ \text{M} \cdot 63.54 \frac{\text{g}}{\text{mol}} \cdot 2.000\ \text{L} \cdot 10^{12} \frac{\text{pg}}{\text{g}}}{10^9 \cdot 180.6\ \text{g}} = 5.6\ \text{pg/g}$

(2 marks for correct equation, 1 mark for each correct calculation)

2.13: False (1 mark)

EUSO 2017 Experiment 3
Metazoan Life in Extreme Environments
Grading system

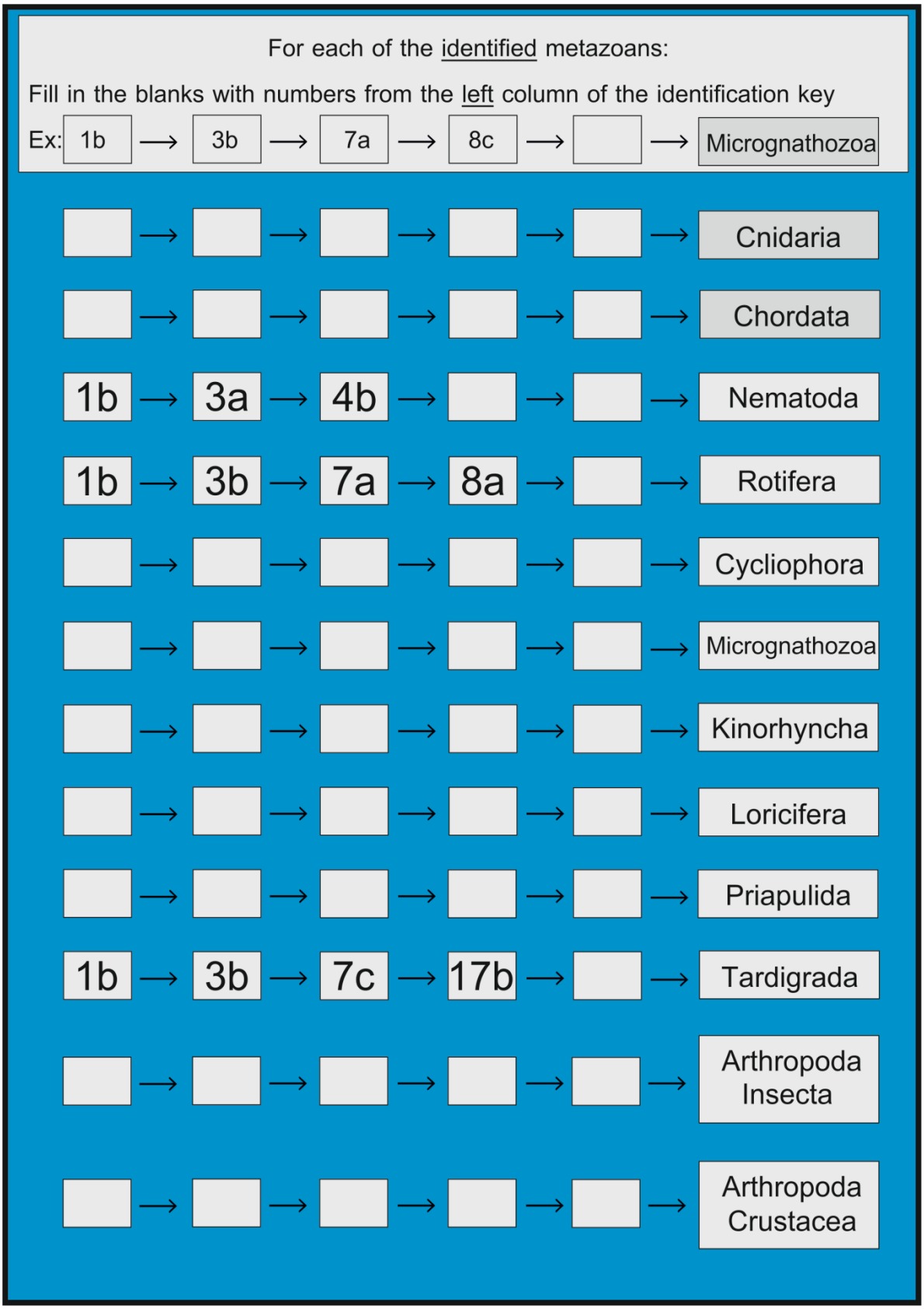
Microscopic live specimens of the following metazoan phyla were present in the sediment sample: Tardigrada, Rotifera and Nematoda.

Correctly identifying one of these phyla will result in 2 points – if all three phyla were identified the team receives 6 points (see table below). Additional, 1 point will be given for every box in the Answer Sheet that is correctly filled out according to the numbers given in the left column of the Identification Key. If a team has no errors, i.e. the students have identified exactly the three phyla present in the sample and if they have filled out the numbers correctly according to the Key the team receives the maximum/ full points (20 points).

Scoring of the Answer sheets for Exp. 3	**Points**	**Total points attainable**
Correct identification of phyla	2	6
Each box filled correctly according to the Identification Key	1	11
No errors	3	3
Max points		**20**

Wrong identification/suggestion of taxa that are not present in the sample material will be ignored during the grading. However, answer sheets that suggests the presence of more than 7 metazoan taxa within the sample material will be given 0 points, in order to avoid rewarding teams that potentially suggest a large number of randomly picked taxa with no apparent reference to the provided sample material.

Full 20 points will be given to teams who have correctly identified the three metazoan phyla and who have correctly filled out the numbers from the Identification Key - see below.



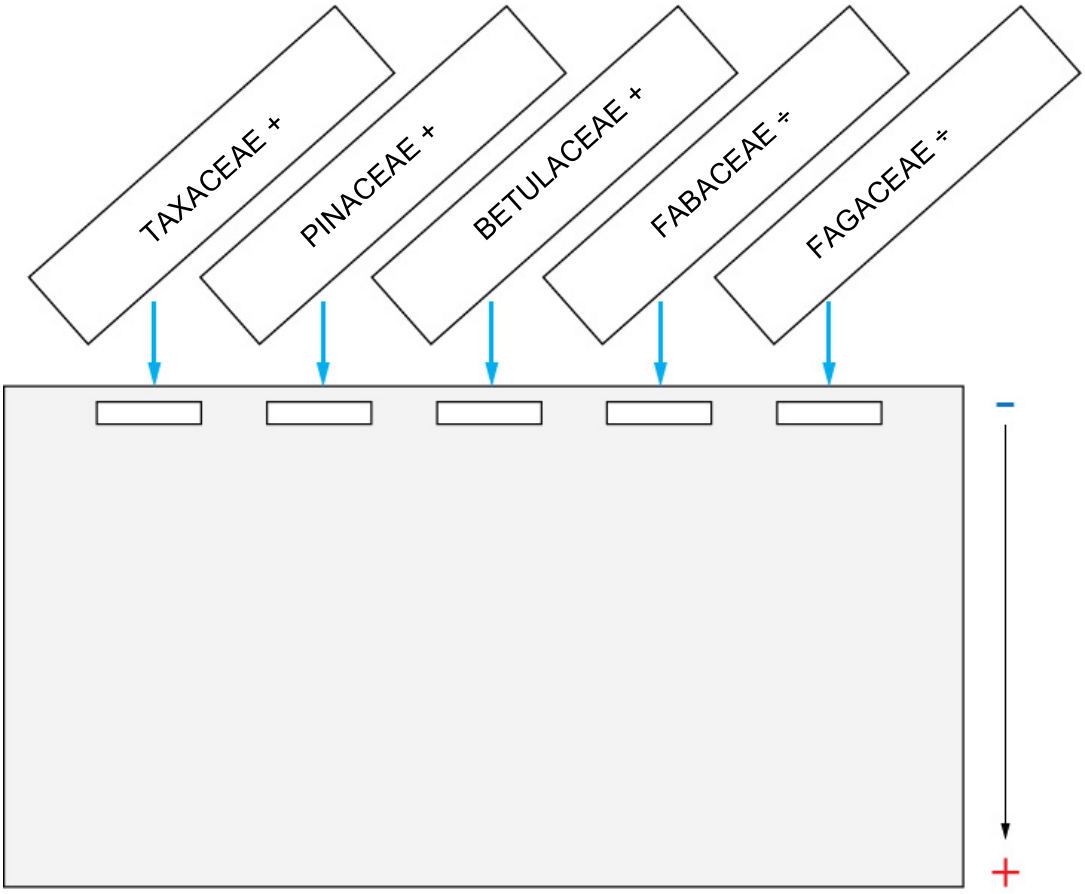
Opgave 4

4.1: **points 3 (0,3)**

	Written word	Letter code
1	**Wells**	**M**
2	**Proteins**	**L**
3	**DNA fragments**	**H**
4	**Size**	**R**
5	**Charge**	**D**
6	**Positive pole**	**W**
7	**Net negative charge**	**Q**
8	**Phosphate-groups**	**T**
9	**Amino acid**	**A**

4.2 **points 3**

Write the names of the families you have analyzed in the boxes and indicate if the family was present of not present in you sample. This is done by + (present) or – (not present) written on the gel under the name.



4. 3 **points 3 (0.5)**

Are these statements true or false? Mark with a 'X'

Statements	True	False
No plants were present at the time		x
Only four families existed at the time		x
The winters were below -2℃and the summers were above ℃	x	
Only three families existed at the time		x
Nothing can be concluded about the temperature by information based on only the families		x
Greenland had a forest at the time	x	

4. 4 **points 2 (0.4 fra)**

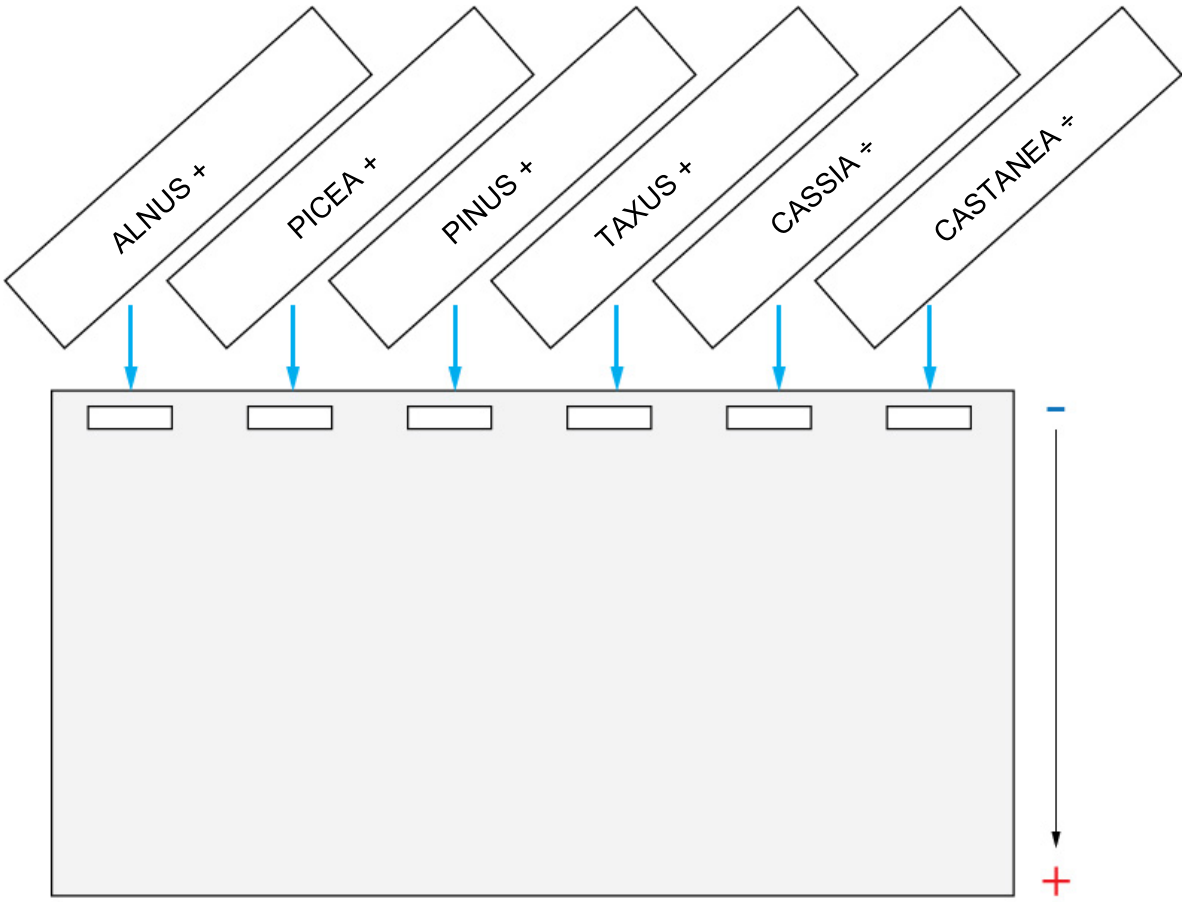
Which families would be interesting to investigate for further analysis? Highlight your answer by drawing a ring around the names.

Taxaceae ~~**Fagaceae**~~ ***Pinaceae***

~~**Fabaceae**~~ ***Betulaceae***

4. 5 **points 3**

Write the names of the genera you have analyzed in the boxes and indicate if the genus was present or not present in you sample. This is done by marking either + (present) or - (not present) written on the gel under the name.



4.6 **points 2.5 (0.5 fra)**

Based on experiment B and Appendix A and the above answers what kind of habitat was dominant at the location of Dye-3? (only one correct answer)

Statement	
Rainforest	
Deciduous temperate forest	
Mire (a wetland terrain without forest cover, dominated by living, peat-forming plants)	
Meadow (an open area with grassland)	
Boreal forest with a mix of conifers and deciduous trees	x

4.7 **points 2.5 (0.5 fra)**

We want to be sure that the DNA from the basal ice samples are really representing the ancient ecosystems and not just contaminations from the air that was transported to Greenland from other areas through time. Where would you take control samples in the ice core to check for airborne exotic DNA? (only one correct answer)

Statement	**True**	**False**
In the center of the glacial ice core and close to the basal ice where exotic plant DNA might have been incorporated together with air, airborne contaminants and snow.	x	
In the clean glacial ice much closer to the surface than to the basal ice	x	
Only on top of the ice cap since this place is most likely to be contaminated.		x
Air samples since this is when the contaminants are.		x
Air samples and top of the ice cap since both contain the contaminants.		x

4.8 **points 1 (0.3 fra)**

From the indicator genera, make an analysis on what the climate most likely looked like at the time these organisms were living in Greenland – what are the upper and lower temperature boundaries? Use Appendix A.

Statement	True	False
Summers are more than 10 ^{o}C warm.	x	
Winters are down to -40 ^{o}C		x
Winters are not colder than -17 ^{o}C	X	
Winters does not go below -1 ^{o}C		x

4.9 **points 2**

Calculate possible RNA-combinations of the protein sequence based on differences in nucleotides. Show your calculations.

1 *2 *2 *2 *2 *2*1 = 32

4.10 **points 2**

Write the possible RNA-sequence for the protein-sequence.

5’ AUG UUC GAU CAG GAC UAC UGG 3’ (nummer 3 i rækken)

.

4.11 **points 1**

Write the specific primer, that you would use for further analysis.

3’ GTC CTG ATG ACC 5’ (nummer 3 I rækken)

4.12 **points 1 (0.3 fra)**

When can you determine the last time that forest occurred in the Dye-3 location from a combination of the 4 methods? (only one correct answer)

Statement	**True**	**False**
Forest occurred in Greenland between 450,000 and 17,5 million years ago		X
Forest occurred in Greenland between 450,000 and ca 800,0000 years ago	x	
Forest in Greenland has only occurred in a time period younger than 450,000 years ago in the area of DYE-3		X
Forest in Greenland occurred at a time between ca 800,000 and 17.5 million years ago		x