When does chromosome crossing over occur?

A. Growth Phase
B. Synthesis Phase
C. Mitosis
D. Meiosis 1
E. Meiosis 2

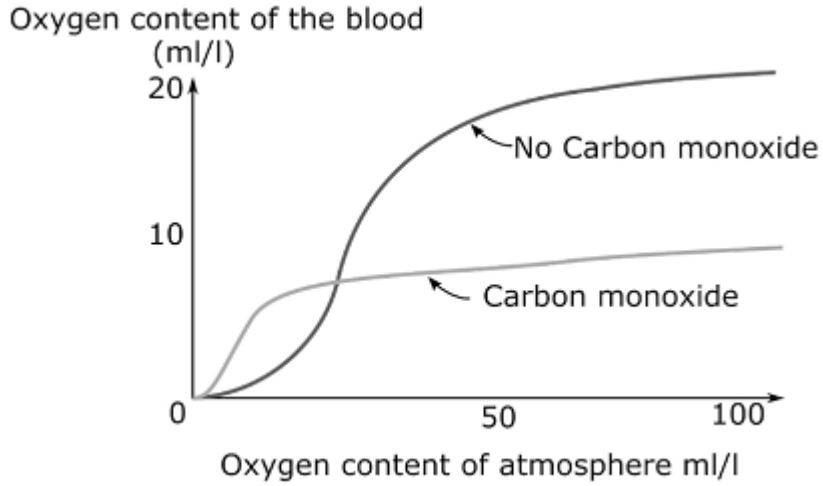
What do lipases break down?

A. Complex carbohydrates
B. Simple carbohydrates
C. Proteins
D. Fats
E. Vitamins

Pavlov's dogs are famous for salivating when they heard a bell ring.
What is the best explanation for this?

A. The bell made the dogs hungry
B. The dogs learnt that food appears when the bell rings
C. The bell sounds like the dogs' food bowls
D. The bell hurts the dogs' ears
E. The dogs salivate after any loud noise

Carbon monoxide is a poisonous gas which can be released by poorly burning fuels.
It enters the blood and binds haemoglobin very tightly.
The amount of oxygen in blood has been plotted against the concentration of oxygen in the atmosphere, with and without the presence of carbon monoxide.



Which of the following is true?

A. Carbon monoxide increases the tightness of binding (affinity) of haemoglobin for oxygen

B. Carbon monoxide increases the solubility of oxygen in the blood plasma
C. Carbon monoxide increases the amount of functional haemoglobin in the blood
D. Carbon monoxide is a competitive inhibitor of oxygen binding to haemoglobin
E. Carbon monoxide can be used in respiration instead of oxygen

Several diseases can lead to someone producing large amounts of dilute urine.
What could cause one of them?

A. Absence of antidiuretic hormone (ADH / vasopressin)
B. Blood loss (haemorrhage)
C. Low blood glucose levels
D. Damage to the large intestine
E. Excessive salt consumption

A dye remains trapped in the blood plasma until it is filtered by the kidneys into the urine. If the dye is infused into a person's vein at 0.2 mol/min it reaches a steady concentration of 1.6 mol/L in the plasma.
Calculate how much plasma the kidneys filter every minute.

A. 25 ml/min
B. 50 ml/min
C. 75 ml/min
D. 100 ml/min
E. 125 ml/min

The speed at which an action potential travels down a neuronal axon depends on the following:

For myelinated neurons, the speed is directly proportional to the axon radius.

For unmyelinated neurons, the speed is directly proportional to the square root of the axon radius.

Which of these axons conducts action potentials at the highest speed?

A. A myelinated axon of radius: r
B. An unmyelinated axon of radius: r/2
C. An unmyelinated axon of radius: r^2
D. A myelinated axon of radius: $r \sqrt{2}$

Cows ferment grass in their stomach, which means almost everything they consume is metabolized by microorganisms. Cows then digest these microorganisms when they pass into their intestines.

Which of the following is correct?

A. Cows absorb a large amount of carbohydrate from their diet
B. Cows eat small amounts of highly nutritious grass rather than large amounts of tough grass
C. Cows convert microorganism proteins into carbohydrate
D. Cows convert microorganism fats into carbohydrate
E. Cows have long and large intestines relative to their size

Kwashiorkor is a severe form of malnutrition which occurs when people eat insufficient protein. The levels of proteins in the blood plasma become very low.

Which of the following are features of Kwashiorkor?

A. The blood has higher water potential
B. Water is absorbed from the blood into tissues
C. High sugar supplements are a treatment
D. The amount of urea producing enzymes is increased

Animals and plants have very different developmental genetics. This can be related to the way plants and animals function.

Order the features so as they match up with the list of evolutionary consequences:

1) Cannot move
2) Susceptible to herbivory
3) Primary producer
4) Fast movement
5) Complex anatomy

Any cell can re-grow any body part

Nervous system

Variable body plan

Large part of genome regulates transcription factors

Large part of genome encodes enzymes

Plants use starch to store glucose, whilst animals store glycogen. Starch and glycogen stores have different properties which reflect the different ways plants and animals function.
Which of the following is NOT a correct explanation of the difference between plant and animal stores?

A. Animals need to release glucose quicker than plants to contract muscles
B. Animals store most of their energy as fat
C. Animals need to store their glucose in a denser form than plants
D. Animals need to control the concentration of glucose in their fluids more than plants
E. Animals often synthesise glucose form amino acids

An action potential occurs because …

A. Voltage sensitive channels open allowing sodium to enter the cell.
B. Calcium sensitive channels open allowing sodium to enter the cell.
C. A pump pushes more sodium into the cell than potassium out of the cell.
D. Voltage sensitive channels open allowing calcium to enter the cell.
E. Electrons flow along the cell.

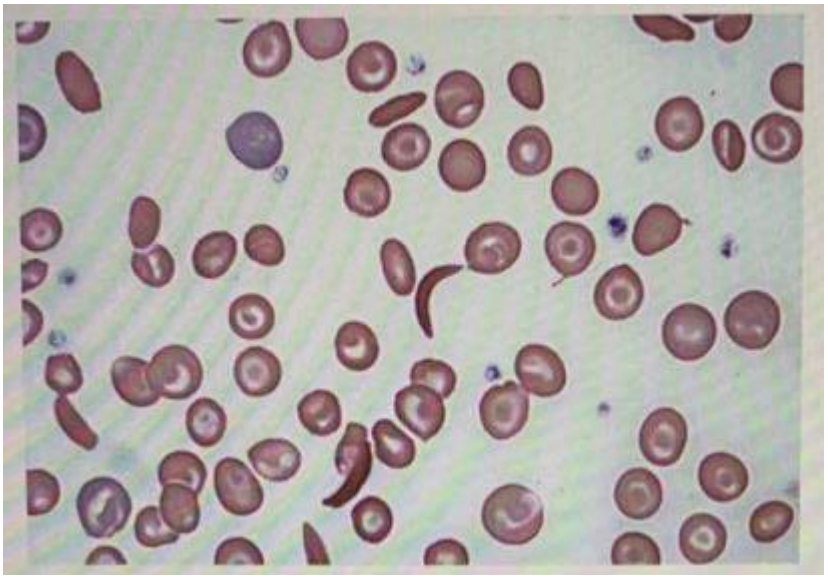
Which of the following is LEAST likely to cause an immune response?

A. Proteins from the nucleus released into tissue fluids by damage
B. Blood taken from a baby and injected into the mother
C. An artificial small protein
D. AN artificial small non-protein
E. Mutated proteins present on the surface of cancer cells

Cancer cells often contain many genetic mutations in their DNA.
Which of the following does NOT contribute to this observation?

A. Cancer tends to occur in older people after many cell divisions
B. Most DNA mutations cause cells to divide more often rather than less often
C. Genes must be mutated to allow uncontrolled cell division
D. Cancer can be caused by toxins and radiation which damage DNA
E. DNA repair mechanisms are often damaged in cancer cells

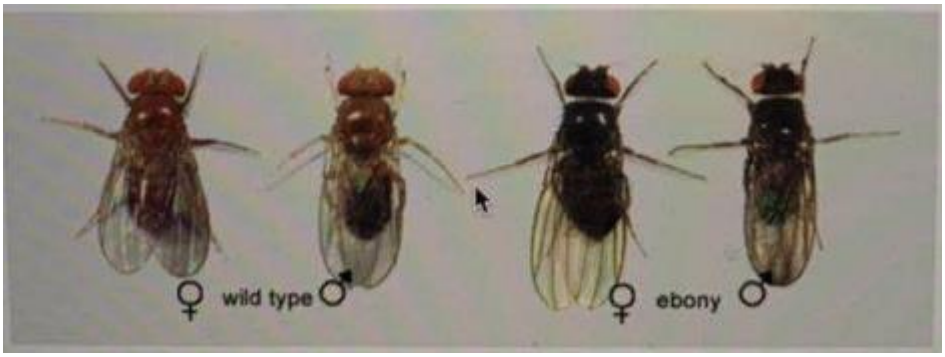
In a small village, 5% of people suffer Sickle Cell disease, caused by a recessive haemoglobin allele.



Calculate the frequency of the sickle cell allele in the village population.

A. 5.0%
B. 7.4%
C. 13.1%
D. 22.4%
E. 39.7%

Fruit flies are the best organism for studying genetics. Wild type flies have a yellow body, whereas a mutant has an ebony body.



A yellow male and an ebony female were crossed. Their progeny had a roughly equal number of yellow and ebony flies of both sexes.

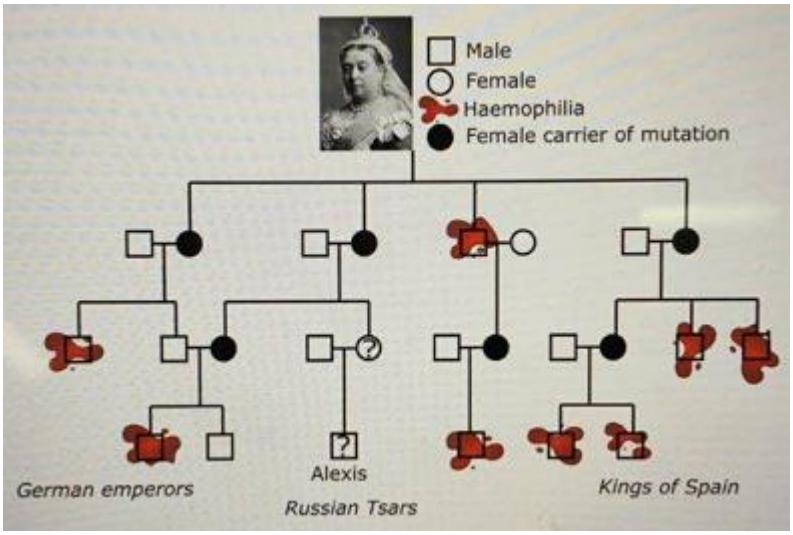
Which of the following is true?

A. Inheritance of body colour is NOT mendelian
B. The mutation is X-linked
C. One parent was homozygous and one parent was heterozygous
D. Both parents were homozygous
E. Both parents were heterozygous

A genetic mutation occurred within Queen Victoria which caused many of her descendents to die from Haemophilia.

The mutation is carried on the X chromosome, and is recessive.

Using this family tree, calculate the probability Alexis had Haemophilia.



A. 0%
B. 12%
C. 25%
D. 50%
E. 100%

The resolving power of a microscope is the minimum distance apart tow features have to be before the microscope can distinguish them.

The objective lenses of microscopes have two numbers engraved on them which are 'magnification / numerical aperture'. E.g. a 40/0.65 lens has 40x magnification and a numerical aperture (NA) of 0.65.

λ is the wavelength of light in μm used to see the sample.

The resolving power of a microscope, is μm, is 0.61λ/NA.

Which of the following is true?

A. Zooming in on the image produced by an objective lens allows more detail to be seen
B. Structures which glow red can be seen in more detail than structures glowing blue
C. The example microscope can resolve organelles 1 μm apart using light of wavelength 1 μm
D. A lens of NA = 0.2 is better than a lens of NA = 20
E. Electrons in an electron microscope are accelerated to increase their wavelength

Many species of plants are epiphytes, which means they grow on the branches of trees, to get brighter sunlight. Epiphytes collect their own water and nutrients so do not steal from the tree.

Which of the following correctly describes the epiphyte niche?

A. Growing on branches reduces competition
B. Epiphytes are parasites of trees
C. Trees and epiphytes are in a mutualistic symbiosis
D. Epiphytes increase the fitness of trees
E. Epiphytes only colonise living branches

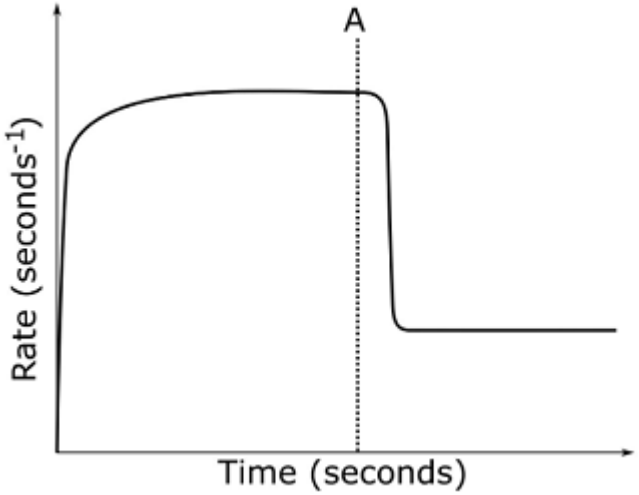
Monocots and dicots are the two major groups of flowering plants.

Which of the following are features of monocots? *Choose from the options below*

I Two seed leaves (cotyledons)
II Long narrow leaves
III Radial veins
IV Taproot
V Stem vessels in a ring

A. I
B. II
C. III
D. IV
E. V
F. II and IV
G. II and V
H. III, IV, V
I. I, III, IV, V

An enzyme was extracted from a bacterium native to Antarctica. The enzyme was mixed with an excess of substrates and the rate of reaction over time was measured.

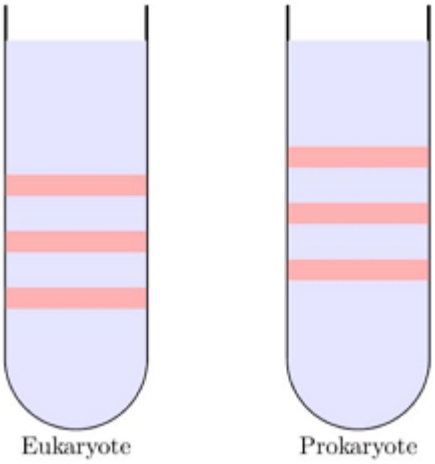


What could have happened at time A?

A. The substrates ran out
B. An excess of non-competitive (allosteric) inhibitor was added
C. The reaction tube was placed in an ice-water bath
D. A large volume of water was added to the reaction
E. The reaction tube was placed in a warm-water bath

Particles can be put in a solution and then centrifuged. Bigger particles tend to move faster and sediment quicker.

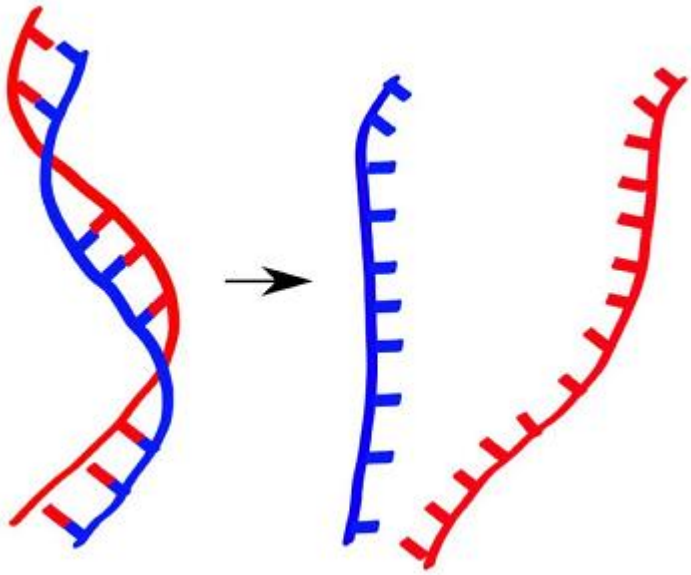
Ribosomes taken from a eukaryotic organism and a prokaryotic organism were centrifuged and the following pattern was observed:



Which of the following is TRUE?

A. Eukaryotes and prokaryotes contain three types of ribosomes
B. Eukaryotic ribosomes are smaller than prokaryotic ribosomes
C. There are three subunits in these ribosomes
D. Treatment with RNAse would alter the position of these bands
E. Any particles with the same molecular weight will be found in the same band

Heat causes the two strands of DNA helices to separate (melt / denature). G/C pairs form with 3 hydrogen bonds, whilst A/T pairs form with 2 hydrogen bonds.



Which of the following helices will denature at the highest temperature?

A. Short strand with a high proportion of A/T base pairs
B. Long strand with a high proportion of A/T base pairs
C. Short strand with a high proportion of G/C base pairs
D. Long strand with a high proportion of G/C base pairs

Which of the following features is shared between prokaryote and eukaryote?

i) DNA

ii) ATP

iii) Ribosomes

iv) Mitochondria

v) Nuclei

A. i and ii

B. i, ii and iii

C. i, ii, iii and iv

D. all

E. i and iii

Which organelle is responsible for photosynthesis?

A. Nucleus

B. Mitochondria

C. Chloroplast

D. Peroxisome

E. Amyloplast

Which of the following may be found in DNA but not in RNA?

A. 2'-hydroxy group

B. Pentose sugar

C. Phosphodiester bonds

D. Purines

E. Thymine

Which of the following element is not present in haemoglobin?

A. iron

B. oxygen

C. nitrogen

D. Phosphorus

E. Hydrogen