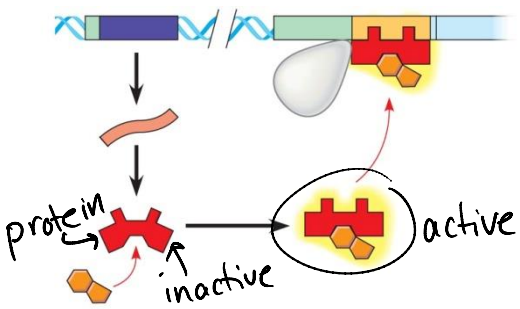
AP Biology – Science Practices Review **KEY** Name:_____ Date:_____

Answer the following examples questions and indicate whether which big idea they represent (evolution, free energy, information, or systems)

page 7 Holtz.

Science Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.



a) Label the repressor protein in the diagram, indicating the *active* and *inactive* forms.

b) Is this repressor protein for an inducible operon or a repressible operon?

Repressable

example → Tryptophan.

BIG IDEA(s): 3 → Information "Living systems store, retrieve, transmit, + respond to information essential to Life processes"

Science Practice 2: The student can use mathematics appropriately.

A true-breeding green-seed pea plant was crossed with a true-breeding yellow-seed plant, producing an F1 generation that was all green-seeded. In the F2 generation, 351 plants had green-seeds and 110 had yellow seeds. Use chi square statistical analysis to determine if this example supports the idea that the mode of inheritance for seed colour in peas is complete dominance.

BIG IDEA(s): 3 → information

P → GG × gg

F_1 → Gg

F_2 →

GG ← green gg ← yellow

Gg ← green

	G	g
G	GG	Gg
g	Gg	gg

Phenotypes	o	e	(o−e)	$(o-e)^2$	$\frac{(o-e)^2}{e}$
Green	351	373	−22	484	1.298
Yellow	110	88	22	484	5.5

$\Sigma x^2 = 6.798$

Total → 461
expected 3:1

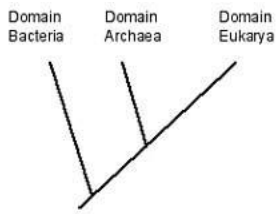
d.f = 1
p = 0.05
CV = 3.84

$x^2 > 3.84$

∴ we can reject the null hypothesis

* you must consider other variations for your data.

Science Practice 3: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.



What scientific questions can you ask based on the phylogenetic tree shown?

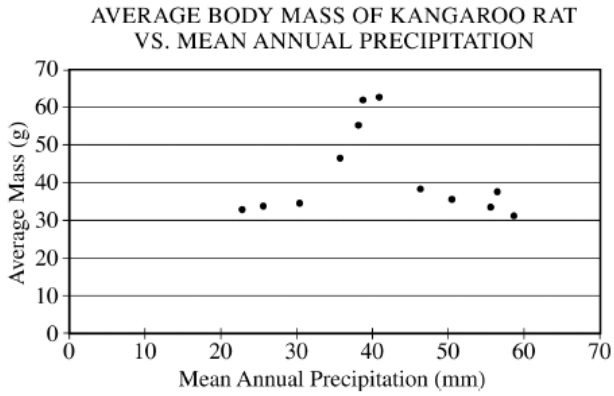
What domain was the first to evolve?
Do the distances between branches represent time?

BIG IDEA(s): 1 Evolution "The process of evolution drives the diversity and unity of life"

Science Practice 4: The student can plan and implement data collection strategies appropriately to a particular scientific question.

Kangaroo rats, like other organisms, show specific adaptations to the environments in which they live. Kangaroo rats can survive in the desert with no free water. They can survive by obtaining water from dry seeds and grass that they eat, and have specialized kidneys that allow them to excrete urea with very little output of water.

The graph shows the average body mass for kangaroo rats at twelve locations throughout the southwestern United States as a function of mean annual precipitation at each location.



(a) **Describe** the trends shown in the graph.

(b) **Develop** a hypothesis that would explain the data and **design** an experiment that would test the hypothesis.

BIG IDEA(s): 1 Evolution

a) kangaroo rats have the highest body mass around 40 mm of precipitation (mass 62g) increasing from 25mm to 40mm and then decreasing to 60mm

b) *may have to assume that increased body mass means increased survival/fitness

*a hypothesis stating the 40mm is suited for survival of kangaroo should not receive credit

Some hypothesis…

40mm is the condition that produces most of the kangaroo rats preferred seeds and grasses

Kangaroo rats predators do not survive well around 40mm of precipitation

Diseases/parasites that affect kangaroo rats thrive in conditions greater than or less than 40 mm of precipitation

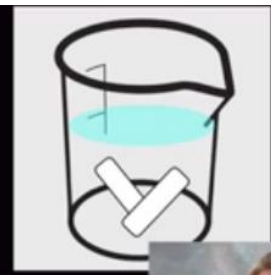
Design: control, variable that is being tested, variables that are controlled, what data would be collected (what are you measuring?), trials and/or sample size, statistical analysis or graph

Science Practice 5: The student can perform data analysis and evaluation of evidence.

Molarity	Initial mass (g)	Final mass (g)
0 M	12.1	11.0
.2 M	13.2	12.8
.4 M	13.3	13.2
.6 M	11.9	12.4
.8 M	12.9	13.8
1.0 M	13.7	15.2

down doesn't fit trend

*mislabel beaker?



potato lab

Identify the possible sources of error in the data set.

Revise the protocol to obtain more valid data. ← label + repeat *trials

Source: Bozeman Biology YouTube Channel (Scientific Practices 5 video)

2 BIG IDEA(s): Free Energy "Biological systems utilize free energy + molecular building blocks to grow, to reproduce, and to maintain homeostasis"

Science Practice 6: The students can work with scientific explanations and theories.

Which of the following statements most directly supports the claim that different species of organisms use different metabolic strategies to meet their energy requirements for growth, reproduction, and homeostasis?

(A) During cold periods pond-dwelling animals can increase the number of unsaturated fatty acids in their cell membranes while some plants make antifreeze proteins to prevent ice crystal formation in tissues.

(B) Bacteria lack introns while many eukaryotic genes contain many of these intervening sequences.

(C) Carnivores have more teeth that are specialized for ripping food while herbivores have more teeth that are specialized for grinding food.

(D) Plants generally use starch molecules for storage while animals use glycogen and fats for storage.

BIG IDEA(s): Free Energy

Science Practice 7: The student is able to connect and relate knowledge across various scales, concepts and representation in and across domains.

The endocrine system incorporates feedback mechanisms that maintain homeostasis. Which of the following demonstrates negative feedback by the endocrine system?

A. During labor, the fetus exerts pressure on the uterine wall, inducing the production of oxytocin, which stimulates uterine wall contraction. The contractions cause the fetus to further push on the wall, increasing the production of oxytocin.

B. After a meal, blood glucose levels become elevated, stimulating beta cells of the pancreas to release insulin into the blood. Excess glucose is then converted to glycogen in the liver, reducing blood glucose levels.

C. At high elevation, atmospheric oxygen is more scarce. In response to signals that oxygen is low, the brain decreases an individual's rate of respiration to compensate for the difference.

D. A transcription factor binds to the regulatory region of a gene, blocking the binding of another transcription factor required for expression.

BIG IDEA(s): System "Biological systems interact, and these systems and their interactions posses complex properties"