LIGHT ENERGY

ECOLOGY

13/05/2008 – TEST 1A

Country: …….

Team: …….

Time: 1hour 15 min: ……

SAFETY ASPECTS OF FIELD WORK

It is imperative that students should cooperate by behaving responsibly in order to reduce the risks of accidents. You are specifically asked to:

- Observe all safety instructions given by party leaders or supervisors. Anyone not conforming to the standards required may be **dismissed** from the field course.
- Stay with the party, except by clear arrangement with the leaders. Assemble where requested in order to receive specific instructions regarding likely hazards.
- You must report any injury or illness.

Illness of Participants in the Field

Participants must notify a supervisor of any relevant medical problems. Problems may include asthma, or other breathing or heart problems, nausea, back problems, limb problems and diabetes.

Heat and sun

We shall be working under clear skies most of the time, and there will be no shade at some sites. It is essential that a cap (provided) or other head covering is worn. Clothes that allow you to cover up and are loose should be worn. Sun block on all exposed skin will also be needed. It is essential that enough water is drunk during the day as it is very easy to get dehydrated. It is suggested that you drink little and often, and do not wait until you feel thirsty. Anyone feeling unwell in the field must inform a supervisor.

Animal bites

Although snakes are sometimes seen in the grass or on footpaths bites are very rare. If you do not disturb them they will not normally attack. Look out for them on rough ground. Hospital treatment (anti-venom serum) will be needed in the case of a bite from a blunt nosed viper. You must also report any insect (ex. bee) or spider bites.

First Aid

Persons leading field trips are nowadays often registered First-Aiders. Suitable first-aid kits are available during the field work.

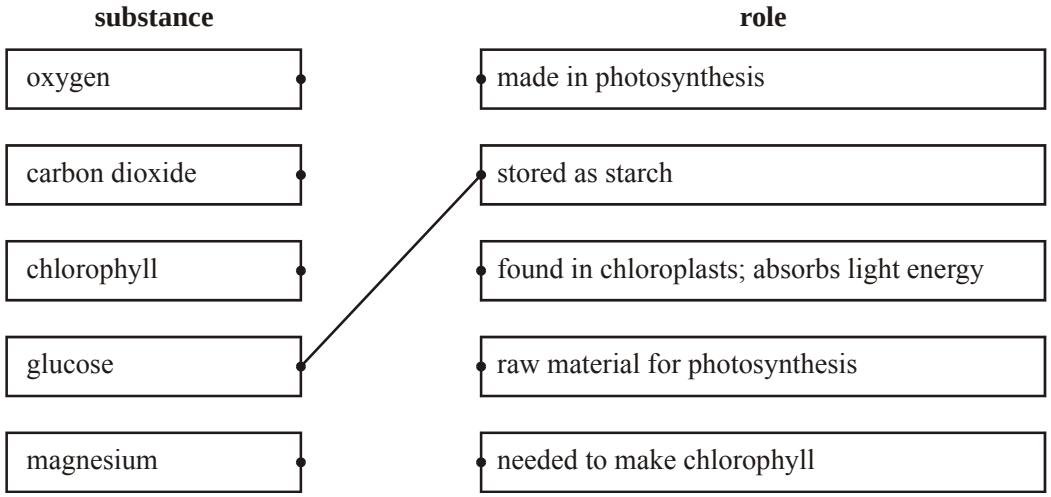
Normal field equipment (without all of these items you will not be able to do all of the work required)

- Hand lens
- Hard pencils. Also a spare pencil.
- Pens with black ink.
- Eraser
- Ruler
- Pencil sharpener
- Board for writing
- Your calculator

CONTENTS	MARKS
Science Questions 1/2/3/4	15
Experiment 1	1
Experiment 2	8
Experiment 3	5
Experiment 4	21

SCIENCE QUESTIONS 1

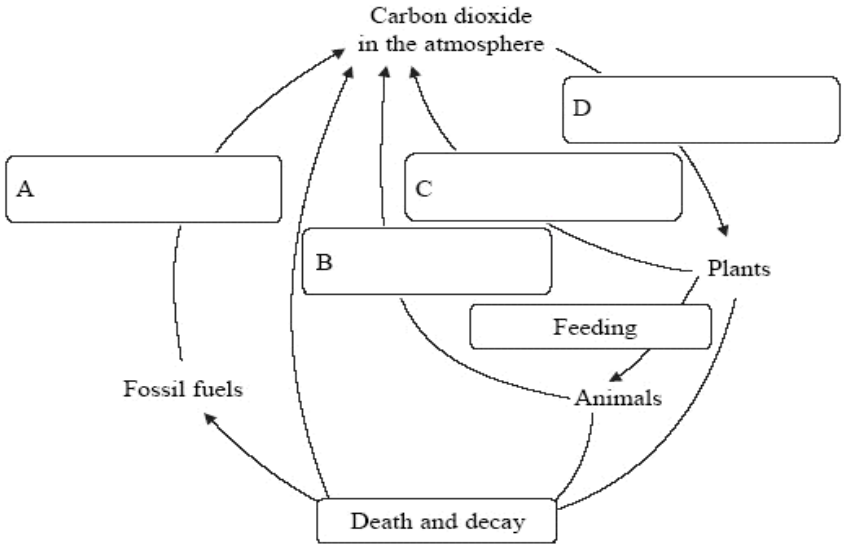
Energy exists in many forms: heat, light energy, chemical energy, mechanical energy, and electrical energy. Plants use light energy for photosynthesis, which is used to make organic molecules. Draw a straight line from each substance to its role in photosynthesis. One has been done for you. Draw only one line to connect each box.



(2 marks)

SCIENCE QUESTIONS 2

The diagram below shows a simplified carbon cycle. All life is based on carbon. Proteins, carbohydrates and other molecules essential for life contain carbon, so living organisms must have carbon available to them. Carbon cycles between the abiotic and biotic components of the environment.



(a) Each box represents a process. Write the correct letter OR letters which represent each process in the table below.

NAME OF PROCESS	LETTER
respiration	
combustion	
photosynthesis	

(2 marks)

(b) Look inside your quadrat ($1m^2$ square box) to identify any possible carbon sink (actively accumulating carbon) without actually performing an experiment.

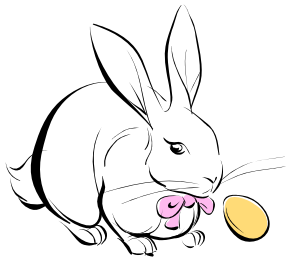
Draw a circle around the correct answer/answers

A	plant
B	snail (when alive)
C	minerals
D	organic matter in soil

(2 marks)

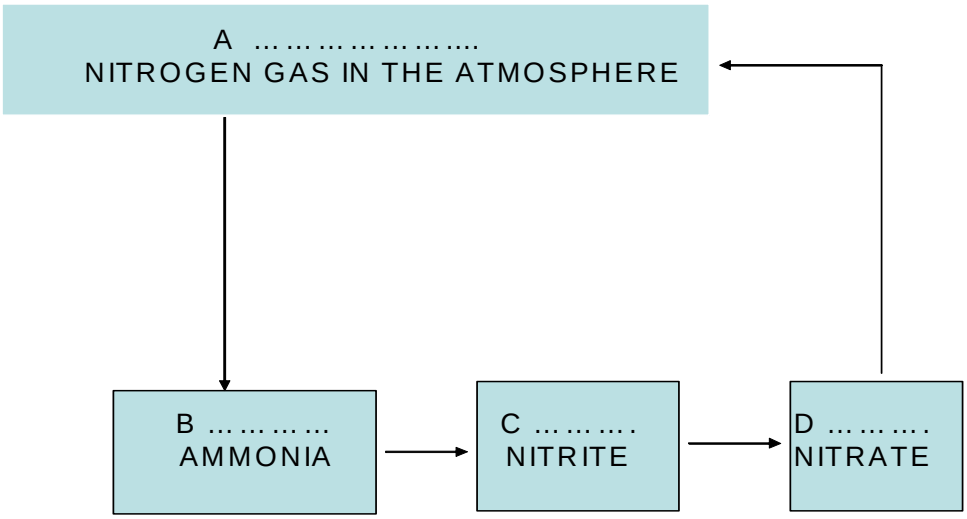
SCIENCE QUESTIONS 3

(a) Grazing mammals have an important role to play in the recycling of nutrients on the grassland.



Their **dung** is rich in organic nitrogen-containing compounds. These compounds are converted to nitrates. Most plants obtain the nitrogen they need as inorganic nitrate from the soil solution. The diagram below shows part of the **nitrogen cycle**. You are required to **write the chemical formulae of each substances/ions** present in the cycle below.

(4 marks)



SCIENCE QUESTIONS 4

A group of students wanted to produce a pyramid of fresh biomass for a field. They carried out the procedure described below.

- A fine mesh cage was used to enclose part of the field. All the plant material inside the cage was cut down to ground level and weighed. All the animals in the enclosed area were collected and identified. They were then sorted into herbivores or carnivores and weighed.
- The fresh biomass of the organisms present is given in the table below.

(a) Use the data in the table to construct a pyramid of fresh biomass on the ***graph paper on page 11***

Organisms	**Fresh biomass / g**
Green plans	2260
Herbivores	240
Carnivores	40

(2 marks)

(b) Calculate the percentage loss in fresh biomass between the green plants and the herbivores. Show your working.

Answer .....

(2 marks)

(c) Draw a circle around the correct answer which explains why only a small percentage of the light energy that falls on green plants is incorporated into biomass.

I light is partly reflected and transmitted

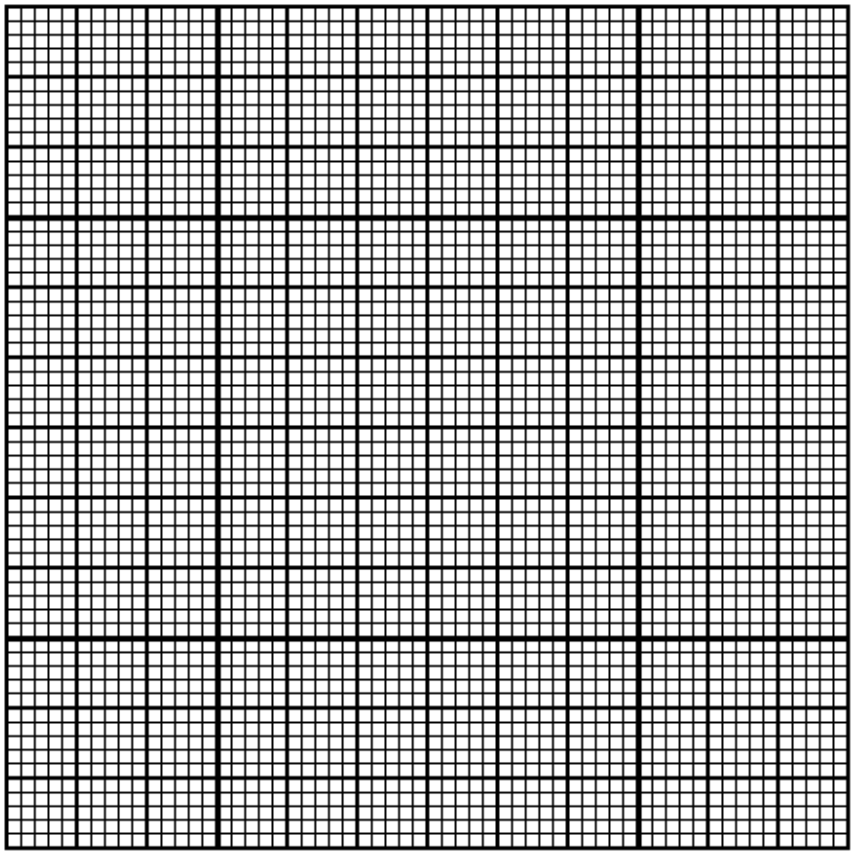
II light energy is partly converted into heat energy

III some wavelengths of light are not utilised by chlorophyll in photosynthesis

IV the biochemical energy conversion efficiency is not 100%

A	Only I and II are correct
B	Only II, III and IV are correct
C	Only I, III and IV are correct
D	I, II, III and IV are correct

(1 mark)



EXPERIMENT 1

Determine the plant genus/group of *Convolvulus oleifolius* (see photo and plant present in your quadrat) with the help of the pictures provided below and on the next page**.**

The dichotomous key applies to members of the genera included in the book

'Trees and shrubs in Cyprus' Tsingis T.K. *et al.* and the key

Draw a circle around the correct group

1. Leaves are compound ►2
   Leaves are simple ► 3

2. Leaves opposite ►Group A
   Leaves alternate, spirally or variously arranged ►Group B

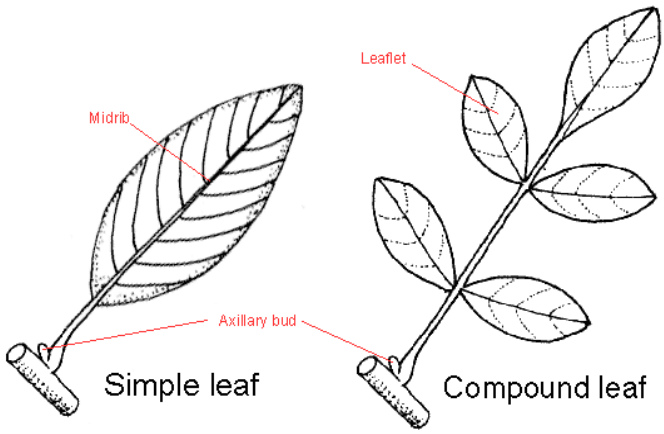
3. Leaves are opposite ►4
   Leaves are alternate, spirally or variously arranged ►5

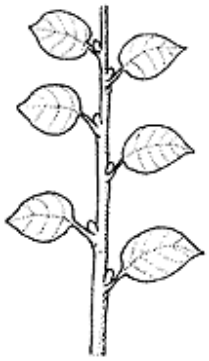
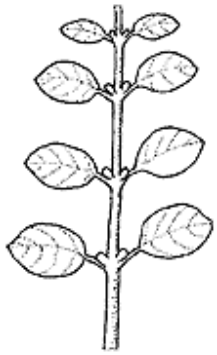
4. Leaves with obvious lamina*, entire or lobed ► Group C
   Leaves needle-shaped, spiny or scale-like ► Group D

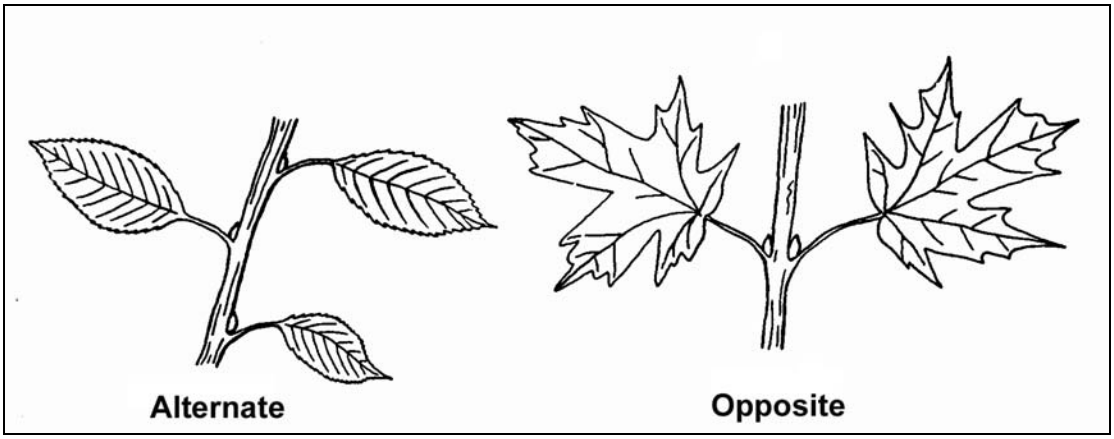
5. Leaves with obvious lamina, entire or lobed ► Group E
   Leaves needle-shaped, spiny or scale-like ► Group F

*Lamina: the blade of the leaf that usually bears the chlorophyll

(1 mark)



	Alternate	Opposite
Simple		
Compound		



EXPERIMENT 2

(a) Draw on the blank next page a flower of *Cistus creticus* (magnified approximately 10X) indicating clearly the reproductive organs (clear drawing, straight lines, no shading):

A	Stigma
B	Style
C	Ovary
D	Anther
E	Filament
F	Petals

A supervisor will indicate a plant in blossom that you can draw.

Make sure that you label with letters your drawing otherwise you will be deducted 3 marks.

Materials

- Hand lens
- Pencil
- Ruler

(5 marks)

(b) Select three features which indicate that the flower of *Cistus creticus* is pollinated by insects. Draw a circle around each correct answer

A. Large petals

B. Small petals

C. Hanging anthers

D. Small anthers

E. Presence of large numbers of pollen

F. Presence of small numbers of pollen

(3 marks)

EXPERIMENT 3

Read the following passage about the adaptations of *Convolvulus oleifolius* to life in dry conditions, and then write on the dotted lines the most appropriate **letter** to complete the passage.

Plants which live in habitats where there is shortage of water often have..... on the surface of their leaves, to reduce water loss by trapping a layer of still air around the leaf. This effect is also achieved by curling or rolling the leaves, so that the surface bearing most of the ..... through which water loss occurs, is on the inside. Leaves may also have a thick waxy ..... to reduce evaporation. Another adaptation is for the leaves to have a ..... by having narrow linear leaves instead of broad leaves. Plants with such adaptations are known as ..... .

A. Stomata

B. Cuticle

C. Large Surface area

D. Xerophytes

E. Hydrophytes

F. Small surface area

G. Mesophytes

H. Hairs

I. Cells

J. Protein

(marks 5)

EXPERIMENT 4

INTRODUCTION

ATHALASSA PARK, NICOSIA

Thyme is indigenous in Cyprus, very common to rocky slopes, disturbed ground and occasionally on sand dunes, in shrub lands and forests. It grows on all types of soils, as it is a low demanding plant and it prevents soil erosion. Thyme has been well known since ancient times as a good source of nectar for honey bees and for its aromatic and medicinal properties. “Thyme is a source of food for bees” (Aristotle *Historia animalium*). Shepherds also used it as fuel for making the local goat cheese. Such was the demand for thyme that there was a class of traders called “throumpopoulides” (sellers of thyme).

VISALIA, California: David Bradshaw has endured countless stings during his life as a beekeeper, but he got the shock of his career when he opened his boxes last month and found half of his 100 million bees missing.

In 24 states across America, beekeepers have gone through similar shocks as their bees have been disappearing inexplicably at an alarming rate, threatening not only their livelihoods but also the production of numerous crops, including California almonds, one of the nation's most profitable crops.

The sudden mysterious losses are highlighting the critical link that honeybees play in the long chain that gets fruit and vegetables to supermarkets and dinner tables across the country. Beekeepers have fought regional bee crises before, but this is the first US national affliction.

In a mystery worthy of Agatha Christie, bees are flying off in search of pollen and nectar and simply never returning to their colonies. And nobody knows why.

Researchers say the bees are presumably dying in the fields, perhaps becoming exhausted or simply disoriented and eventually falling victim to the cold.

As researchers scramble to find answers to the syndrome they have decided to call it “colony collapse disorder”. Growers are becoming openly nervous about the capability of the commercial bee industry to meet the growing demand for bees to pollinate dozens of crops, from almonds to avocados to kiwis.

A Cornell University study has estimated that honeybees annually pollinate more than $14 billion worth of seeds and crops in the United States, mostly fruits, vegetables and nuts.

“Every third bite we consume in our diet is dependent on a honeybee to pollinate that food”, said Zac Browning, Vice President of the American Beekeeping Federation.

Growers have tried before to do without bees. In past decades, they have used everything from giant blowers to helicopters to mortar shells to try to spread pollen across the plants.

More recently, researchers have been trying to develop “self-pollinating” almond trees that will require fewer bees. One company is even trying to commercialize a “blue orchard bee” that is stingless and works at colder temperatures than the honeybee.

Once the domain of hobbyists with a handful of backyard hives, beekeeping has now become increasingly commercial and consolidated. Over the last two decades, the

number of beehives, now estimated by the US Agriculture Department to be 2.4 million, has dropped by a quarter and the number of beekeepers by half.

"There are less beekeepers, less bees, yet more crops to pollinate", Browning said. "While this sounds sweet for the bee business, with so much added loss and expense due to disease, pests and higher equipment costs, profitability is actually falling".

About 15 worried beekeepers convened in Florida this month to brainstorm with researchers on how to cope with the extensive bee losses.

Investigators are collecting samples and exploring a range of theories for the colony collapse disorder, including viruses, a fungus, poor bee nutrition and electromagnetic waves from mobile phones.

They are also studying a group of pesticides that were banned in some European countries, including France, to see if they are somehow affecting bees' innate ability to find their way back home. **It could just be that the bees are stressed out.**

By Alexei Barrionuevo (paper adapted) Published: February 27, 2007 Herald Tribune International

A Cypriot amateur beekeeper has kept bee hives in his garden for the last three years but he has not been able to increase their number. This year Cyprus has had very little rain fall and it faces desertification. The bee hives have not produced swarms and two beehives have perished. Human impact on the environment has been severe and it seems that bees and plants need to adapt in an ecosystem that has been modified by humans.

Athalassa Park is the result of afforestation (deliberate planting in an area which had not recently been a forest land. The bee keeper has developed a theory that states "The number of thyme and corridothymus plants in Athalassa Park is declining due to human impact. As a result the bee populations have decreased due to lack of nutrients."

It could be that *Thymus capitatus* plants are stressed out

Your team is expected to *plan an investigation* to estimated how the density of two specific plants (*Convolvulus oleifolius and Thymus capitatus*) that are present in "ATHALASSA PARK" ecosystem (picture page 19) will be affected over the next five years.

"Field technique" to put it simply means you need to record what is there, how much of it is there and where it is within the area you are investigating. The techniques you use depend very much on the area being investigated and the nature of organisms there.

(a) Check your definitions, match relevant terms to the descriptions given.

(A) Population or (B) community

A group of individuals in a species is a …….

All organisms in a habitat is described as a …….

(C) Numbers or (D) density

Population size refers to the ……. in a population

Population ……. refers to numbers in a given area or volume

(2 marks)


You are here
© 2008 Europa Technologies
Image © 2008 DigitalGlobe
Google
35°07'38.06" N 33°23'27.92" E
elev 180 m
Jun 11, 2006
Eye alt 1.95 km

(b) ***SELECT SEVEN ROMAN NUMBERS THAT REPRESENT THE BEST METHOD /PLAN FOR SUCH AN INVESTIGATION***

Draw a circle around each correct answer

I. Equally spaced quadrats sampling the area systematically

II. Random selection of sampling area using randomly established coordinates

III. Investigate all the abiotic factors: Temperature/ Light intensity/ Relative humidity/ Wind speed/ pH/ Nature of particles/ Nutrients/humus

IV. Investigate zones at same time of day / season / for the next five years

V. Investigate suitable-sized area of 100 m^2

VI. Use a standard quadrat size 1 m^2

VII. Use a standard quadrat size 10 m^2

VIII. Standardisation of collecting method e.g. standard sweep of insects

IX. Suitable, named method of collection, e.g. pooter / sweep net / pitfall trap

X. Sensible method of preventing escape

XI. Method of species identification e.g. use of key

XII. Minimize damage to the habitat

(7 marks)

(c) If the area under investigation is 100m^2 how many samples/quadrats within a 100 m^2 area would **your team** investigate? Draw a circle around the correct answer.

- 1
- 10
- 50

(1 mark)

(d) Using your assigned quadrat, please complete the table given to you.

Quadrat /number	*Convolvulus oleifolius* **/Number**	*Thymus capitatus* **/Number**
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
Total number of each plant species		
Estimated Mean Density		

(marks 5)

(e) Limitations of your experiment. Indicate whether the statement/ limitation is true or false

- Difficult to control all abiotic factors **TRUE OR FALSE**
- Not all plants are counted/ difficult to identify them **TRUE OR FALSE**
- Area selected may not represent plant density **TRUE OR FALSE**
- No repetition has been carried out **TRUE OR FALSE**
- There may be seasonal variation in plant distribution **TRUE OR FALSE**

(5 marks)

A very common indigenous species in Cyprus growing on rocky slopes and in forests. The glands on the tips of the hairs of creticus contain the medicinal and aromatic resinous substance “ladanum”. During spring the shepherds would drive the goats to the bushes because the ladanum adheres to the hairs and beards. Later, they cut off the hairs, boil them and obtain the valuable substance. Ladanum was exported to Egypt and used in perfumery and soap making.