Part B: Short Answer Questions - Please answer in the space provided (worth 15 marks)

1. What can be deduced about mating if a population is not proven to depart from Hardy-Weinberg equilibrium? (1 mark)

   Accept any or all of these four possibilities: the population has no evidence of genetic drift, natural selection, non-random mating, or mutation. It is also acceptable to say that there is no evidence for different types of natural selection (e.g. directional selection, heterozygote advantage) or different types of non-random mating (inbreeding, outbreeding)

2. Please list and explain two possible evolutionary consequences of hybridization. (2 marks)

Consequence 1 and explanation:

Consequence 2 and explanation:

Acceptable answers: speciation of hybrids, formation of a hybrid zone, amalgamation of two parental species, reinforcement of reproductive barriers, extinction of a parental species.

Also acceptable: inviable hybrids, allopolyploidization, polyploidization.

1 MARK PER CORRECT EXPLANATION

3. Soapberry bugs were observed to have interesting phenotypic variation in mouth morphology with respect to their environment. Please explain why soapberry bugs are a good example of sympatric speciation. Please also state what type of selection is occurring. (3 marks)

The soapberry bugs are not geographically isolated (1mark) but feed and breed on different fruits which constitute different habitats (1 mark).

Disruptive selection is occurring (1 mark).

4. Using the box below, draw the result of a scenario that illustrates the divergence of POPULATION "A" AND POPULATION "B" due to vicariance. Use the caption line (the line below the box) to BRIEFLY describe what has occurred. (2 marks)

Caption: _____

A diagram should be drawn that illustrates a broadly distributed ancestral population. Then a barrier arises such as a river or a mountain, or the drifting apart of continental plates. This leads to speciation. The key here is that the age of the barrier must about the same age as the age of the speciation event.

1MARK FOR CORRECT ILLUSTRATION (THERE IS AN EXAMPLE IN THE TEXTBOOK)

1 MARK FOR CAPTION EMPHASIZING THAT THE BARRIER AROSE OR WAS NOT PRE-EXISTING.

5. Using the space below, please draw phylogenetic relationships between the following taxa: (1) a species in the domain Archaea, (2) a fish, (3) a platypus (which is a monotreme mammal) and (4) a kangaroo. On this phylogeny please label (A) the root and (B) where the origin of shelled eggs occurred. (5 marks)

Give 3 marks for correct phylogeny (Archaea,(fish, (platypus, kangaroo))). Give 1 point partial marks if the phylogeny is wrong but Archaea is still sister to (fish, platypus, and kangaroo) with the root in betwee these clades.
Give one mark for labeling the root between (Archaea) and (fish, (playtpus, kangaroo))
Give one mark for labeling the origin of shelled eggs on the branch leasing to (platypus, kangaroo)

6. Please provide two ways that Hox genes have evolved in metazoans that have resulted in the amazing morphological diversification we see today. (2 marks)

Acceptable responses;

Changes in Hox gene number through gene duplication

Changes in Hox gene number through genome duplication

Changes in Hox gene number through gene deletion

Changes in Hox gene expression by expanding or contracting the expression domain

Turning “on” or “off” Hox gene expression in new places or developmental stages

Changing the genes that are targeted by Hox genes

Changing the promoter regions of genes that are regulated by Hox genes

Changing the promoter regions of Hox genes

THE END