**Bugs With Gears**

Name and date submitted (3 pts):

Using this handout as a template, respond to all questions below. KEEP THE SAME NUMBERING. Upload your completed work by the due date.

(64 questions, 100 points total)

Part 1: Watch “Bugs with Gears” on Discovery Science. At the time of writing, it was here <https://www.youtube.com/watch?v=Iyrga53Cwc4>

1. (0.00 – 1.00) The design inference
   1. The field of engineering which mimics biology is called \_\_\_\_\_
   2. Studying the eyes of flies has led to
   3. Studying the physics of dragonfly wings has led to
   4. Studying cockroach mechanics has led to
   5. A honeybee algorithm helped to
2. Who is credited with inventing the toothed gear? Look it up…
3. (1.00-2.00) Regarding the Planthopper taxonomic classification,
   1. State the family:
   2. State the genus:
   3. State the species:
4. Jumping motion
   1. The Planthopper can jump how many body lengths?
   2. This is like a human long jumper jumping how far?
   3. When jumping, the Planthopper coordinates the movement of its legs with \_\_\_\_
   4. Making long jumps accurately requires that \_\_\_\_
5. (2.00-3.00) Gear function
   1. As one leg starts to move, the interlocking gears perform what function?
   2. How fast in teeth per second do the gears move?
6. (3.00-4.00) Darwin proposed that all life evolved due to V\_\_\_\_\_\_\_\_\_\_\_\_\_ followed by N\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
7. (3.00-4.15) Polar bear evolution
   1. Evolutionary biologists believe that Polar Bears evolved from what animal?
   2. First, a brown bear was born with a mutation in its DNA which enabled the lucky bear to survive by eating what animals?
   3. Generations later, another bear cub was born with a DNA mutation that altered what feature that allowed it to sneak up on prey in a snowy environment?
   4. Fill in the (4) blanks: V\_\_\_\_\_\_\_\_\_\_ in the ancestral species of the \_\_\_\_\_\_\_\_\_\_\_\_, followed by N\_\_\_\_\_\_\_\_\_\_\_\_\_ for the harsh, snowy environment of the North, were responsible for building the magnificent Polar Bear in S\_\_\_\_\_\_\_\_\_\_\_\_.
8. (4.15-4.45) What Darwin didn’t know: We now know that changes we can see (Phenotypes) are driven by changes we cannot see (Genotypes).
   1. Specifically what is meant by “phenotype”? Give a complete definition.
   2. Specifically what is meant by “genotype”? Give a complete definition.
9. (4.50-5.10) The logical conclusion of macro-evolution:
   1. If brown bears can give rise to Polar Bears simply through mutations and natural selection, what is the logical conclusion for bears and for humans?
10. Give the complete taxonomic classification for the Polar Bear
    1. Kingdom:
    2. Phylum:
    3. Class:
    4. Order:
    5. Family:
    6. Genus:
    7. Species:
11. The brown bear uses the same classification, except for species. What is the species name used for the brown bear?

Part 2: Watch “The Effects of Mutation” on Discovery Science. At the time of writing, it was here <https://www.youtube.com/watch?v=v9AxqLsKmMA>

1. (0.00-0.30) Geneticists believe all modern dogs descended from what animal?
2. (0.30-1.45) It turns out, Polar Bear fur is the result of a “broken gene”, not an “improved gene”:
   1. In animals, DNA is found in what organelle?
   2. Are animals eukaryotes, or prokaryotes? (select the correct one)
   3. The four bases on DNA are (state the full name of all 4 bases here)…
   4. What is meant by “gene”? Write out the full definition given in the video:
   5. A mutation in a gene occurs when?
   6. What does a mutation ‘break’?
   7. How does the ‘broken gene’ lead to white fur on the animal?
3. (1.45-3.00) Observing modern mutations in bacteria
   1. The researchers worked with bacteria called E. coli. What is the full genus name for E. coli?
   2. In the early 1990’s, they saw that the descendant bacteria started to do what?
   3. What was the cause of this? What happened to one of its genes?
   4. They examined a dozen other genes in the E. coli. What had happened to these genes?
   5. Mutations has left the genes either C\_\_\_\_\_\_\_\_\_ or completely D\_\_\_\_\_\_\_\_\_\_\_\_.
4. (3.00-3.45) How can “breaking” a gene help an organism survive:
   1. Explain the car analogy. What is going on? What did he do to the car in order to survive? Why?
   2. Was the car improved? Or was the car partly destroyed?
   3. Extending the analogy, did the car ‘evolve’ new, more-advanced features and architecture, or did the car merely ‘devolve’ and end up losing features to give it a short-term advantage?
5. (3.45-5.00) Dogs
   1. The genetic differences in breeds of dogs were caused by several mutations in genes. The mutations didn’t “construct new genes”; rather, what they actually did was \_\_\_\_\_\_\_
   2. Increased muscle mass in some breeds was caused by what?
   3. A yellow coat was caused by what?
   4. Short tails were caused by what?
   5. The friendliness of some breeds, compared to wolves, was caused by what?
   6. What is the ‘price’ of breaking genes? Will they ever return to normal? Explain…
   7. Will the Polar Bear ever mutate back again? Why or why not?
6. (5.00-5.30) iPhone ‘evolution’ or ‘devolution’?
   1. Do DNA mutations actually represent a genetic “upgrade” for the organism?
   2. Explain the iPhone analogy. What is the point being made?
   3. Disabling your iPhone’s GPS may save your battery, but does it give your phone new functionality? Explain…
   4. Extending the analogy, does disabling your iPhone’s GPS represent upward ‘evolution’ of your iPhone, or simply downward ‘devolution’ in order to give you a short-term advantage? Explain….
7. (5.30-end) Evolution vs. Devolution
   1. We are told the main driver for macro-evolution is \_\_\_\_\_\_\_\_\_
   2. We are also told that evolution is responsible for ‘lower forms’ being upgraded to \_\_\_\_\_\_\_\_\_\_
   3. However, modern evidence points to new species/varieties being formed by \_\_\_\_\_\_\_\_\_\_ existing genes.

Further study: Watch the next video in the series, “The X Factor in Life”.