

**Exercise****Question 1:**

Explain antibiotic resistance observed in bacteria in light of Darwinian selection theory.

**Solution 1:**

According to Darwin, environment selects organisms with favorable variations and these organisms are able to survive. When a bacterial population encounters a particular antibiotic, those sensitive to it die. But some bacteria that have favorable mutations become resistant to the antibiotic. Such resistant bacteria survive and multiply quickly as the competing bacteria have died. Thus, their numbers increase. Additionally they may also pass on the genes imparting resistance to other members of the population. Therefore, antibiotic resistance become widespread and entire bacterial population becomes resistant.

**Question 2:**

Find out from newspapers and popular science articles any few fossil discoveries or controversies about evolution.

**Solution 2:**

Chimps are more evolved than humans (The Times of India):

A study suggests that chimpanzees are more evolved than humans. There is no doubt that humans are the more advanced species. But a comparison of 14,000 human and chimpanzee genes shows the forces of natural selection have had the greatest impact on our ape cousins.

The researcher's discovery challenges the common assumption that our large brains and high intelligence were the gifts of natural selection. Humans and chimps followed different evolutionary paths from a common ape ancestor about 5 million years ago. Both underwent changes as the fittest survived to pass their genes on to future generations. But the US study shows that humans possess a 'substantially smaller' number of positively-selected genes than chimps.

**Question 3:**

Attempt giving a clear definition of the term species.

**Solution 3:**

Species is population or group of individuals that have potential of interbreeding and are able to produce viable and fertile young ones.

**Question 4:**

Try to trace the various components of human evolution (hint: brain size and function, skeletal structure, dietary preference, etc.)

#### Solution 4:

The various components of human evolution are:

1. Human-Brain Volume
2. Skeletal structure
3. Posture
4. Dietary preference
5. Behavioral features

Summary of human phylogeny

Genus	Age of appearance/ million years ago	Skull	Brain capacity/cm	Teeth	Diet	Posture	Significance
1. <i>Dryopithecus</i> (earliest fossil ape)	25 (Miocene)	large muzzle	?	large canines, incisors, molars square	soft fruit, leaves	knuckle walker	earliest fossil ape, large arms and legs equal sized
2. <i>Ramapithecus</i> (Earliest hominid fossil)	15 (Miocene)	deeper jaw	?	small canines, flattened molars, thicker enamel	seeds nuts	semi erect	grounddwelling
3. <i>Australopithecus afarensis</i> ('Lucy')	4.0 (Pliocene)	large jaws	450	small canines, small incisors	herbivorous	fully erect	still at home in trees but savannah dwellers.
4. <i>A. africanus</i> (ape-man)	2.5 (Pliocene)	ventral foramen magnum	450	small canines	carnivorous	fully erect	small game hunter, many variant forms
5. <i>Homo habilis</i> (The tool maker, handy man)	2.0 (Pleistocene)	lighter jaw	700	small canines	carnivorous	fully erect	earliest stone tools, began hunting for meat, major increase in brain size foreshadowing social attributes
6. <i>Homo erectus</i> (The erect man)	1.5 (Pleistocene)	thick, low forehead brow ridges	800-1100	small canines	omnivorous	1.5-1.8m tall	beginning of cultural evolution, used stone and bone tools, cooperative hunting rudimentary language, used fire.
7. <i>Homo neanderthalensis</i> (Neanderthal man)	100,000 to 34,000 yrs. (Pleistocene)	face long and narrow, brow ridges, enlarged nasal cavity	1300-1600	heavier than modern teeth, wisdom teeth	omnivorous	1.5-1.66 m tall	Cave dweller, made flint flake tools, used hides as clothes, buried the dead
8. <i>Homo sapiens fossilis</i> (Cro-Magnon man)	34000 yrs. (Holocene)	vaulted cranium shorter skull, reduced jaws	1650	teeth closer together, wisdom teeth	omnivorous	1.8 m tall	Strong jaws with teeth close together, wisdom teeth, cave-dweller, paintings and carvings in caves, had art and culture, also called "chimpan"
9. <i>Homo sapiens sapiens</i> (Living modern man)	25000 yrs. (Holocene)	Thinning of skull bones, slight reduction in cranial capacity	1300-1600	strong jaws with teeth close together wisdom teeth	omnivorous	1.5-1.8 m tall	Backbone with 4 curves; most intelligent; has art, culture, language, speech; cultivates plants; domesticates animals.

**The following main morphological changes occurred in the ancestors of modern man:**

- (1) Narrowing and elevation of nose.
- (2) Formation of chin.
- (3) Reduction of brow ridges.
- (4) Flattening of face.
- (5) Reduction in body hairs.

- (6) Development of curves in the vertebral column for erect posture.
- (7) Formation of bowl like pelvic girdle with broad ilia in support of viscera.
- (8) Increase in height.
- (9) Attainment of erect posture and bipedal locomotion.
- (10) Enlargement and rounding of cranium.
- (11) Increase in brain size and intelligence.
- (12) Broadening of forehead and with vertical elevation

#### Question 5:

Find out through internet and popular science articles whether animals other than man has self-consciousness.

#### Solution 5:

**Self-awareness** is the capacity for introspection and the ability to recognize oneself as an individual separate from the environment and other individuals. It is a measure of intelligence in the animal kingdom and yet most living species do not possess it. Of the many animals tested few animals other than humans have shown this capacity. They are orangutans, chimpanzees, gorillas, bottlenose dolphins, elephants, orcas, bonobos, Rhesus macaques and European Magpies.. Among domestic animals, dog and other members of Canidae family show subtle self consciousness.

#### Question 6:

List 10 modern-day animals and using the” internet resources link it to a corresponding ancient fossil. Name both

#### Solution 6:

Serial Number	Animal	Fossil
1	Man	<i>Ramapithecus</i>
2	Horse	<i>Eohippus</i>
3	Dog	<i>Leptocyon</i>
4	Camel	<i>Protylopus</i>

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5	Elephant	<i>Moerithers</i>
6	Whale	<i>Protocetus</i>
7	Fish	<i>Arandaspis</i>
8	Tetrapods	<i>Ichthyostega</i>
9	Bat	<i>Archaeonycteris</i>
10	Giraffe	<i>Palaeotragus</i>

### Question 7:

Practice drawing various animals and plants.

### Solution 7:

Select few plants and animals that you find relatively easy to draw and label and practice to make these diagrams perfect. You can take suggestions from teachers, parents or even look up in the internet for simple animal and plant figures

### Question 8:

Describe one example of adaptive radiation.

### Solution 8:

Adaptive radiation is when members of a single group or lineage evolutionarily diverge into a variety of different forms. These forms are dictated by natural selection and the use of habitats or resources. Darwin's finches of the Galapagos islands had common ancestors but now have different types of modified beaks according to their food habits. These finches have developed different eating habits and different types of beaks to suit their feeding habits. The insectivorous, blood sucking, and other species of finches with varied dietary habits have evolved from a single seed eating finch ancestor.

### Question 9:

Can we call human evolution as adaptive radiation?

### Solution 9:

No, human evolution cannot be called adaptive radiation. Adaptive radiation can be defined as evolutionary process that produces new species from a single common ancestor. In case of human evolution, while we share a common ancestor we have undergone gradual but progressive modification in our body structure, eating habits, etc. Human evolution does not

involve diversifying and radiating into different species which is characteristic of adaptive radiation.

**Question 10:**

Using various resources such as your school library or the internet and discussions with your teacher, trace the evolutionary stages of any one animal say horse.

**Solution 10:**

The evolution of horse started with Eohippus during Eocene period. It involved the following evolutionary stages.

Eohippus – Mesohippus – Merychippus – Pliohippus – Equus.

Evolutionary trend:

- (i) Increase in body size.
- (ii) Elongation of neck.
- (iii) Lengthening of limbs.
- (iv) Enlargement of third digit.
- (v) Gradual reduction of lateral digits
- (vi) Increase in structural complexity of teeth for feeding on grass
- (vii) Strengthening of back
- (viii) Development of brain and sensory organs