

Cells and Evolution Revision Questions

1. [1 mark]

What is a function of the plant cell wall?

- A. Formation of vesicles for transport of large molecules
- B. Prevention of excessive water uptake
- C. Communication with other cells by means of glycoproteins
- D. Active transport of ions

2. [1 mark]

What distinguishes prokaryotic cells from eukaryotic cells?

	Prokaryotic cells	Eukaryotic cells
A.	no plasma membrane	plasma membrane
B.	80S ribosomes	70S ribosomes
C.	Golgi apparatus	mitochondria
D.	no internal membrane compartments	internal membrane compartments

3. [1 mark]

What structures are part of an *Escherichia coli* cell?

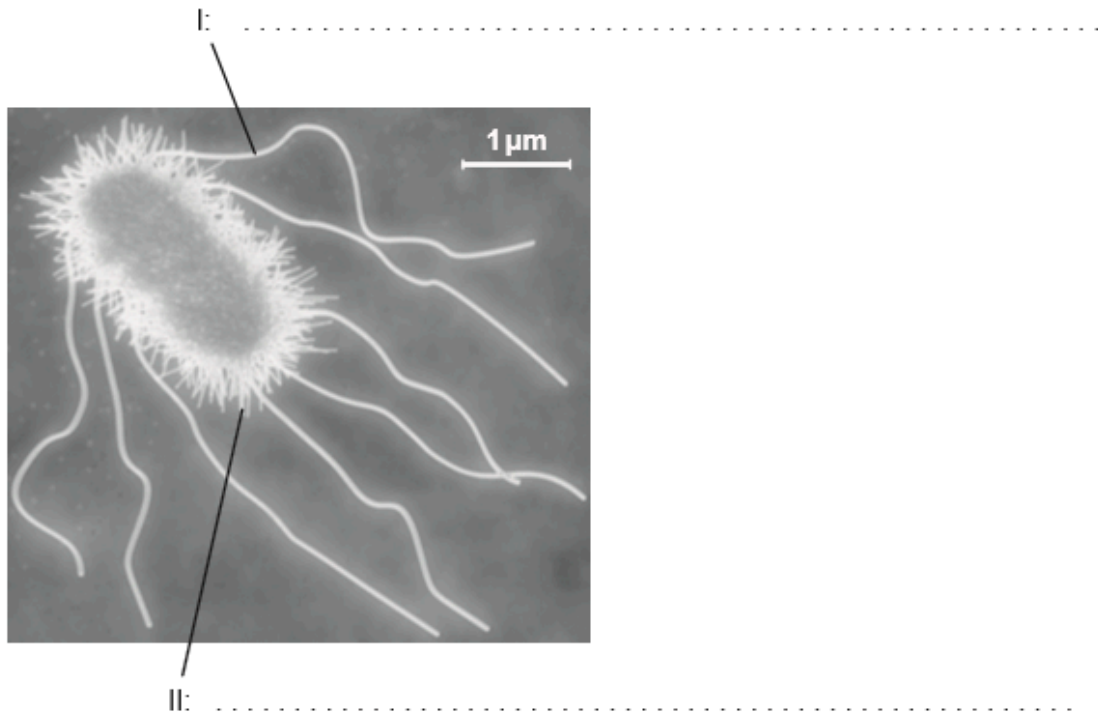
- A. Ribosomes, nucleoid and Golgi apparatus
- B. Ribosomes, mitochondria and pili
- C. Cell wall, plasma membrane and nuclear membrane
- D. Pili, flagella and cytoplasm

4a. [5 marks] Draw a labelled diagram of a prokaryotic cell.

4b. *[6 marks]* Explain the evolution of antibiotic resistance in bacteria.

5a. *[2 marks]* Outline the cell theory

5b. [2 marks]

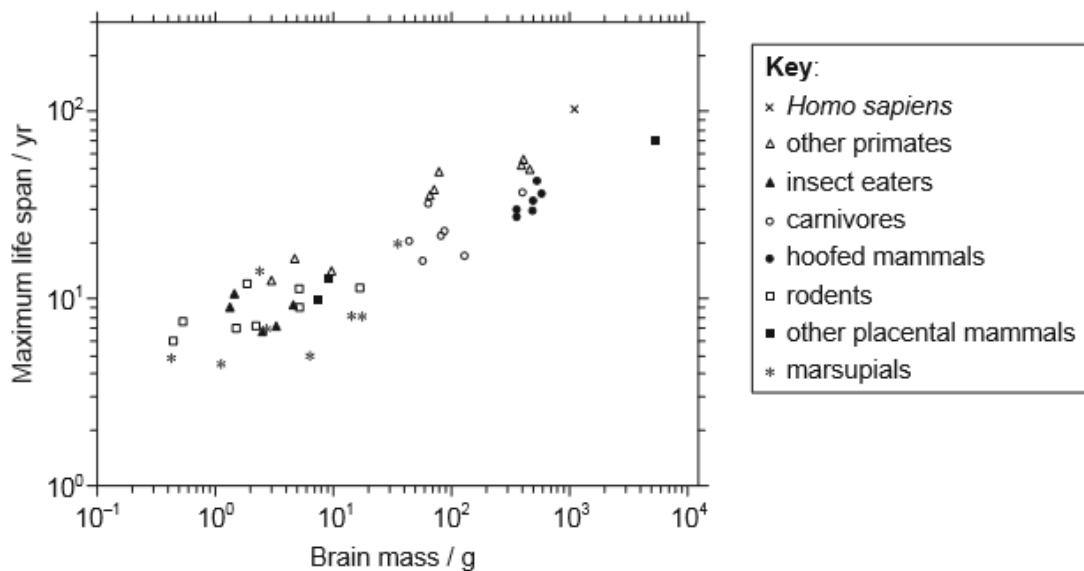


Annotate the electron micrograph of the *Escherichia coli* cell with the function of the structures labelled I and II.

5c. [1 mark] Calculate the magnification of the electron micrograph.

6. [5 marks] Describe the consequences of the potential overproduction of offspring.

7a. [1 mark] The evolution of increased body size in mammals has been accompanied by an increase in life span. Another variable that could affect life span is brain size. Data was analysed from 47 mammalian species.



[Source: Hofman, M. A. (1993), Encephalization and the evolution of longevity in mammals. *Journal of Evolutionary Biology*, 6: 209–227. doi: 10.1046/j.1420-9101.1993.6020209.x]

State the relationship between brain mass and maximum life span.

7b. [1 mark] Identify the group with the widest range of brain mass.

7c. *[3 marks]* Compare the brain mass and life span of primates and marsupials.

7d. *[2 marks]*. Discuss how a larger brain size and longer life span might have contributed to the evolution of these species.

8a. *[2 marks]*. Outline how fossil records can provide evidence for evolution.

8b. *[1 mark]* Distinguish between the terms genotype and phenotype.

9. [8 marks]. Explain how evolution may happen in response to environmental change with evidence from examples.

Cell and Natural Selection Revision [42 marks]

1. [1 mark]

Markscheme

B

2. [1 mark]

Markscheme

D

3. [1 mark]

Markscheme

D

4a. [5 marks]

Markscheme

- a. cell wall – *uniformly thick and drawn outside the plasma membrane;*
 - b. plasma membrane – *a continuous single line;*
 - c. cytoplasm/cytosol;
 - d. nucleoid/(naked) DNA – *shown as a tangle of thread or irregular shape without a nuclear membrane;*
 - e. (70S) ribosomes – *drawn as a small circle or dark dot;*
 - f. pili – hair like structures / flagellum – *shown to be longer than any pili;*
 - g. plasmid – *circular ring of DNA;*
 - h. capsule – *drawn outside the cell wall;*
- Award [1] for each structure clearly drawn and labelled which conforms to the italicized guidelines given above.*

4b. [6 marks]

Markscheme

- a. antibiotics (are chemicals) used to treat bacterial diseases;
- b. within populations, bacteria vary in their (genetic) resistance to antibiotics/fitness;
- c. resistance arises by (random) gene mutation;
- d. when antibiotics are used antibiotic-sensitive bacteria are killed;
- e. (natural) selection favours those with resistance;
- f. resistant bacteria survive, reproduce and spread the gene / increase allele frequency of resistant bacteria;
- g. the more an antibiotic is used, the more bacterial resistance/the larger the population of

- antibiotic-resistant bacteria;
- h. genes can be transferred to other bacteria by plasmids;
- i. doctors/vets use different antibiotics but resistance develops to these as well;
- j. multiple-antibiotic resistant bacteria evolve/it becomes difficult to treat some infections;

(Plus up to [2] for quality)

5a. [2 marks]

Markscheme

- a. living things are composed of cells;
 - b. cells are the basic/smallest unit of life;
 - c. cells come from pre-existing cells;
- Do not accept cells are the “smallest organisms”.*
Do not accept “cells are the building blocks” of life on its own.

5b. [2 marks]

Markscheme

- a. I: locomotion;
 - b. II: attachment to surfaces / holds bacteria together / conjugation;
- Do not accept “exchange material” on its own.*
If more than one function is given, mark the first answer only.

5c. [1 mark]

Markscheme

$\times 15\,000$ (accept answers in the range of $\times 14\,000$ to $\times 16\,000$)

6. [5 marks]

Markscheme

Remember, up to TWO “quality of construction” marks per essay.

- a. more (offspring) than the environment can support / carrying capacity reached;
- b. increased mortality/lower life expectancy/more deaths;
- c. competition (for resources) / struggle for survival;
- d. food/mates/nest sites/territory/other example of resource shortage / example of greater need;
- e. variation between members of population / example of variation;
- f. better adapted more likely to survive / converse; (reject Lamarckian statements such as those who adapt survive)
- g. better adapted reproduce / pass on (favourable) genes/traits / converse;
- h. natural selection / (survival of fittest) leads to evolution;

7a. [1 mark]

Markscheme

As brain mass increases life span increases / positive/direct relationship/correlation.

7b. [1 mark]

Markscheme

Other placental mammals.

7c. [3 marks]

Markscheme

	<i>primates</i>	<i>marsupials</i>
a.	larger range of brain mass	(smaller);
b.	(generally) greater brain mass	(generally less);
c.	larger range of life span	(smaller);
d.	(generally) with greater life span	(generally with lesser life span);
e.	both with positive relationship between brain mass and life span;	
f.	both overlap (with the primates higher);	

Do not accept answers stating only numerical values without comparative wording.

7d. [2 marks]

Markscheme

- a. larger brain size allows for higher intelligence/better cognition/more complex brain functions;
- b. more efficient food finding / escape from predators;
- c. longer life span favours parental care/survival for more reproduction;
- d. (these advantages) favour natural selection which leads to evolution;

8a. [2 marks]

Markscheme

- a. the sequence in which fossils appear matches the expected sequence of evolution;
- b. comparisons with fossils and living organisms (morphology) shows change in characteristics from an ancestral form / *OWTTE*;

Vestigial organs and homologous structures are acceptable answers.

- c. fossils of extinct species show that (evolutionary) change has occurred;
- d. fossils can be dated with radioisotopes / geological depth/strata indicates (relative) age/date of organism;
- e. can yield DNA for molecular clock analysis;
- f. example of any of the above can earn one mark (*eg*: reptiles follow amphibians);

8b. [1 mark]

Markscheme

genotype is the genetic make-up/set of alleles (of an organism) while phenotype is the characteristics (expressed/shown in an organism)

9. [8 marks]

Markscheme

- a. variation in population;
- b. (variation is) due to mutation/sexual reproduction;
- c. valid example of variation in a specific population;
- d. more offspring are produced than can survive / populations over-populate;
- e. competition / struggle for resources/survival;
- f. example of competition/struggle for resources;
- g. survival of fittest/best adapted (to the changed environment)/those with beneficial adaptations / converse;
- h. example of changed environment and adaptation to it;
- i. favourable genes/alleles passed on / best adapted reproduce (more) /converse;
- j. example of reproduction of individuals better adapted to changed environment;
- k. alleles for adaptations to the changed environment increase in the population;
- l. example of genes/alleles for adaptations increasing in a population;

m. evolution by natural selection;

n. evolution is (cumulative) change in population/species over time / change in allele frequency;

Suitable examples are antibiotic resistance and the peppered moth but any genuine evidence-based example of adaptation to environmental change can be credited.

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