1st April 2014 – Task A

All about Olive oil

- Answer sheet -

Country and Team No. _____

Name _____ **Signature** _____

Name _____ **Signature** _____

Name _____ **Signature** _____

Task A1: Study of transpiration rate

Biology - Answer sheet

(TOTAL MARKS 34)

TASK A1.1

ASSEMBLY OF THE POTOMETER ***CHECKED BY SUPERVISOR*** **(3 MARKS)**

WATER UPTAKE AT ROOM CONDITIONS (RC)

A **Time (min)**	**B Volume** **(mL)**	**C** **Water loss / m^2** **(mL / m^2)**
0		**0**
5		
10		
15		
20		
25		
30		

TABLE 1: ROOM CONDITIONS (RC) 3 MARKS

Task A1.2

CALCULATION OF THE TOTAL LEAF SURFACE AREA (USED IN RC)

3 Marks

a.Total leaf mass: ……. g

b. Mass of 10 cm^2 pieces: …….. g

c. mass of $1m^2$ leaves in g: …….. g

d.Total leaf surface per branch in m^2: S= ….

calculations

Water loss per m^2 of leaf surface at the respective time point (e.g. 5 min, 10 min etc.)

Input your answers in column C, table 1

calculations

TASK A1.3 CALCULATION OF WATER UPTAKE UNDER LIGHT CONDITIONS (LC)

A Time (min)	B Volume (mL)	C Water loss / m^2 (mL / m^2)
0		**0**
5		
10		
15		
20		
25		
30		

TABLE 2: LIGHT CONDITIONS 3 MARKS

Task A1.4

CALCULATION OF THE TOTAL LEAF SURFACE AREA (USED IN LC)

3 MARKS

A. Total leaf mass: ……. g

B. Mass of 10 cm^2 pieces: …….. g

C. Mass of 1 m^2 in g: …….. g

D. Total leaf surface per branch in m^2: ……. S = ...

calculations

Water loss per m^2

calculations

Input your answers in column C, table 2

Task A1.5

DRAW A GRAPH **6 MARKS**

Using the data in tables 1 and 2, draw a graph on the graph paper provided. Draw the appropriate line derived from your data in table 1 and label it 'RC'. On the same graph, draw a second line, which will be derived from your data in table 2 and label it 'LC'.

Calculation of transpiration rate **2 Marks**

Calculate the transpiration rate at:

a) Room Conditions (RC)

b) Light Conditions (LC)

Transpiration rate is defined as total water loss (mL/m^2) over time (per hour).

calculations

Question BIO 1 **1 Mark**

- Choose the correct answer based on your experimental measurements and the deduced graph

a. There are no differences in transpiration rate measured in either room conditions or light conditions

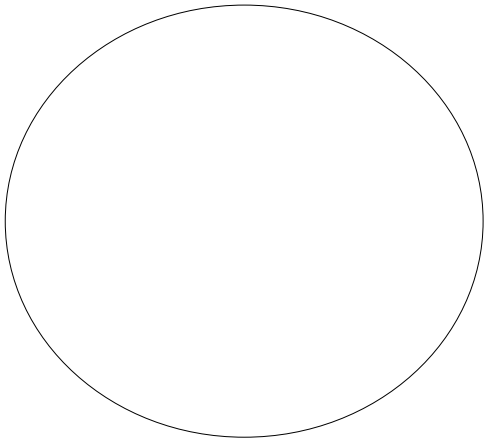
b. Light accelerates the transpiration rate

c. Light slows down the transpiration rate

Task A1.6

Depiction of Trichomes **6 Marks**

- Draw the Trichomes in as much detail as possible



Question BIO 2 **1 Mark**

- Select the single best answer:

Trichomes on olive leaves:

A. are a morphological structure that blocks entry of rain water into the leaves

B. are a morphological adjustment that prevents water evaporation by the stomata

C. have no significant functional role and only serve to make leaves more attractive

D. protect the leaves from excessive exposure to the sun

Additional Questions

Question BIO 3 **1 Mark**

A potometer was used to measure water loss in a leafy plant shoot. The following readings were obtained:

Question a: At which conditions was transpiration higher? ……

Question b: At which conditions was transpiration lower? ……

	Conditions	Time required for water to move 10 mm (in sec)
1	Cold, wind current, sunny	**8**
2	Cold, no wind current, sunny	**24**
3	Hot, wind current, sunny	**4**
4	Hot, no wind current, sunny	**12**
5	Hot, no wind current, dark	**360**

Question BIO 4 **2 Marks**

Trees (e.g. olive trees) found in Mediterranean countries, known for long periods of sunshine and drought, are able to survive due to their specialised morphological and functional adjustments.

Decide whether the statements below are True (T) or False (F).

A. Leaves on these trees have a large surface ☐

B. These trees have thick and leathery leaves ☐

C. Leaves on those trees contain morphological structures, which restrict transpiration ☐

D. These trees have significantly more stomata compared to plants that reside in humid and darker environments ☐

OK! YOU HAVE NOW COMPLETED BIOLOGY TASK A

Task A2 - Chemistry - Answer Sheet

In the following questions, circle the correct answer where appropriate.

Che 1. During the experiment, $CHCl_3$ is used

1 Mark

a) as a solvent

b) to increase the rate of the reaction

c) to avoid oxidation of the sample

d) to increase the yield of the reaction

Che 2. The conical flask is placed in the dark for 5 minutes

1 Mark

a) to avoid nitrogen in the air affecting the sample

b) to avoid a reaction between the oxygen in the air and the sample

c) to avoid any undesirable photochemical activity

d) to avoid any reducing activity by the air

Che 3. During the titration, a color change was observed due to the presence of a substance which acted as an indicator. Which of the compounds used during the experiment acted as the indicator?

1 Mark

a) $Na_2S_2O_3$

b) KI

c) CH_3COOH

d) starch

Che 4. Complete Table 1 below and carry out all necessary calculations bellow.

Table 1: Olive oil Sample A

5 Marks

	1st titration	2nd titration	3rd titration
Mass of Olive oil (g)			
Initial Volume of $Na_2S_2O_3(aq)$ (mL)			
Final Volume of $Na_2S_2O_3(aq)$ (mL)			
Volume of $Na_2S_2O_3(aq)$ used (mL)			
Peroxide Value (PV) (mmol/Kg)			
Average Peroxide Value (PV)			

Calculations

2.5 Marks

Che 5. Complete Table 2 below and carry out all necessary calculations bellow.

Table 2: Olive oil Sample B

5 Marks

	1st titration	2nd titration	3rd titration
Mass of Olive oil (g)			
Initial Volume of $Na_2S_2O_3(aq)$ (mL)			
Final Volume of $Na_2S_2O_3(aq)$ (mL)			
Volume of $Na_2S_2O_3(aq)$ used (mL)			
Peroxide Value (PV) (mmol/Kg)			
Average Peroxide Value (PV)			

Calculations

2.5 Marks

Che 6. When you compare the Peroxide Values (PV) for the two oils, which one do you think is more suitable for eating?

1 Mark

a) Sample A

b) Sample B

Che 7. You are given two samples of oil (samples C and D). Sample C has been stored in an open container for 5 months, while sample D has been recently manufactured. Is it possible to identify the two samples by measuring the PV for each?

1 Mark

a) Yes, because 5 months is required to deteriorate the sample oil

b) No, because PV remains constant over time

c) Yes, because PV increases with time

d) No, because storage occurs in an open container

Task A3 - Physics - Answer Sheet

Viscosity and Refractive Index of Olive-Oil

Task A3.1 - Measuring the olive-oil coefficient of viscosity

[Use the correct number of significant figures in measurements and calculations]

Proof of relationship (5):

_____

_____

_____

_____

_____

_____

Total: 2 points

A3.1a Measurement of the radius r of the plastic spheres. Calculation of their mass. Experimental calculation of the density ρ_s of the spheres.

Experimental calculation of the density (ρ_{ol}) of olive-oil.

_____

_____

_____

_____

_____

_____

r = _____ *m* = _____

ρ_s = _____ ρ_{ol} = _____

Total: 6 marks

A3.1b Calculation of the viscosity coefficient of olive-oil: follow the instructions described in step A3.1b of the work-sheet and fill-in table B:

TABLE B olive-oil (L=10cm)							
time t (s)					mean-time (s)	v (cm/s)	viscosity coefficient (Pa.s)

Total: 5 marks

Task A3.2 - Measuring the refractive index of olive-oil

From Ptolemy's law to Snell's law

A3.2a Record the measurements of the refractive angle β at the cells of the second column of table C1

TABLE C1					
angle of incidence α (degrees)	refraction angle β (degrees)	sinα	sinβ	$n_j=\sin\alpha_j/\sin\beta_j$	$n'_j=\alpha_j/\beta_j$
30		0,500			
40		0,643			
50		0,766			
60		0,866			
70		0,940			

A3.2b Experimental calculation of the refractive index of olive-oil.

Fill in the 4th column of table C1. Plot your graph, according to the instructions of the worksheet. Determine the refractive index of olive-oil (n_{oil}).

Calculations:

_____

_____

_____

n_{oil} =_____

Total: 15 marks

A3.2c Deviation of the experimental data from the theoretical predictions of Snell's law

Based on the experimental data recorded in table C1, fill in the 5th column of table C1. Calculate the deviation A_{Snell} of the experimental data from Snell's law predictions (to be helped, fill in the first and second columns of table C2). Express A_{Snell} in % percentage.

Show your calculations analytically:

TABLE C2			
nj (Snell)	deviations (Snell) $A_j = \left\| \frac{n_j - n_{oil}}{n_{oil}} \right\|$	n'j (Ptolemy)	deviations (Ptolemy) $A'_j = \left\| \frac{n'_j - n'_{oil}}{n'_{oil}} \right\|$
Mean deviation (Snell)		Mean deviation (Ptolemy)	

Calculations:

_____

_____

_____

_____

A_{Snell} = _____%.

Total: 5 marks

A3.2d Recursion in history: The law of Claudius Ptolemy

Based on table C1 and the instructions given in step A3.2d of the worksheet, draw the experimental straight line $a = n'_{oil} \cdot \beta$. Determine the refractive index (n'_{oil}) of olive-oil, according to Ptolemy's law.

Calculations:

_____

_____

_____

_____

_____

n'_{oil} = _____.

Total: 11 marks

Fill in the 6th column of table C1. Calculate the deviation $A_{Ptol.}$ of the experimental data from the theoretical predictions of Ptolemy's law, according to relationship (5) of the part A3.2d of the worksheet (to be helped, fill in the third and fourth column of table C2). Express $A_{Ptol.}$ in % percentage.

Calculations:

_____

_____

_____

_____

_____

$A_{Ptol.}$ = _____

Total: 4 marks

Choose the theory that seems best: A) Snell's? B) Ptolemy's?

OK! YOU HAVE NOW COMPLETED PHYSICS TASK A

Total marks for the task A3 - Physics (A3.1 and A3.2) = 11 + 35 = 46 marks