BA SANGAM COLLEGE

YEAR 13

BIOLOGY

WORKSHEET 5

STRAND 1   STRUCTURE AND LIFE PROCESSES

1. In tomatoes, plants homozygous for the hairy (HH) and purple (GG) stem phenotypes were crossed with hairless (hh) and green (gg) stem plants.

The F1 offspring were test-crossed with a hairless and green tomato plant and the F2 offspring are as follows:

Hairy with purple stem - 39

Hairy with green stem - 11

Hairless with purple stem - 9

Hairless with green stem - 41

(i) What information in the result indicates that the genes for stem texture and stem colour are linked?

(ii) Calculate the percentage recombination between the two genes. Show your working.

(iii) What is the distance (in map units) between the gene for stem texture and the gene for stem colour?

(iv) If the genes for stem texture and stem colour were **not** linked, calculate the number of tomatoes that would be represented by each of the four phenotypes in the F2 generation. Show your working.

2. Use the table below to answer the questions that follow.

First base		Second base				Third base
		U	C	A	G	
	U	phe	ser	tyr	cyst	U
		phe	ser	tyr	cyst	C
		leu	ser	STOP	STOP	A
		leu	ser	STOP	trp	G
	C	leu	pro	his	arg	U
		leu	pro	his	arg	C
		leu	pro	gin	arg	A
		leu	pro	gin	arg	G
	A	ile	thr	asn	ser	U
		ile	thr	asn	ser	C
		ile	thr	lys	arg	A
		met(+START)	thr	lys	arg	G
	G	val	ala	asp	gly	U
		val	ala	asp	gly	C
		val	ala	glu	gly	A
		val	ala	glu	gly	G

Adapted from: *Biology Revision Form 7*, Hanson, M., 1999.

(i) Determine the order of the amino acids coded for by the "read" strand AGGTAGCTAGGC.

(ii) What is the advantage of some amino acids being coded for by two or more codons?

3. Thalassaemia is a hereditary disease characterised by reduced rate of haemoglobin production resulting in severe anaemia. It is produced when an individual is homozygous for an autosomal recessive gene and usually

the individual dies in early childhood. The result of a research showed that 1 in 3 600 individuals in a local area are affected by this disorder.

(i) Calculate the frequency of this recessive allele in the human population of this local area.

(ii) A child who is homozygous recessive for this allele often dies at the age of six. Does this mean that the recessive allele will, in a few more generations, be removed from the population? Explain your answer.

4. Cystic fibrosis is a genetic disorder which causes death in the homozygous recessive individuals in their teenage years. Every 100 in 10,000 babies are born with cystic fibrosis.

(i) In natural populations it is difficult for the gene frequencies to exist in the Hardy Weinberg equilibrium. Give **one** reason why this is likely to occur.

(ii) Calculate the frequency of the recessive allele in the population.

(iii) In a population of 10,000 babies, how many babies would be the carriers of this allele?

5. Read the passage below and use it to answer the questions that follow.

> The bacterium *Staphylococcus aureus* (or golden staph) is responsible for many pus forming infections, particularly boils and open wounds. Many strains of this bacterium have evolved resistance to antibiotics. Outbreaks of severe infections regularly occur in many large hospitals. A strain of *S. aureus* was found to be resistant to all antibiotics. This resistance is a genetically determined trait in the bacteria

(i) Outline **four** important steps in natural selection which have led to the evolution of resistant strains of *S. aureus*.

(ii) Why would hospitals provide a suitable environment for the rapid evolution of bacteria?

(iii) State **two** particular features of bacteria which contribute to the rapid evolution of new strains.

(iv) *Staphylococcus* bacteria have developed resistance to the antibiotic activity of penicillin.
Identify the type of selection that has occurred and explain how such antibiotic-resistant bacteria continue to occur over generations.

6. The questions that follow are related to the description of a type of speciation given below.
A species of fish in a lake may be separated into a number of populations by physical factors.
Source : *Essentials of Biology,* Robert Smith, 2001.

(i) Name a physical factor.

(ii) Name the type of speciation described above.

(iii) State **two** ways by which prezygotic isolation prevents interbreeding between members of different species of fish.

7. Describe **two** features of the primitive atmosphere before the simple cells appeared.

8.Which of the following statements about the primitive atmosphere is **false** ?

A. It had heterotrophs that can survive with organic molecules and without oxygen.

B. It was the atmosphere of the earth before living things first appeared.

C. It was a reducing atmosphere.

D. It allowed chemical reactions to form inorganic molecules which become dissolved in seas.