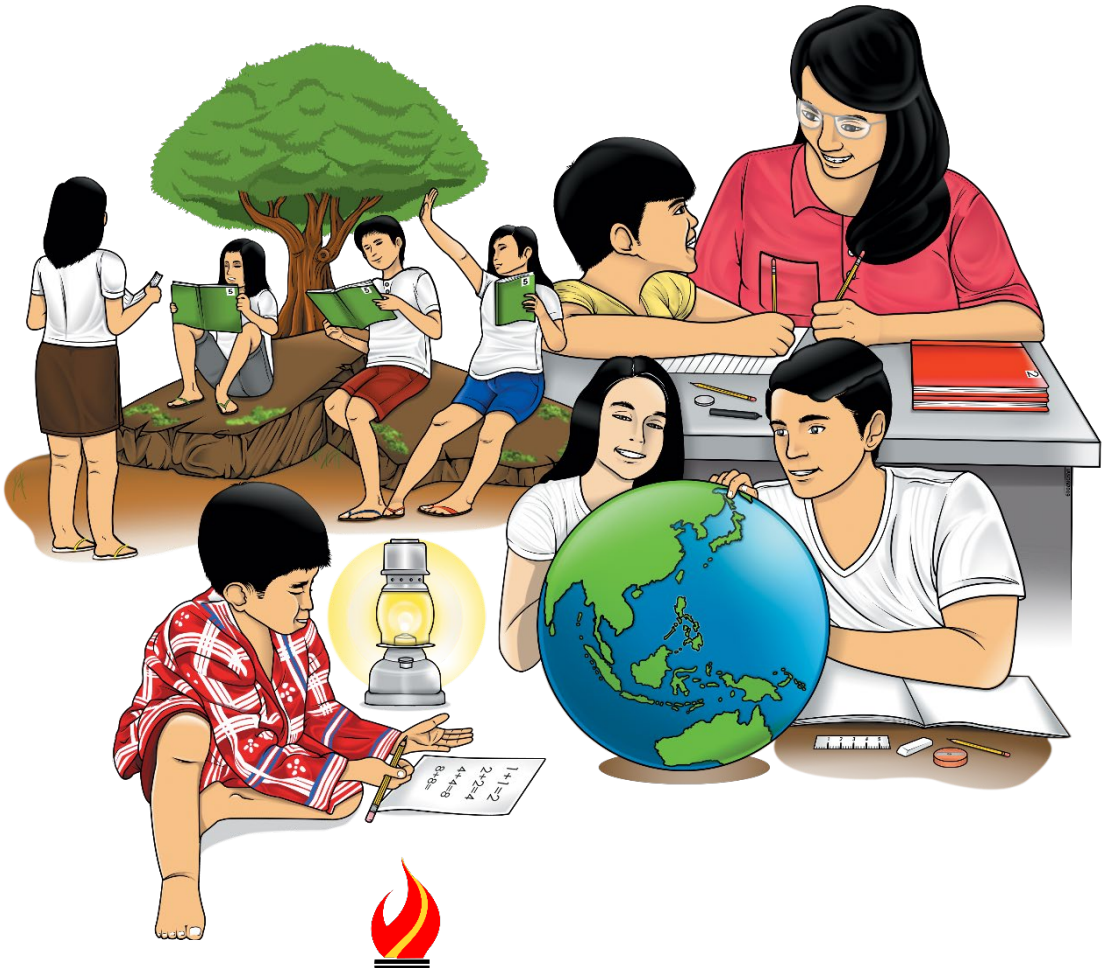
Senior High School

DepED
DEPARTMENT OF EDUCATION

Earth and Life Science

Quarter 2 – Module 9:
The Process of Evolution



ALTERNATIVE DELIVERY MODE
ADM

Earth and Life Science
Alternative Delivery Mode
Quarter 2 – Module 9: Process of Evolution
First Edition, 2021

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

Development Team of the Module

Writers: Wilma A. Aguspina

Editors: Erwin R. Abrencillo, Jocelyn M. Manset

Reviewers: Franz Kevin Manalo, Dominic Almirez, Princess Paolah L. De Guzman, Marissa C. Betchaida, Louie L. Alvarez, Gregorio M. De Chavez Jr., Marichelle C. Calingasan, Jocelyn M. Manset, Mario B. Maramot, Elaine T. Balaogan, Job S. Zape Jr., Vrigin Kathleen D. Cupo

Illustrator: Cherry Amor R. Laroza, Lovely Joy La Rosa, Charles Erick A. Jusay, Sandro Carlo B. Tablizo

Layout Artist: Elizalde L. Piol, Anselma M. Ebero

Management Team: Francis Cesar B. Bringas
Job S. Zape, Jr.
Ramonito Elumbaring
Reicon C. Condes
Elaine T. Balaogan
Fe M. Ong-ongowan
Merthel M. Evardome
Nicolas M. Burgos
Nadine C. Celindro
Mario B. Maramot
Rosalinda A. Mendoza

Printed in the Philippines by _____

Department of Education – Region 4A CALABARZON

Office Address: Gate 2 Karangalan Village, Brgy. San Isidro, Cainta, Rizal
Telefax: 02-8682-5773/8684-4914/8647-7487
E-mail Address: lrmd.calabarzon@deped.gov.ph

Senior High School

Earth and Life Science

Quarter 2 – Module 9:
The Process of Evolution

DepED
DEPARTMENT OF EDUCATION

Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

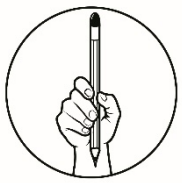
This module was designed and written with you in mind. It is here to help you master the nature of Biology. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module covers:

- Lesson 9 – The Process of Evolution

After going through this module, you are expected to:

1. Describe how the present system of classification of organisms is based on evolutionary relationships ancestors to produce the organismal diversity observed today;
2. Describe how the present system of classification of organisms is based on evolutionary relationships;
3. Interpret and explain the phylogenetic tree;
4. Explain the importance of phylogenetic tree to evolutionary relationship of organisms.



What I Know

Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. The Greek word phylon from the word phylogeny means _____.
    A. ancestor
    B. branch
    C. origin
    D. tribe

2. The Greek word genesis means _____.
    A. ancestor
    B. branch
    C. origin
    D. tribe

3. Diagram that traces evolutionary relationships and connections among organisms
    A. evolution
    B. family tree
    C. lineages tree
    D. phylogenetic tree

4. Lineages that evolved early from the root and remain unbranched
    A. basal taxon
    B. branch point
    C. root
    D. sister taxa

5. The point where split takes place
    A. basal taxon
    B. branch point
    C. polytomy
    D. sister taxa

6. Branch with more than two lineages
    A. basal taxon
    B. branch point
    C. polytomy
    D. sister taxa

7. Point of two lineages stem from the same branch
    A. basal taxon
    B. branch point
    C. root
    D. sister taxa

8. Indicates that an ancestral lineage gave rise to all organisms on the tree
   A. basal taxon
   B. branch point
   C. root
   D. sister taxa

9. Monophyletic group is also called _____.
   A. clade
   B. domain
   C. genus
   D. taxa

10. Group which shows similar traits that is different from the other descendants of a common ancestor
   A. monophyletic
   B. paraphyletic
   C. polyphyletic
   D. polytomy

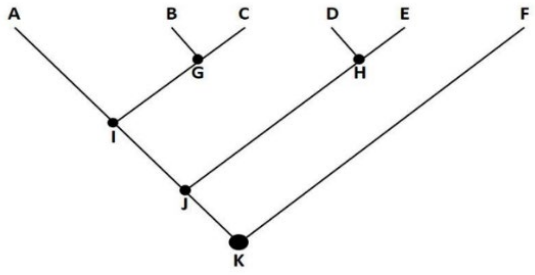
11. Indicates more than two immediate descendants
   A. monophyletic
   B. paraphyletic
   C. polyphyletic
   D. polytomy

12. A group of organisms that does not include recent common ancestors, and does not share characteristics with the original common ancestor.
   A. monophyletic
   B. paraphyletic
   C. polyphyletic
   D. polytomy

13. Refers to a group of organisms whose most recent ancestors descended from two or more ancient common ancestors.
   A. monophyletic
   B. paraphyletic
   C. polyphyletic
   D. polytomy

For numbers 14 -15. Analyze the structure of phylogenetic tree.

14. What letter represents the root?
   A. A
   B. I
   C. J
   D. K



15. B and C are _____.
   A. node
   B. polytomy
   C. sister taxa
   D. branch point

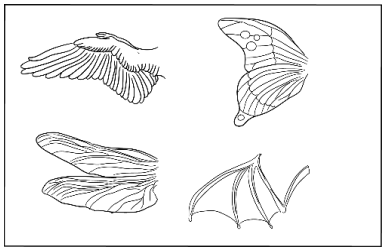
Lesson 9 The Process of Evolution

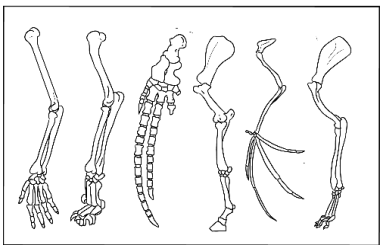
In 1835, when Darwin visited the Galapagos Islands, evidence has been found to indicate that living things have changed gradually during their natural history. The study of fossils as well as biogeography, embryology, molecular evidence, and comparative anatomy such as homologous structure, analogous structure and vestigial structure provide evidence for evolution.

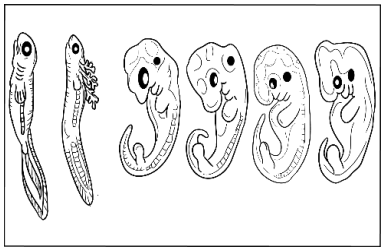
What's In

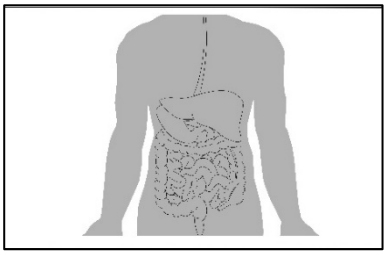
Activity 1

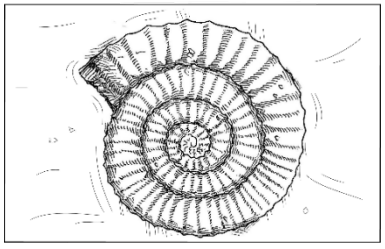
Match the picture with each type of evidence. Choose from the word bank below the pictures. Write your answer on the space provided below each item.

1. 

2. 

3. 

4. 

5. 

6. 

analogous structure	molecular evidence	Fossil
embryology	vestigial structure	homologous structure

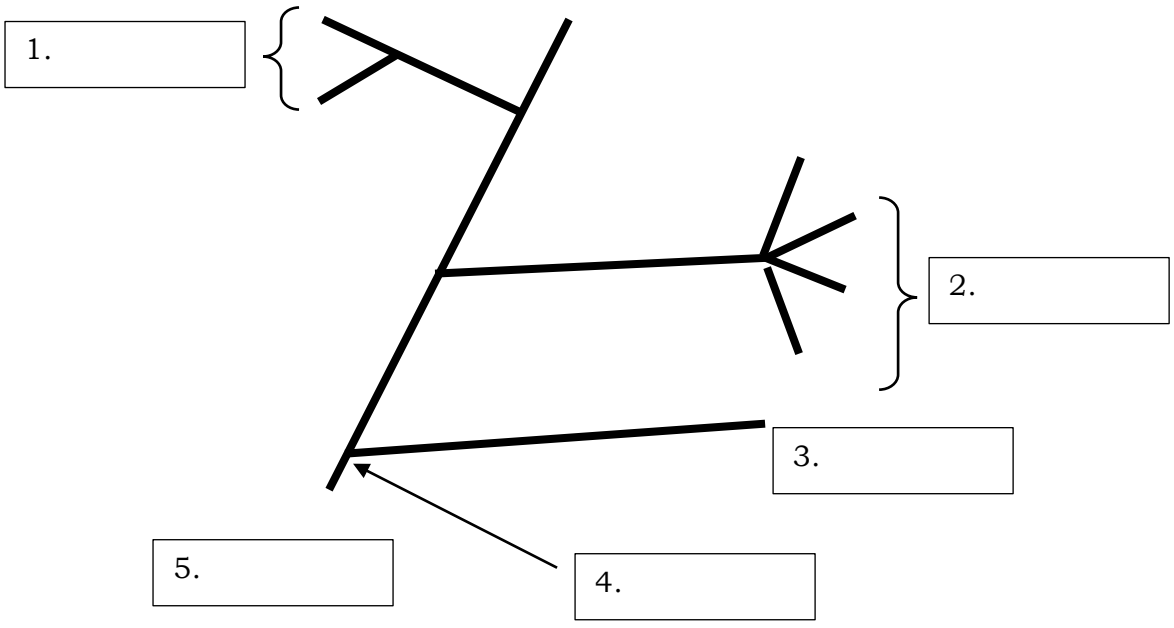
What's New

The evolutionary history of a group of organisms is called phylogeny from the Greek word phylon which means "tribe" and genesis which means "origin". Biologists traditionally represent the genealogy or an organism's line of evolutionary development in phylogenetic trees, which are diagrams that trace evolutionary relationships and connections among organisms.

A phylogenetic tree can be read like a map of evolutionary history. Rooted phylogenetic trees have single lineage at the base representing a common ancestor.

Activity 2

Label the parts of a rooted phylogenetic tree based on the given description.



Structure of Rooted Phylogenetic tree

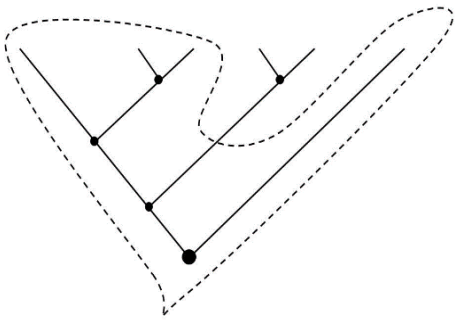
branch point	the point where split occurs
basal taxon	lineage that evolved early from the root and remains unbranched
sister taxa	point of two lineages stem from the same branch
Polytomy	branch with more than two lineages
Root	Indicates that an ancestral lineage gave rise to all organisms on the tree

What is It

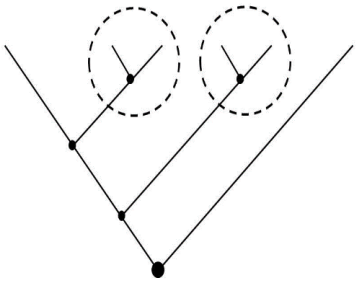
There are four groups of evolutionary tree namely monophyletic, paraphyletic, polyphyletic and soft polytomy. Monophyletic group is also called clade, which shows one common ancestor and the all the descendants share a common characteristic, including their most recent ancestors. Paraphyletic group refers to a group of organisms with similar characteristics and originated from one recent common ancestor, but shows different characteristics from the other descendants of the recent ancestor. Polyphyletic group includes organisms that originated from the same ancient ancestors but not related at all in terms of their most recent ancestors. Soft polytomy indicates more than two immediate descendants.

Activity 3

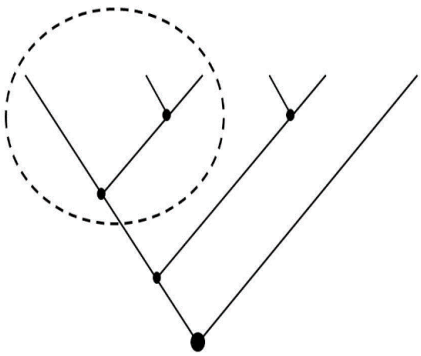
Identify what group of evolutionary tree is illustrated below.

1. 

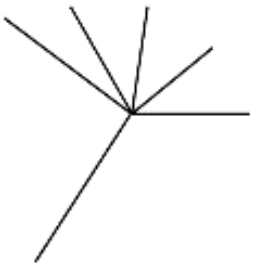
_____

2. 

_____

3. 

_____

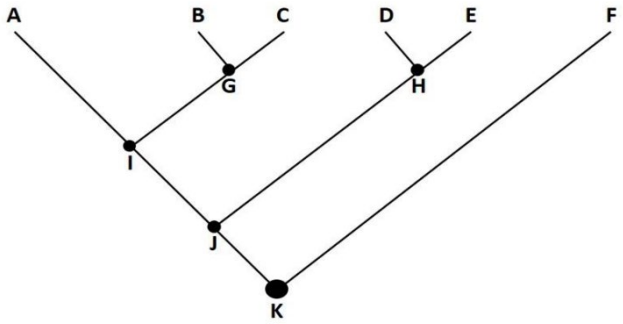
4. 

_____

What's More

Activity 4

Analyze the phylogenetic tree. Fill in the blanks with the correct answer.



A. The root of the tree is represented by letter _____.
B. _____ shows common ancestor of B and C.
C. A to E represents the _____.
D. B and C are _____.
E. Which is more likely close related? A and C or C and D?

What I Have Learned

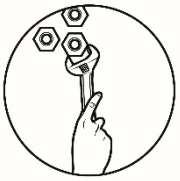
Activity 5

Fill in the blank with the correct information needed to complete the idea. Write your answer on a sheet of paper.

(1) _____ are remains of organisms and were grouped to be used as evidence and basis for further classification of living things. The evolutionary history of a group of organisms is called (2) _____ from the Greek word phylon which means "tribe" and genesis which means "origin".

A (3) _____ can be read like a map of evolutionary history. Rooted phylogenetic trees have single lineage at the base representing a common ancestor. Structures of phylogenetic tree are tip or terminal node, basal taxon, sister taxa, polytomy and root. (4)_____ is the point where split occurs. Lineage that evolved early from the root and remains unbranched is called (5) _____. A branch with more lineages is polytomy while the (6) _____ shows that ancestral lineage which gave rise to all organisms on the tree.

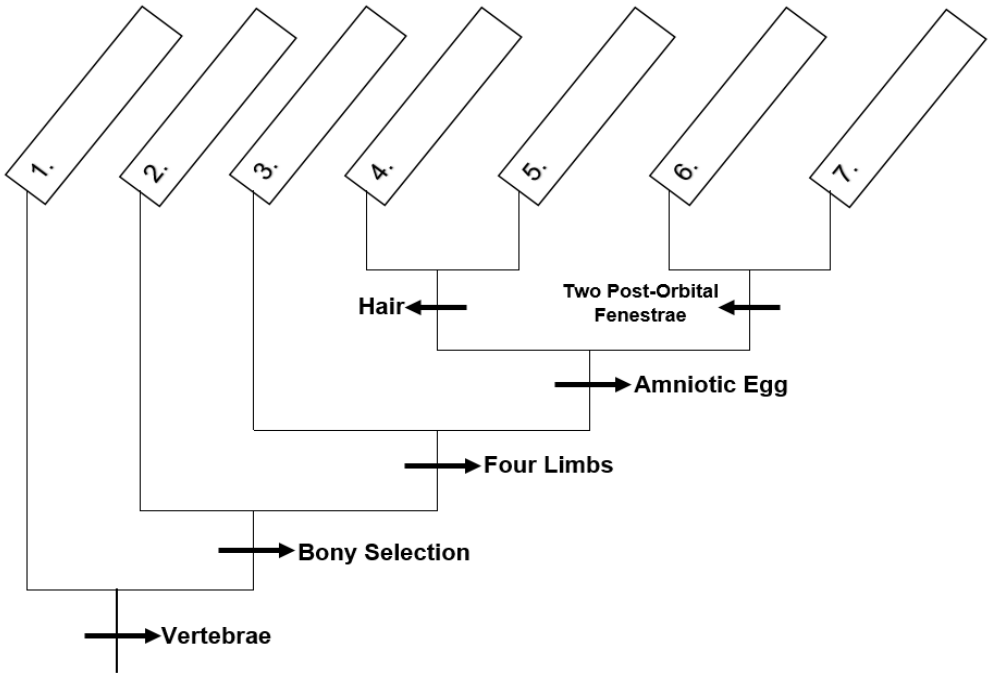
The four groups of evolutionary tree are monophyletic, paraphyletic, polyphyletic and soft polytomy. (7) _____ group is also called clade which shows a common ancestor and all their descendants. (8) _____ group refers to one recent common ancestor but not all descendent are included, as they have different characteristics from the other descendants. (9) _____ group does not include recent common ancestors as the organisms are only related from the ancient ancestor. (10) _____ indicates that the branching is unknown or there is insufficient information on the genetic divergence.



What I Can Do

Activity 6

Look at the picture below. This illustrates Complete the phylogenetic tree. Choose the corresponding organism from the word bank.



Alligator	Beavers	Dolphin	Tuna
Frog	Gorilla	Tyrannosaurus	

Assessment

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Lineages that evolved early from the root and remain unbranched
   A. basal taxon
   B. branch point
   C. root
   D. sister taxa

2. The point where split takes place
   A. basal taxon
   B. branch point
   C. polytomy
   D. sister taxa

3. Indicates that an ancestral lineage gave rise to all organisms on the tree
   A. basal taxon
   B. branch point
   C. root
   D. sister taxa

4. Monophyletic group is also called _____.
   A. clade
   B. domain
   C. genus
   D. taxa

5. Branch with more than two lineages
   A. basal taxon
   B. branch point
   C. polytomy
   D. sister taxa

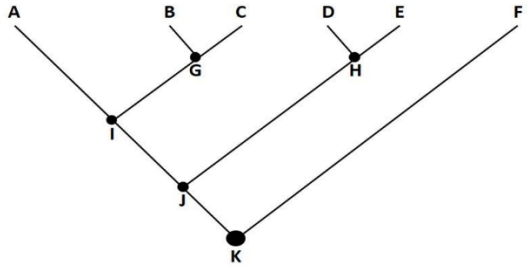
6. Point of two lineages stem from the same branch
   A. basal taxon
   B. branch point
   C. root
   D. sister taxa

7. Greek word phylon from the word phylogeny means _____.
   A. ancestor
   B. branch
   C. origin
   D. tribe

8. Greek word genesis from the word phylogeny means _____.
   A. ancestor
   B. branch
   C. origin
   D. tribe

9. Diagram that traces evolutionary relationships and connections among organisms
    A. evolution
    B. family tree
    C. lineages tree
    D. phylogenetic tree

For numbers 10 -11. Analyze the structure of phylogenetic tree.



10. Letter K represents _____?
    A. branch point
    B. node
    C. sister taxa
    D. root

11. D and E are _____.
    A. branch point
    B. node
    C. sister taxa
    D. root

12. Group of organisms that share ancient ancestors but not most recent ancestors.
    A. monophyletic
    B. paraphyletic
    C. polyphyletic
    D. polytomy

13. Indicates more than two immediate descendants
    A. monophyletic
    B. paraphyletic
    C. polyphyletic
    D. polytomy

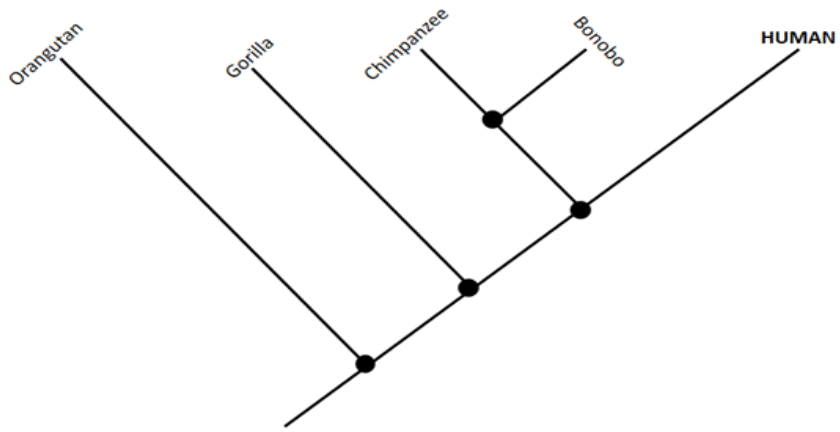
14. Group of organisms with a most recent common ancestor, but not other descendants of the recent ancestor
    A. monophyletic
    B. paraphyletic
    C. polyphyletic
    D. polytomy

15. Indicates recent common ancestor and all the descendants of the recent common ancestor
    A. monophyletic
    B. paraphyletic
    C. polyphyletic
    D. polytomy

Additional Activities

Activity 7

Study the phylogenetic tree then answer the questions below.



Questions:

1. What do you call to the place where two branches split apart?
   _____
2. What does the branch point that connects chimpanzee, bonobo and human represent?
   _____
3. What is that single branch point from which all branches originate?
   _____
4. What does the node closest to the root represent?
   _____
5. How important is phylogenetic tree?
   _____

Answer Key

What I Know

1. D 9. A
2. C 10. A
3. D 11. D
4. A 12. C
5. B 13. B
6. C 14. D
7. D 15. C
8. C

What's In

Activity 1

1.analogous structure
2.homologous structure
3. embryology
4. vestigial structure
5. fossil record
6. molecular evidence

What's More

Activity 4

1. K
2. G
3. tip or terminal node
4. sister taxa
5. A and C

What Is It

Activity 3

1. Paraphyletic
2. Polyphyletic
3. Monophyletic
4. Soft Polytomy/Polytomy

What I Can Do

Activity 6

1. dolphin
2. tuna
3. frog
4. gorilla
5. beaver
6. alligator
7. tyrannosaurus

Additional Activity

Activity 7

1. branch point
2. most recent common ancestor of all the species on those branches
3. root
4. represents most recent common ancestor for all organisms in the tree
5. used to help represent evolutionary relationship between organisms that are believed to have some common ancestry.

What's New

Activity 2

1. Sister Taxa
2. Polytomy
3. Basal Taxon

What I Have Learned

Activity 5

1. fossils
2. phylogeny
3. phylogenetic tree
4. branch point
5. basal taxon
6. root
7. monophyletic
8. paraphyletic
9. polyphyletic
10. soft polytomy

Assessment

1. A 9. D
2. B 10. D
3. C 11. C
4. A 12. C
5. C 13. D
6. D 14. B
7. D 15. A
8. C

References

Miller, K. R. & Levine, J. (2004). *Prentice Hall: Biology.* New Jersey, Pearson Education Inc.

Sia, S. & Cortez, L. (2016). Science in Today's World for Senior High School

https://media.hhmi.org/biointeractive/click/Phylogenetic_Trees/02.html

https://evolution.berkeley.edu/evolibrary

https://www.youtube.com/watch?v=RVW8iIEfiZI

For inquiries or feedback, please write or call:

Department of Education - Bureau of Learning Resources (DepEd-BLR)

Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600

Telefax: (632) 8634-1072; 8634-1054; 8631-4985

Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph