

1st

European Union Science Olympiad

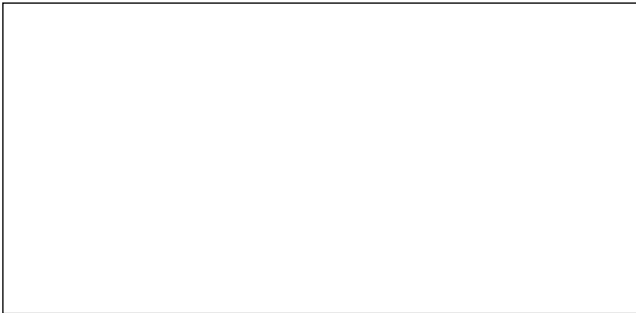
in Dublin, Ireland

TASK A ANSWER SHEET



Task A**Photosynthesis – Answer sheet****Task A.1: Chlorophyll extraction***5 Marks*

1. Write down the wavelengths of all absorbance maxima in your spectrum:



Graph 1: Absorbance spectrum of extracted chlorophyll.

**Task A.2: Nanocrystalline solar cell***25 Marks*

2. Illustrate with a small diagram how you decided which side of the transparent slide is conducting. Write down the values of the measurements you made.



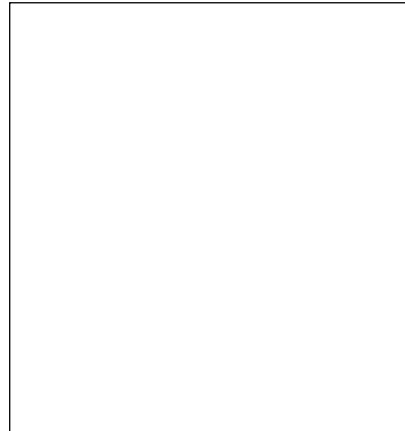
3. What is the open circuit voltage with the light source ~9 cm from the chlorophyll-dyed cell when it is exposed to light and when the cell is covered with the black-out cloth?



4. List in table 1 the variation of the open circuit voltage V_{oc} for various levels of illumination for both the silicon photodiode and the Graetzel cell. Indicate, using a small diagram, how you varied the intensity falling on the cells:

Table 1:

Graetzel cell	Silicon photodiode



Experimental setup.

5. Plot, in a graph labeled "Graph 2", the value of V_{oc} for the silicon photodiode on the horizontal axis of a graph and of V_{oc} for the Graetzel cell on the vertical axis for each level of illumination.



Graph 2: Open Circuit voltages of the Graetzel cell vs. the silicium photodiode.

6. From a best fit line, determine the slope of the graph of V_{oc} of the Graetzel cell versus V_{oc} of the silicon photodiode:



7. The Graetzel cell has a much slower response to variations in light intensity, which you may easily verify. Mark the possible reasons given below for the large difference in response times for these two cells which you feel are plausible. (More than one reason may be correct).

	Yes	No
(a) The open circuit voltage of the Graetzel cell is smaller than that of the silicon photodiode.		
(b) The Graetzel cell stores more electrical energy than the silicon photodiode.		
(c) The transport of charge between various media in the Graetzel cell is slower than in the silicon photodiode.		
(d) The Graetzel cell is more sensitive to the heating effect of the lamp than the silicon photodiode.		
(e) Light causes an irreversible chemical reaction in the Graetzel cell, but not in the silicon photodiode.		

8. Estimate the response time for the Graetzel cell.

Task A.3: Photochemical reduction of indophenol 20 Marks

9. Indicate which colour change occurs for solutions 1 and 2. Choose between: (A) no change; (B) the solution turns red; (C) the solution turns colourless; (D) the solution first turns red, then colourless.

From this experiment, would you agree that: (Circle the correct answer for each statement)

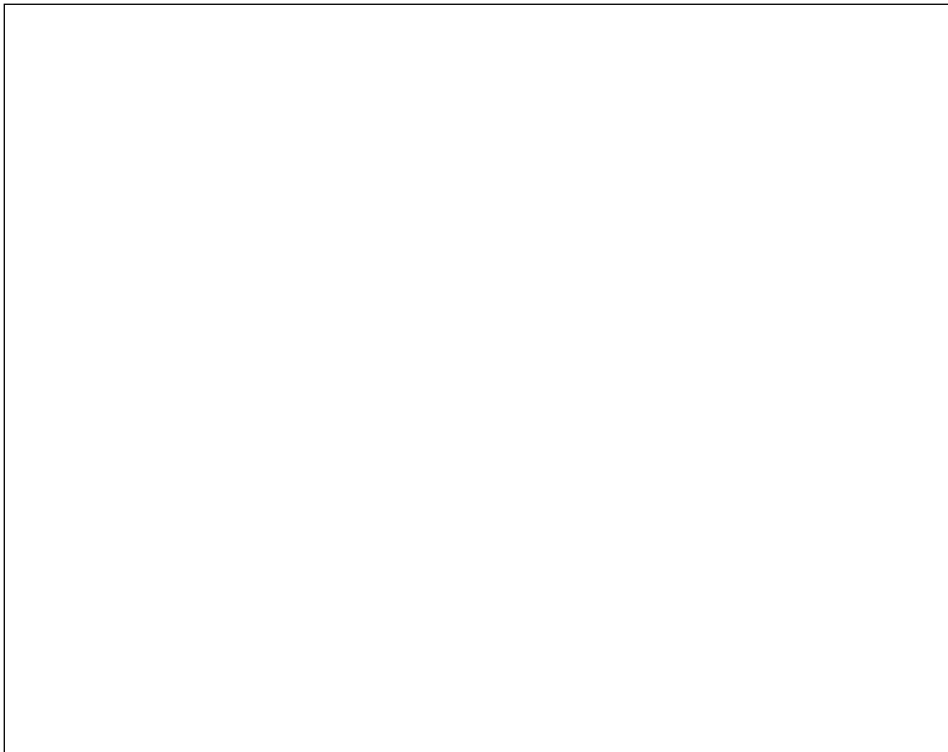
Ascorbic acid has no effect on DPIP	Yes	
Ascorbic acid is able to reduce DPIP		No
Ascorbic acid is able to oxidise DPIP	Yes	
Ascorbic acid is a strong acid and changes the pH of the solution which may result in the colour changes observed	Yes	
The pH of DPIP solution is important		No



10. Indicate whether the solution is (I) blue, (II) light blue, (III) colourless or (IV) light green:

Solution No.	Set A	Set B
1		
2		
3		

11. Optimum wavelength chosen:



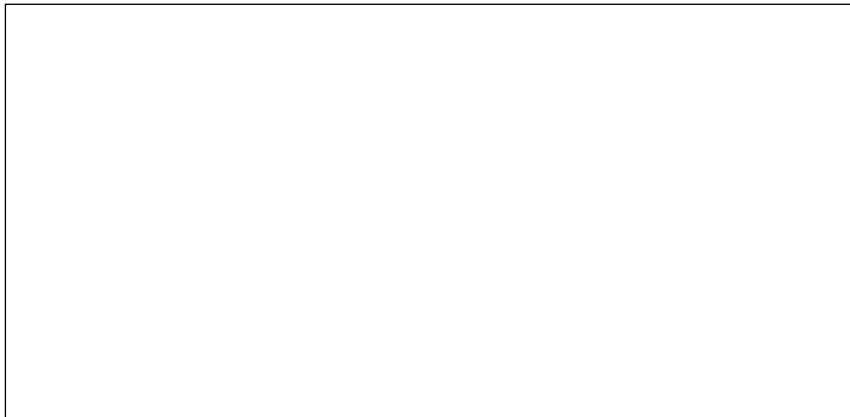
Graph 3: UV-Vis spectra of solution D after 0, 5, 10 and 15 minutes of photolysis.



13. Using the graph paper provided determine the rate of photochemical reduction of DPIP for each solution examined in Abs/min (Abs is absorbance). Label graphs as 'Graph 4' and 'Graph 5'. Use the space below for calculations.



Graph 4: Absorbance against time for sample E.



Graph 5: Absorbance against time for sample F.

Rate of photochemical reduction of DPIP:

