Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1

Wednesday 27 October 2021 (morning)

45 minutes

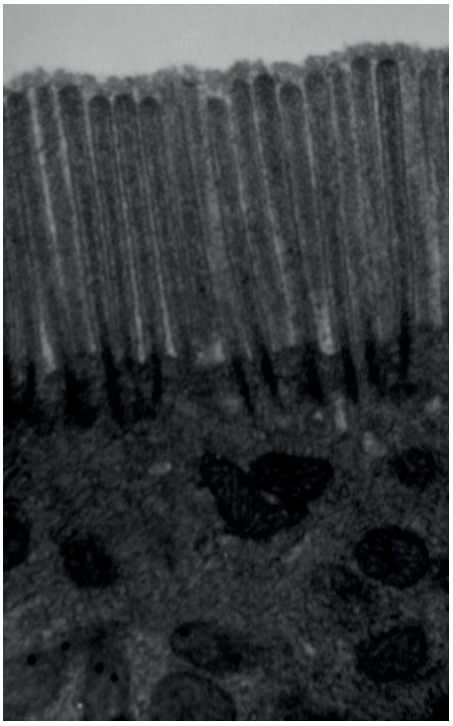
Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.
- The maximum mark for this examination paper is **[30 marks]**.

8821 – 6004

15 pages

1. The image shows part of a mammalian cell.



What is the specialized function of this mammalian cell?

A. Locomotion

B. Absorption

C. Reception of stimuli

D. Gas exchange

2. Which features of phospholipids give them their amphipathic properties?

A. Basic phosphate groups and acidic lipids

B. Acidic phosphate groups and basic lipids

C. Hydrophobic phosphate groups and hydrophilic fatty acids

D. Hydrophilic phosphate groups and hydrophobic fatty acids

3. How is facilitated diffusion in axons similar to active transport?

A. They both require the energy of ATP.

B. They both move substances against a concentration gradient.

C. They both use sodium–potassium pumps.

D. They are both carried out by proteins embedded in the axon membrane.

4. How do both mitochondria and chloroplasts provide evidence for the endosymbiotic theory?

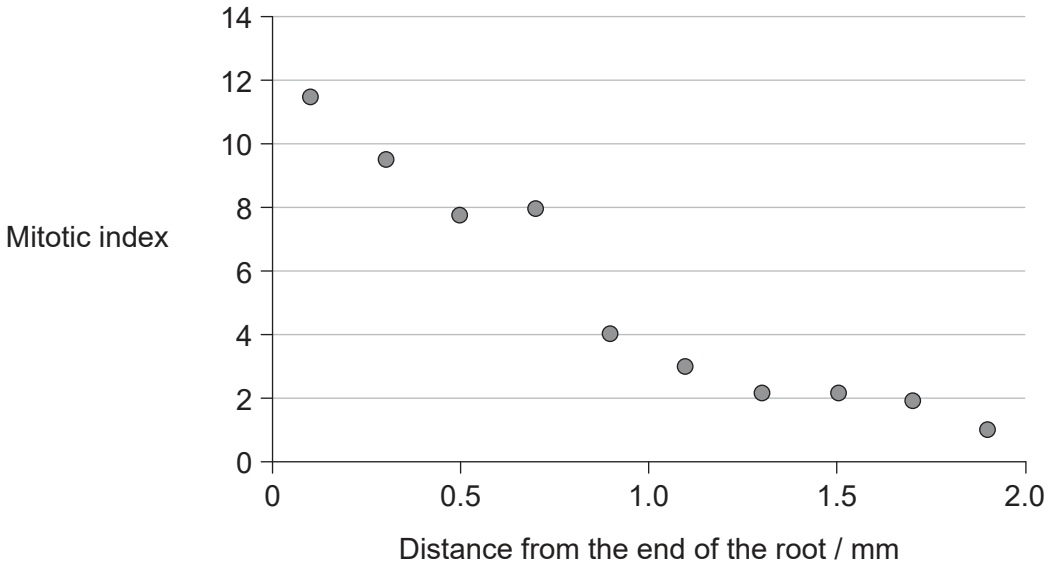
A. They have double membranes.

B. They have 80S ribosomes similar to prokaryotes.

C. They contain the same DNA as the nucleus of the cell.

D. They exist together in eukaryote cells for their mutual benefit.

5. The graph shows the mitotic index in the roots of lentil plants at different distances from the end of the root.



What can be deduced from the graph?

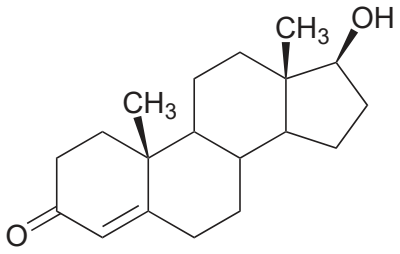
A. As the distance from the end of the root increases, more cells are undergoing mitosis.

B. At 0.5 mm from the end of the root, most of the cells are in prophase.

C. There were fewer cells observed at 1.5 mm than at 0.5 mm.

D. As the distance from the end of the root increases, the percentage of cells in interphase increases.

6. Testosterone is a hormone that is important for male reproductive development.



To which group of compounds does testosterone belong?

A. Nucleotides

B. Carbohydrates

C. Lipids

D. Amino acids

7. What is the benefit to living organisms that water has a high specific heat capacity?

A. Heat can be lost from the skin when sweat evaporates.

B. Aquatic environments do not have a great fluctuation in their temperature.

C. The amount of heat stored by water is highly predictable.

D. It allows water to be a solvent for chemical reactions at body temperature.

8. What prevents plants from converting carbon dioxide into glucose in the dark?

A. They do not have a source of energy.

B. It is too cold.

C. They do not require glucose during the night.

D. Their enzymes are inhibited.

9. Lactose can be removed from milk by passing the milk through a column of alginate beads to which immobilized lactase is bound. What is an advantage of immobilizing the enzyme?

A. It creates more active sites.

B. The alginate beads act as a coenzyme.

C. It lowers the activation energy of the reaction.

D. It allows the product to be separated easily from the enzyme.

10. What is the correct arrangement for the components of one strand in a DNA molecule?

A. — phosphate — deoxyribose — base — phosphate — deoxyribose — base —

B. — base — deoxyribose — base — deoxyribose — base — deoxyribose —

| | |

phosphate phosphate phosphate

C. — phosphate — deoxyribose — phosphate — deoxyribose — phosphate — deoxyribose —

| | |

base base base

D. — phosphate — base — phosphate — base — phosphate — base —

| | |

deoxyribose deoxyribose deoxyribose

11. The data shows part of the genetic code for mRNA. Which anticodon could be found on a tRNA molecule bonded to lysine?

UUU	Phenylalanine
UUC	
AAA	Lysine
AAG	

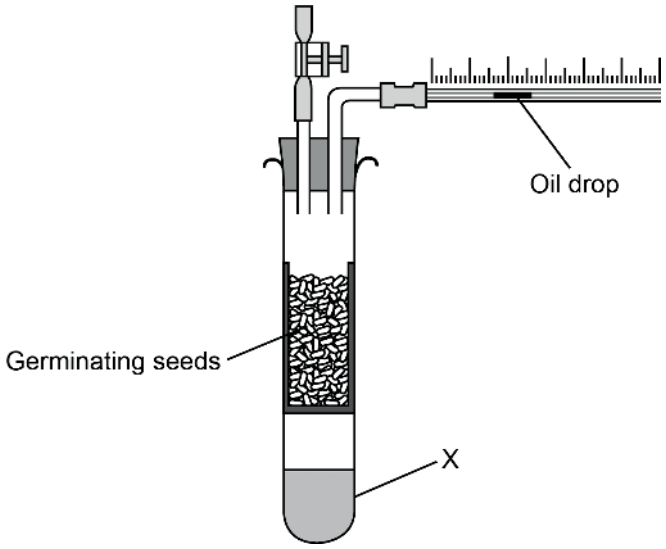
A. AAG

B. UUC

C. TTT

D. GAA

12. A respirometer is used to measure the oxygen consumption of germinating seeds. The distance that the oil drop moves is measured at 15-minute intervals.



What is the function of chemical X?

A. Absorbs carbon dioxide so the oxygen released by the seeds can be measured

B. Absorbs carbon dioxide so the oxygen absorbed by the seeds can be measured

C. Absorbs oxygen so the carbon dioxide released by the seeds can be measured

D. Absorbs oxygen so the carbon dioxide absorbed by the seeds can be measured

13. John Cairns used the technique of autoradiography to produce photographs of DNA from the bacterium *E. coli*.

Which conclusion was drawn from his experiments?

A. The DNA in all organisms is circular.

B. DNA in *E. coli* naturally contains thymidine.

C. DNA replication is conservative.

D. The DNA in *E. coli* is 900 µm in length.

14. Down syndrome can be detected before birth by chorionic villus sampling. From where are the cells for this test taken?

A. Amniotic fluid surrounding the fetus

B. Fetal digestive system

C. Tissue in the placenta

D. Lining of the uterus of the mother

15. In humans, male pattern baldness is caused by a recessive sex-linked gene found only on the X chromosome.

If a father who does not have male pattern baldness and a mother who is a carrier for it have a child, what is the probability that the child will develop male pattern baldness in adulthood?

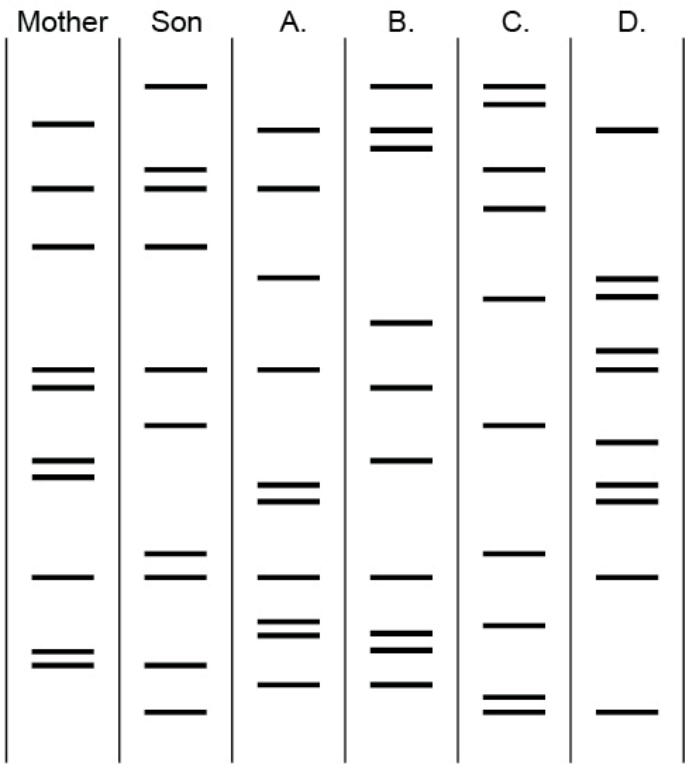
A. 0 %

B. 25 %

C. 50 %

D. 75 %

16. The image shows the result of DNA profiling of a mother, a child and four men. Which man is most probably the father of the child?



17. What is exchanged between a sealed mesocosm and the surrounding external environment?

A. Energy

B. Water

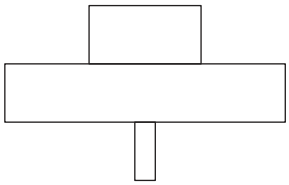
C. Air

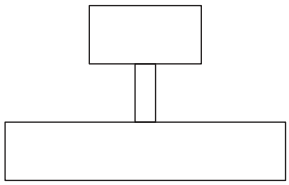
D. Nothing can pass

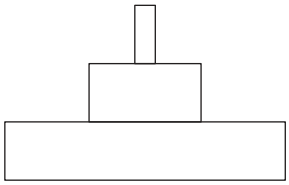
18. In a woodland ecosystem, each tree provides food for numerous aphids which feed on the sap of the tree. The aphids are eaten by carnivorous beetles, as shown in the food chain.

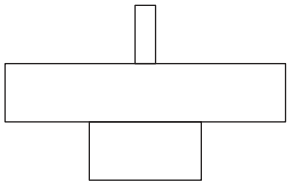
Oak Tree → Aphids → Beetles

Which pyramid of energy represents this relationship?

A. 

B. 

C. 

D. 

19. How do greenhouse gases contribute to global warming?

A. They destroy the ozone layer, allowing radiation to reach the Earth's surface.

B. They prevent radiation from the Earth escaping into space.

C. They trap short wavelength radiation in the atmosphere.

D. They are a product of combustion, which generates heat.

20. The pentadactyl limbs of mammals, birds, reptiles and amphibians are examples of which kind of structures?

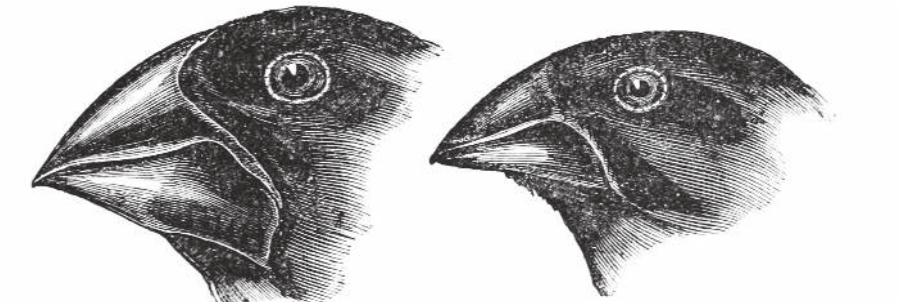
A. Homologous

B. Analogous

C. Vestigial

D. Convergent

21. Scientists studying ground finches (*Geospiza fortis*) on the island of Daphne Major in Galapagos found great differences in the shapes of the beaks.



What is the explanation for this variation in beak shape between the birds?

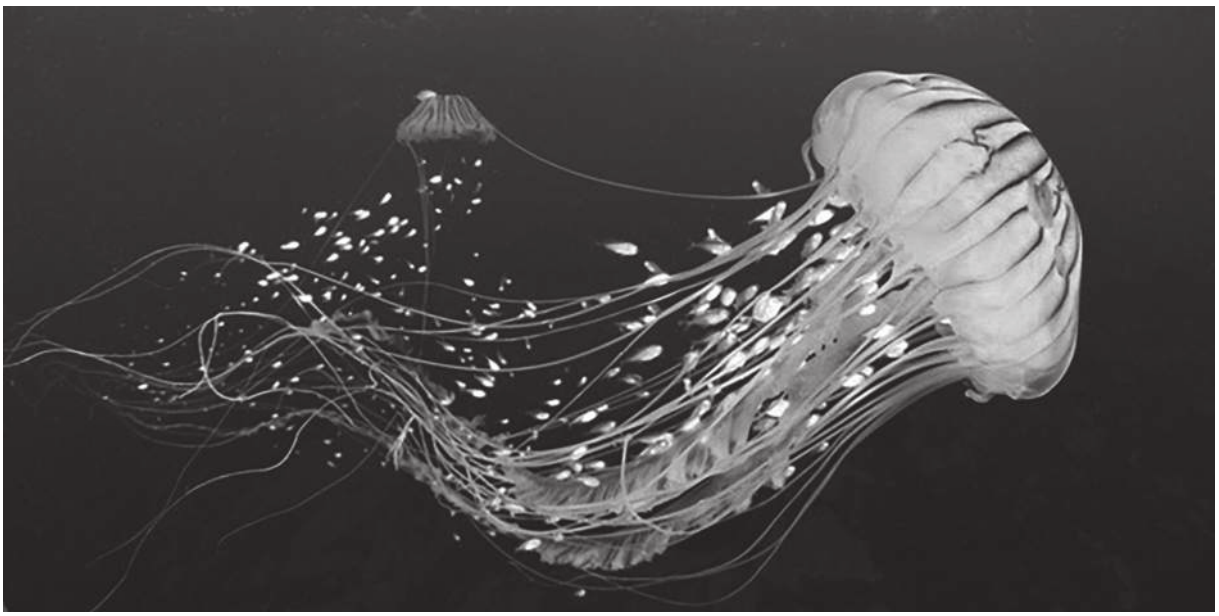
A. Ground finches grow larger beaks if there is competition for food.

B. They belong to different species.

C. They are adapted for different diets.

D. The more a beak is used by a ground finch, the larger it becomes.

22. The image shows the northern sea nettle (*Chrysaora melanaster*).



To which phylum does *C. melanaster* belong?

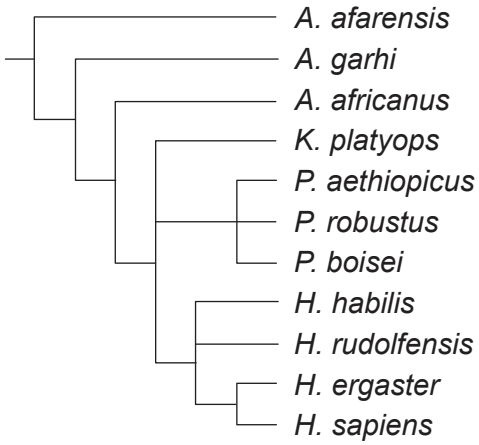
A. Porifera

B. Cnidaria

C. Platyhelmintha

D. Annelida

23. The cladogram shows one theory of how species of hominin evolved.



What can be deduced using the information in the cladogram?

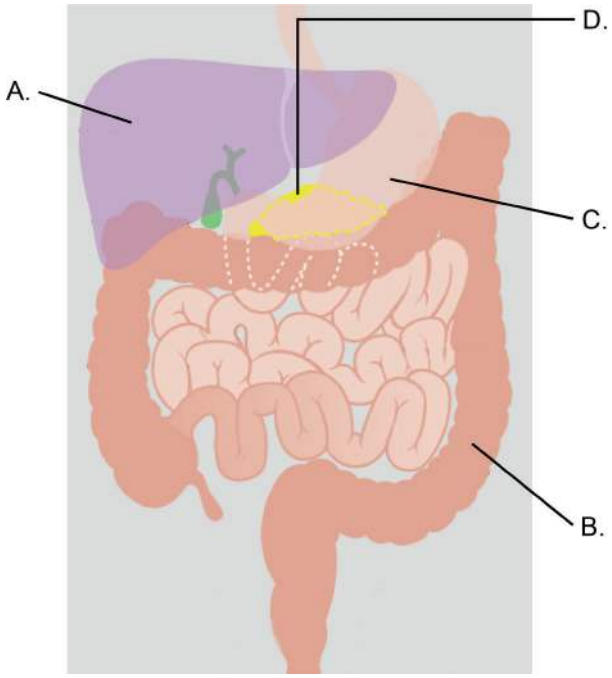
A. The closest species to *K. platyops* is *A. africanus*.

B. *A. afarensis* is extinct.

C. The DNA of *H. sapiens* is the same as that of *H. ergaster*.

D. *H. sapiens* and *P. robustus* shared a common ancestor.

24. The diagram shows some of the organs associated with the digestion of starch. Which organ produces amylase?



25. What occurs as a result of a cut in the skin of a finger?

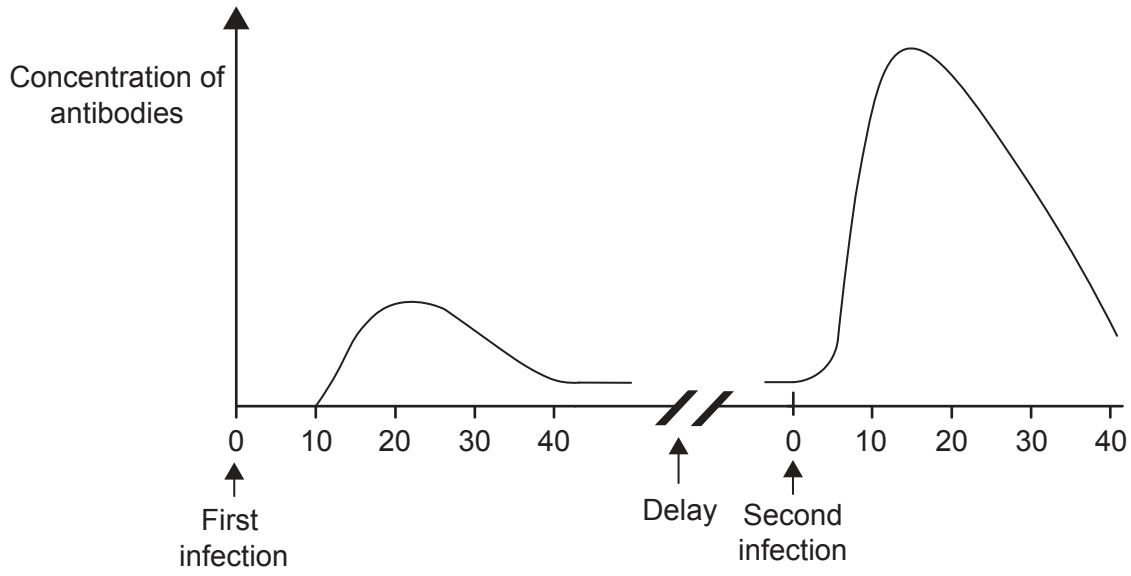
A. Prothrombin is transformed into thrombin.

B. Fibrin is converted to insoluble fibrinogen.

C. Platelets produce antibodies to prevent infection.

D. Clotting factors are released from red blood cells.

26. A person was infected with a pathogen and then later in life they were re-infected with the same pathogen. The graph shows the concentration of antibodies found in the blood that were produced in response to these two infections.



What is the reason for the faster rise in antibody concentration after the second infection?

A. The patient had previously been vaccinated with the antibody.

B. Antibodies had been stored after the first exposure.

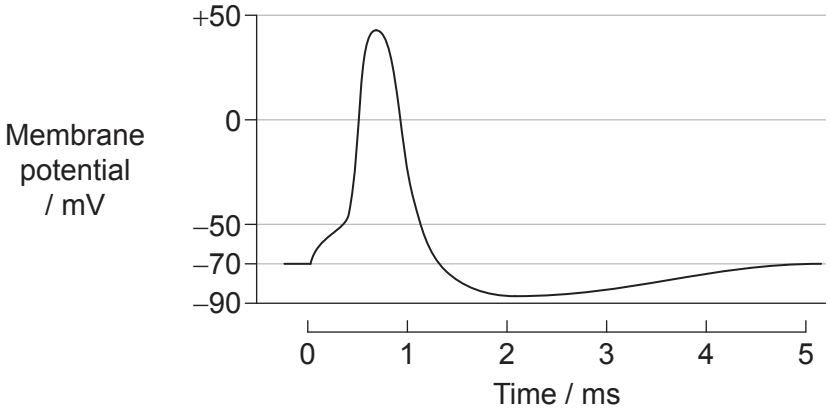
C. Lymphocytes rapidly reproduced to form plasma cells.

D. The second exposure was more infectious.

27. What occurs during inhalation?

	External intercostal muscles	Movement of ribs
A.	relax	fall
B.	contract	fall
C.	relax	rise
D.	contract	rise

28. The graph shows changes in the membrane potential in an action potential.



What is the approximate value of the threshold potential?

A. –88 mV

B. –70 mV

C. –50 mV

D. +45 mV

29. Which hormone regulates the hours of sleep and wakefulness?

A. Thyroxine

B. Insulin

C. Leptin

D. Melatonin

30. What is a function of luteinizing hormone (LH) in the female menstrual cycle?

A. To promote secondary sexual characteristics

B. To inhibit progesterone secretion

C. To stimulate the follicle to release estrogen

D. To trigger ovulation

References:

1. Louisa Howard, Katherine Connollly - Dartmouth Electron Microscope Facility. Available at: https://en.wikipedia.org/wiki/File:Microvilli.jpg.

5. *Physiologia Plantarum*, Volume 105, Issue 1, January 1999, Pages 171–178, Effect of microgravity on the cell cycle in the lentil root F. Yu, D. Driss-Ecole, J. Rembur, V. Legué, G. Perbal Wiley Online Library: https://onlinelibrary.wiley.com/doi/abs/10.1034/j.1399-3054.1999.105125.x

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22. Aflo, 2015. Northern sea nettle (*Chrysaora Melanaster*) floating, with Mackerel fry (*Carangidae*) Izu, Japan. [image online] Available at: https://www.naturepl.com/search/preview/northern-sea-nettle-chrysaora-melanaster-floating-with-mackerel-fry-/0_01489405.html [Accessed 23 March 2020].

24. Cancer Research UK. Diagram showing the parts of the digestive system. 30 July 2014. Available at: https://commons.wikimedia.org/wiki/File:Diagram_showing_the_parts_of_the_digestive_system_CRUK_324.svg. This file is licensed under the Creative Commons Attribution-Share Alike 4.0 International license. https://creativecommons.org/licenses/by-sa/4.0/deed.en [Accessed 2 December 2021]. Adapted.