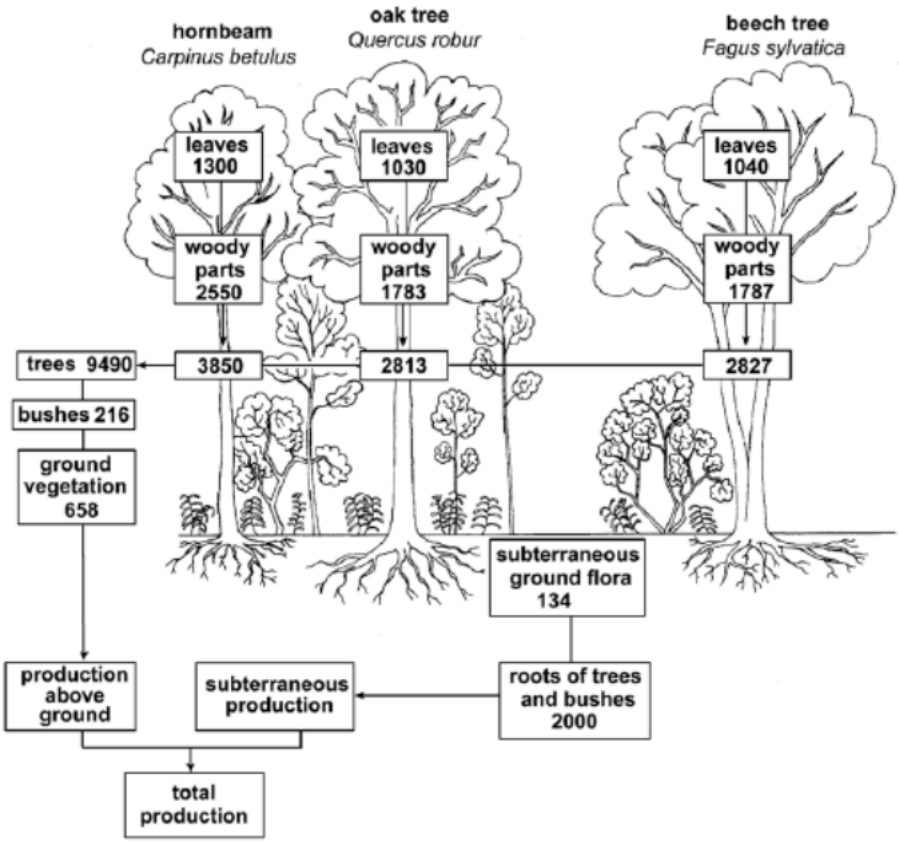
Sample question 1

The picture shows a schematic representation of the production of three well-known trees of a deciduous forest. The production is indicated in kg dry mass per hectare per year.

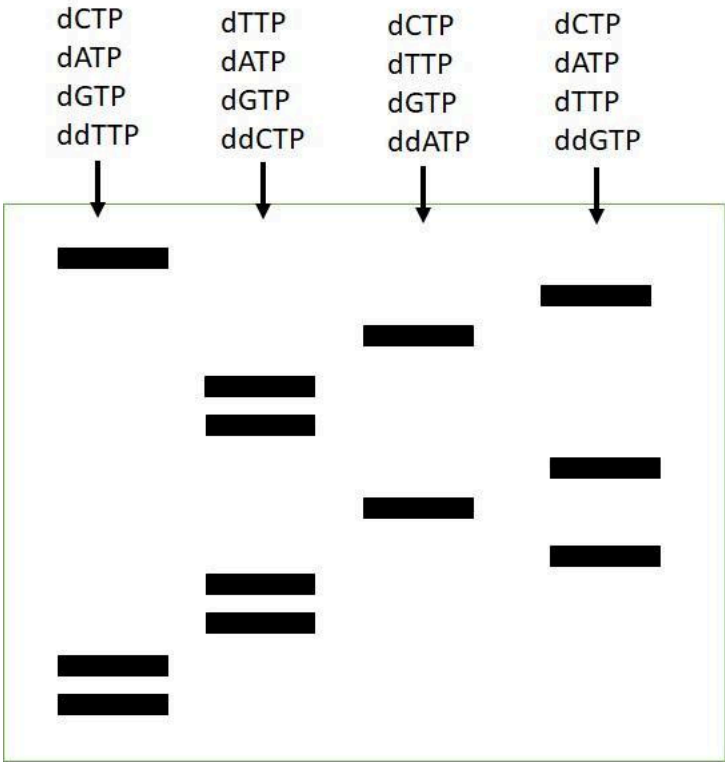


Calculate how much of the total production comes from beech trees. Give your answer as a percentage (%) rounded to an integer (without any decimals).

……..

Sample question 2

Sequencing reactions are an in-vitro replication technique that uses two different types of nucleotides called dNTPs and ddNTPs. Four sequencing reactions were performed with the dNTP and ddNTPs mentioned above the acrylamide gel and the resulting band patterns were separated according to size after running a gel electrophoresis.



Using the gel information, determine what the sequence of the fragment is using the 4 letter code and write the sequence in the 5' to 3 ' direction. Write the DNA sequence only using capital letters with no space between the letters.

……

Sample question 3

The Sac*charomyces cerevisiae* peptide mating pheromones a-factor and α-factor are small peptide signaling molecules, secreted by haploid cells of opposite mating types (MATa and MATα, respectively), that promote mating in yeast. Both factors are required to induce mating through their cell-cell signaling. The diagram below is a simplified view of the process of cell-cell signaling.

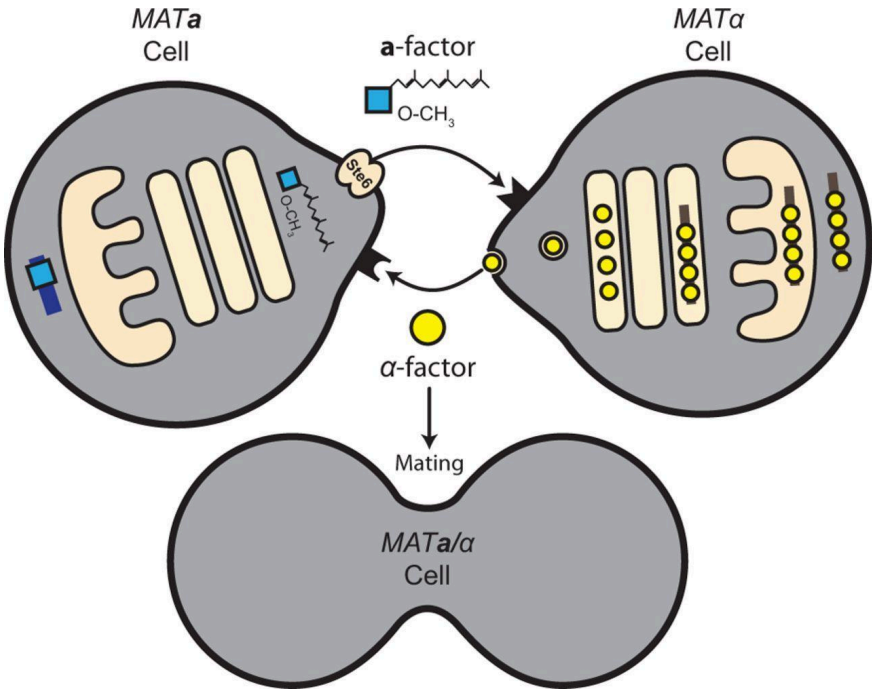


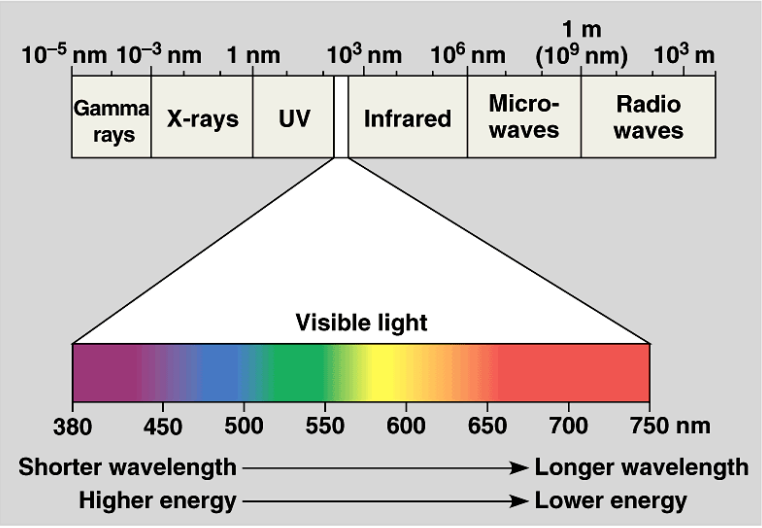
Image from: Michaelis S, Barrowman J. 2012. Biogenesis of the *Saccharomyces cerevisiae* Pheromone a-Factor, from Yeast Mating to Human Disease. Microbiol Mol Biol Rev 76:.

Based on this diagram and your knowledge of cell-cell communication, indicate if the following statements are True or False:

Statement	**T**	**F**
Prior to export, the a-factor is synthesized, including farnesylation, carboxymethylation, and additional proteolytic cleaves in the cytosol of the a-cell.		
Proteolytic processing of the α-factor is processed in the usual means in the ER prior to moving to the Golgi and then onto export to the cell.		
a-factor is hydrophilic and α-factor is hydrophobic		
In recent studies, the mutation of Ste6 prevents the exportation of the a-factor from the cell, thus preventing fusion of the 2 mating cells.		

Sample question 4

Visible light is an electromagnetic energy made of various wavelengths ranging from 380 nm to 750 nm. We perceive these wavelengths as different colors. As light meets matter, the light may be reflected, transmitted or absorbed. Proteins and nucleic acids absorb light in the ultraviolet range. Substances that absorb visible light are called pigments. These molecules are coloured and absorb wavelengths of light in a characteristic pattern giving them their colour.



A spectrophotometer is an instrument that produces UV or white light that is then split in its individual wavelengths. The selected wavelength is passed through a sample and the amount of light that is transmitted/reflected or absorbed is measured.

Determine whether the following statements about spectrophotometry are true (T) or false (F)

Statement	**T**	**F**
A spectrophotometer can only quantify the amount of coloured substances.		
Absorbance is usually used in biological systems because it is directly related to the concentration of the substance in solution.		
An orange is orange because it absorbs orange light.		
There is no relationship between transmittance and absorption.		

Sample question 5

The following question is about the use of a hemocytometer. The preparation of the sample started with a 100 µl sample and the addition of 100 µl of dye to delineate alive/dead cells. Using the Logical Count method, answer the following questions based on this information and diagram below.

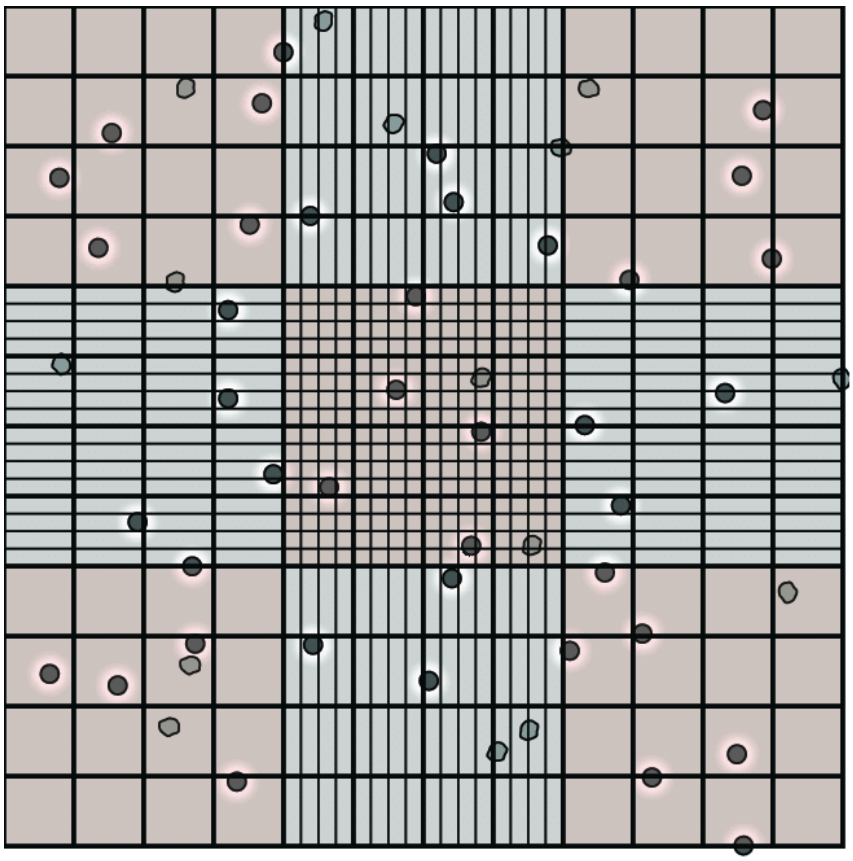


Fig. 1. Live cells are phase bright (represented as circles with white halos) and dead cells are phase dark and tend to be irregularly shaped (represented by gray irregular shapes).

a) What percent of the sample represents viable cells (express as a whole number value)? …….

b) What is the dilution factor for the sample?
   a. 0
   b. 0.5
   c. 1
   d. 2
   e. 100

c) What is the concentration of cells in the original sample (total cells/ml, written as a whole number):

   ……..……

d) If your original sample was 12 mL, how many living cells are in the original sample (in scientific notation with 2 significant figures):

   ……..……

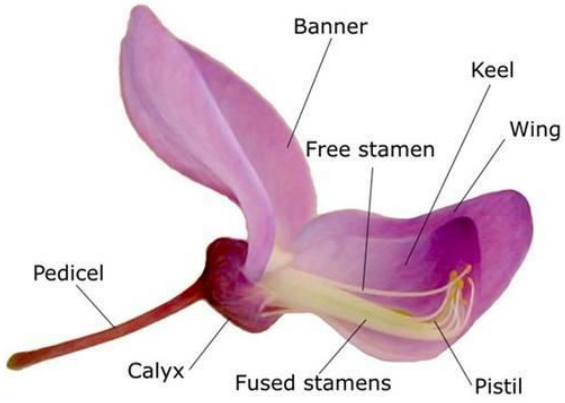
Sample question 6

Match the flowers shown below with their respective floral formula by selecting the letter for the correct Specimen from the selection shown below each of the floral formulae.

Specimen A

Specimen B

Specimen C



Specimen D

$\underline{CaZ^3CoZ^3A^1}$ $G\textcircled{3}$	$\underline{Ca^5\ Co^{2+3}\ A^{10}\ G}$	$\underline{Ca^4\ Co^4\ A^{4+2}\ G^2}$	$\underline{Ca^5\ Co^5\ A^{5-\infty}\ G^5}$
A B C D	A B C D	A B C D	A B C D

(Letters correspond to the specimens shown above)

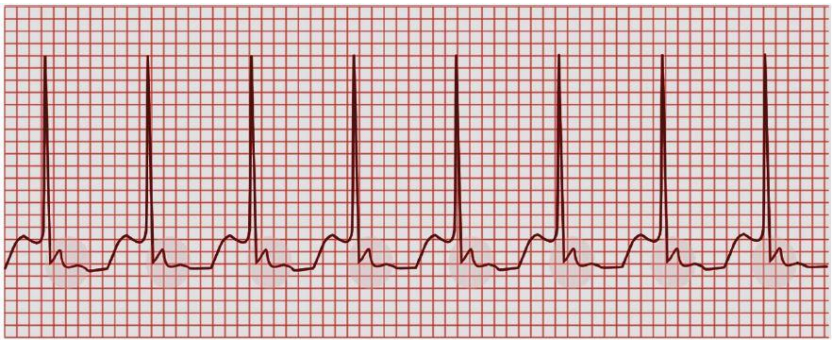
Sample question 7

The electrocardiogram (ECG) is a diagnostic test used routinely to assess normal cardiac function or any problems associated with it. Results are printed in ECG paper, with time measured along the horizontal axis. Each small square is 1 mm in length and represents 0.04 seconds. Voltage is measured along the vertical axis. Ten mm is equal to 1mV in voltage.

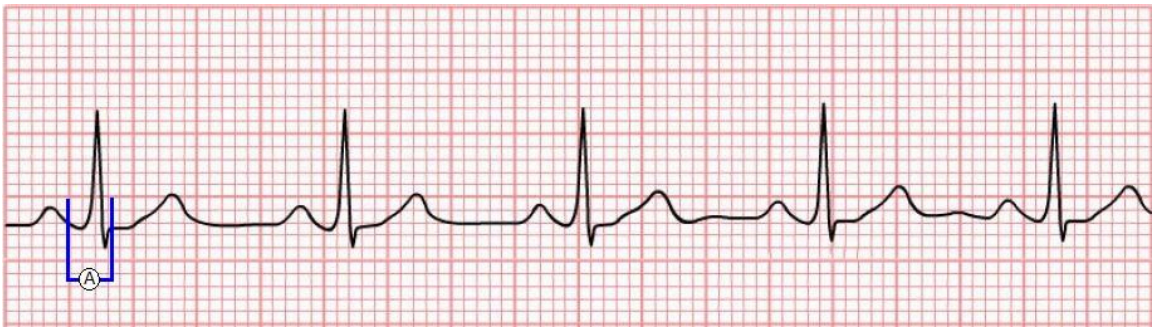
Here are some normal ECG values and two sample ECGs:

Heart rate	60 - 100 bpm
PR interval	0.12 - 0.20 s
QRS interval	≤ 0.12 s
QT interval	< R-R interval (males < 0.40 s ; females < 0.44 s)

Patient I



Patient II



Use the data provided and your knowledge of biology to determine which of the following statements are true and which ones are false, based on your analysis of the two ECGs shown above.

Note: round your answer to the nearest whole number for any calculations.

Statement	**T**	**F**
Patient I's heart rate is approximately 130% faster than that of Patient II.		
In Patient II's ECG, the segment labelled A represents depolarisation of the ventricles.		
Patient I's ECG shows increased activity of the atrioventricular bundle fibres.		
The QT interval is increased in Patient I.		