Exercise sheet 1: Biology Basics

Exercise 1 - General

Here are some general biology questions. Using the Possible Solutions tab will convert each question to multiple choice

Question 1A Where is the genome stored in prokaryotes and eukaryotes?

Hint : Possible Answers

- ☐ Inside the nucleus in eukaryotes
- ☐ Outside the cell in prokaryotes
- ☐ Prokaryotes have no genome
- ☐ Inside the nucleolus in prokaryotes
- ☐ In chromatin in eukaryotes
- ☐ Partially in mitochondria in prokaryotes
- ☐ Directly inside the cell in prokaryotes

Correct Answer

- ☒ Inside the nucleus in eukaryotes
- ☒ Directly inside the cell in prokaryotes

Question 1B Name two more differences between prokaryotes and eukaryotes?

Hint : Possible Answers

- ☐ Prokaryotes have compartmentation through membrane
- ☐ Eukaryotes are not multi-cellular organisms
- ☐ Prokaryotes have mitochondria

- ☐ Eukaryotes have no nucleus
- ☐ Prokaryotes have no ER
- ☐ Eukaryotes are single cell organisms
- ☐ Eukaryotes have no flagellum

Correct Answer

- ☒ Prokaryotes have no ER

Question 1C List examples of prokaryotes and eukaryotes.

Hint : Possible Answers

- ☐ Escherichia coli is a prokaryote
- ☐ Amoebas are prokaryotes
- ☐ Fungi are eukaryotes
- ☐ Archaea are eukaryotes
- ☐ Insects are eukaryotes
- ☐ Salmonella is a prokaryote
- ☐ Plasmodium malariae is a prokaryote

Correct Answer

- ☒ Escherichia coli is a prokaryote
- ☒ Fungi are eukaryotes
- ☒ Insects are eukaryotes
- ☒ Salmonella is a prokaryote

Question 1D What are the three information-carrying biopolymers?

Hint : Possible Answers

- ☐ Protein
- ☐ Cellulose
- ☐ DNA
- ☐ Polysaccharides
- ☐ RNA
- ☐ amino acid
- ☐ nucleotide

Correct Answer

- ☒ Protein
- ☒ DNA
- ☒ RNA

Question 1E What is denoted by the "Central Dogma" of molecular biology?

Hint : Possible Answers

- ☐ Protein can make Protein
- ☐ DNA can make DNA
- ☐ Protein can make RNA and then RNA makes DNA
- ☐ DNA can make RNA and then RNA makes Protein
- ☐ RNA can make RNA
- ☐ DNA can make RNA and then RNA makes DNA
- ☐ Protein can make DNA

Correct Answer

- ☒ DNA can make DNA
- ☒ DNA can make RNA and then RNA makes Protein
- ☒ RNA can make RNA
- ☒ DNA can make RNA and then RNA makes DNA

Exercise 2 - DNA and RNA

The genetic information of an organism is stored in the DNA in the form of a code. This code consists of four building blocks or bases (A for adenine, C for cytosine, G for guanine, T for thymine). These bases or nucleotides follow each other in a certain sequence, e.g.:

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AGTCGTAATTGGCCCCAATTGCAAAAA
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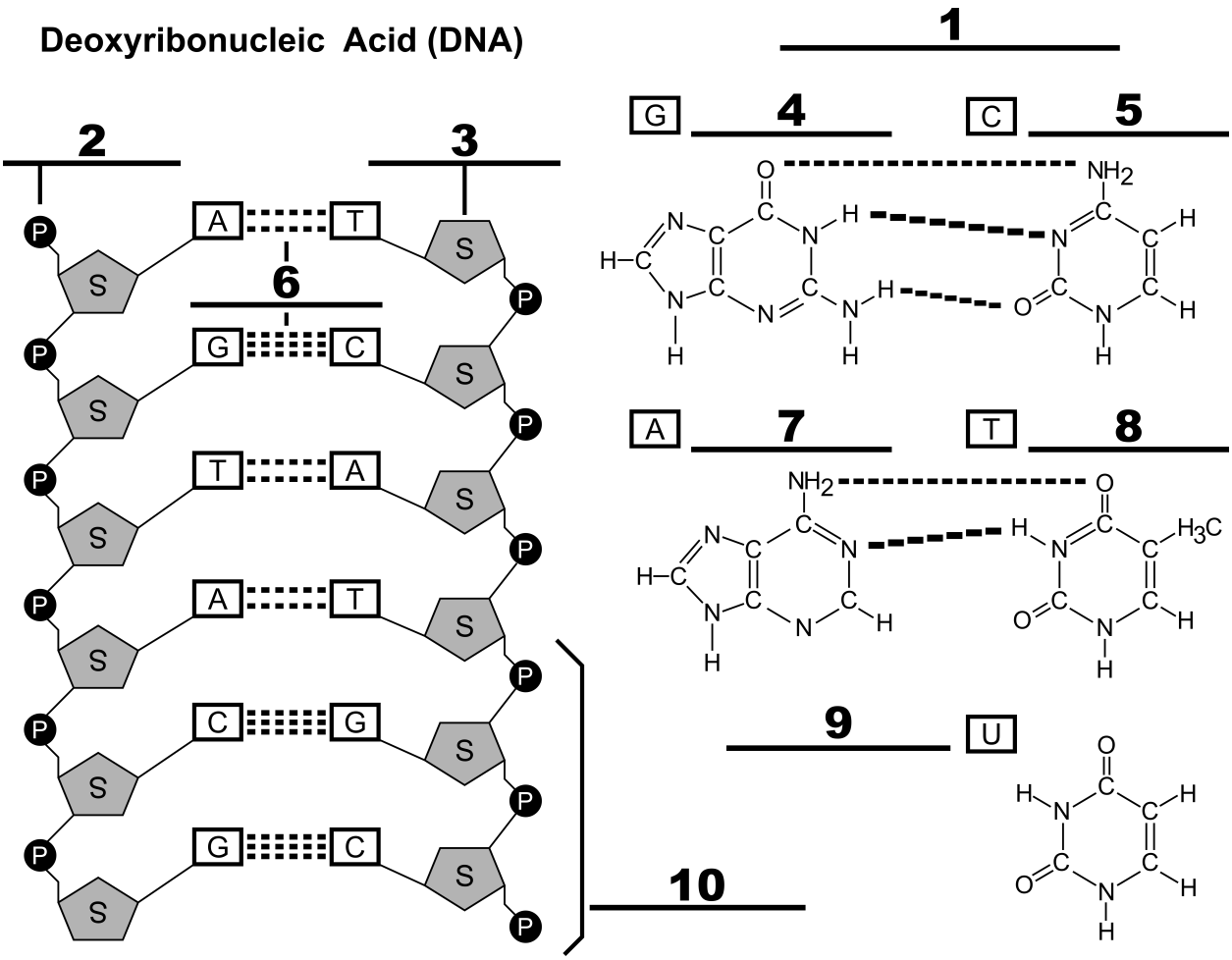
A single hereditary unit consists of a subsequence of DNA (called a gene), which contains the information to build a functional RNA or protein molecule.

Question 2A Match these terms to the correct number in the figure below: adenine, thymine, cytosine, guanine, uracil, phosphate, deoxyribose, hydrogen bond, backbone, and bases.



Hint

1. bases

2.

3. deoxyribose
4.
5.
6. hydrogen_bond
7.
8. thymine
9.
10. backbone

Correct Answer

1. bases

2. phosphate
3. deoxyribose
4. guanine
5. cytosine
6. hydrogen_bond
7. adenine
8. thymine
9. uracil
10. backbone

Question 2B A piece of DNA contains 33% guanine. What are the percentages of adenine, cytosine, and thymine in that piece of DNA?

Hint What is the percentage of cytosine?

What is the combined percentage of guanine and cytosine?

What is the combined percentage of adenine and thymine?

Correct Answer

- guanine: 33%
- cytosine: 33%
- adenine: 17%
- thymine: 17%

Question 2C Decide which bases are pyrimidines and which are purines: A for adenine, C for cytosine, G for guanine, T for thymine, U for uracil.

Hint

Correct Answer

Question 2D Which of these statements concerning DNA and RNA are correct?

- ☐ Uracil is a standard base in RNA
- ☐ DNA is longer than RNA
- ☐ DNA and RNA have a different structure
- ☐ RNA has an intermolecular double-helix structure
- ☐ RNA contains ribose sugar

Hint

Correct Answer

Question 2E In what direction is an RNA sequence written?

Hint

- ☐ 3' end to 5' end
- ☐ 5' end to 3' end

Correct Answer

Question 2F Why is the RNA sequence written in that direction?

Hint: Possible Answers

- ☐ The order is based on the numbering of the carbons in the sugar of the nucleic acid
- ☐ The order is based on the numbering of the carbons in the phosphate of the nucleic acid
- ☐ The order was arbitrarily chosen by the discoverer of RNA

Correct Answer

Question 2G Decide for the following RNAs whether they are coding or non-coding: mRNA, tRNA, rRNA, microRNA, siRNA, snoRNA

Hint There is only one coding RNA

Correct Answer

- coding: mRNA
- non-coding: tRNA, rRNA, microRNA, siRNA, snoRNA

Exercise 3 - DNA and RNA

Question 3A What do these acronyms stand for within this course?

- DNA
- RNA
- ncRNA
- mRNA
- UTR
- ORF
- CDS

Hint

- ☐ non-coding-RNA
- ☐ Opposite-Reading-Frame
- ☐ Deoxyribonucleic acid
- ☐ non-complementary-RNA
- ☐ missense-RNA
- ☐ messenger-RNA
- ☐ ribonucleic acid
- ☐ untranslated region
- ☐ coding-strand
- ☐ coding-sequence
- ☐ open reading frame

Correct Answer

- ☒ DNA - Deoxyribonucleic acid
- ☒ RNA - Deoxyribonucleic acid
- ☒ ncRNA - non-coding-RNA
- ☒ mRNA - messenger-RNA
- ☒ UTR - untranslated region
- ☒ ORF - open reading frame
- ☒ CDS - coding-sequence

Question 3B Check whether the following terms belong to Eukaryotes, Prokaryotes or both.

DNA

- ☐ Eukaryotes
- ☐ Prokaryotes

splicing

- ☐ Eukaryotes
- ☐ Prokaryotes

transcription

- ☐ Eukaryotes
- ☐ Prokaryotes

ncRNA”

- ☐ Eukaryotes
- ☐ Prokaryotes

single-cell-organism

- ☐ Eukaryotes
- ☐ Prokaryotes

Hint DNA - [ ] Eukaryotes - [ ] Prokaryotes

splicing

- V Eukaryotes
- x Prokaryotes

transcription

- V Eukaryotes
- V Prokaryotes

ncRNA”

- ☐ Eukaryotes
- ☐ Prokaryotes

single-cell-organism

- ☐ Eukaryotes

☐ Prokaryotes

Correct Answer DNA

☒ Eukaryotes
☒ Prokaryotes

splicing

☒ Eukaryotes
☐ Prokaryotes

transcription

☒ Eukaryotes
☒ Prokaryotes

ncRNA"

☒ Eukaryotes
☒ Prokaryotes

single-cell-organism

☐ Eukaryotes
☒ Prokaryotes

Question 3C Check whether the following statements are True or False.

☐ The genome is stored in the nucleus

☐ FASTA files are used to store sequence information

☐ A Watson-Crick base pair describes a pyrimidine pairing with a purine

☐ A Watson-Crick base pair describes a purine pairing with a purine

☐ RNA is a single stranded bio-polymer

Hint

☐ The genome is stored in the nucleus

- V FASTA files are used to store sequence information

☐ A Watson-Crick base pair describes a pyrimidine pairing with a purine

- x A Watson-Crick base pair describes a purine pairing with a purine

☐ RNA is a single stranded bio-polymer

Correct Answer

- ☐ The genome is stored in the nucleus
- ☒ FASTA files are used to store sequence information
- ☒ A Watson-Crick base pair describes a pyrimidine pairing with a purine
- ☐ A Watson-Crick base pair describes a purine pairing with a purine
- ☐ RNA is a single stranded bio-polymer