Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Higher level
Paper 1

Thursday 5 November 2015 (morning)

1 hour

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 **[40 marks]**.

8815 – 6001

1. Two populations of the same fish species were fed different diets to investigate the effect of differing nutrition on their growth. What is an appropriate method to determine the significance of a resulting difference?

A. Calculate the mean for each population

B. Calculate the standard deviation for each population

C. Graph the results

D. Perform a *t*-test

2. Which shows the order of size from smallest to largest?

A. Viruses → cell membrane thickness → eukaryotic cells → prokaryotic cells

B. Cell membrane thickness → prokaryotic cells → viruses → eukaryotic cells

C. Cell membrane thickness → viruses → prokaryotic cells → eukaryotic cells

D. Viruses → cell membrane thickness → prokaryotic cells → eukaryotic cells

3. Animal cells often secrete glycoproteins as extracellular components. What is a role of these glycoproteins?

A. Adhesion

B. Additional energy reserve

C. Membrane fluidity

D. Water uptake

4. During which stage does the cell surface area to volume ratio decrease?

A. Interphase

B. Metaphase

C. Telophase

D. Cytokinesis

5. What describes nuclear division in stem cells?

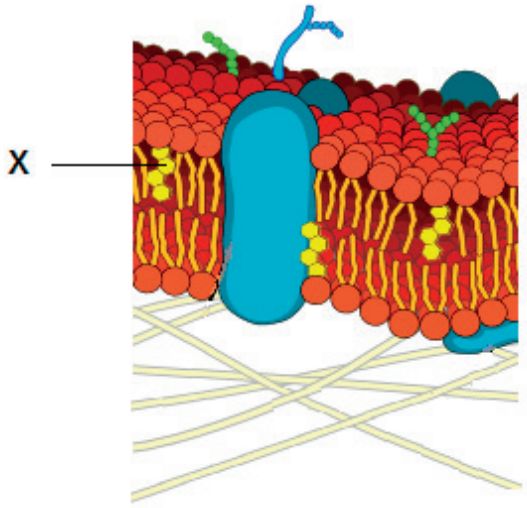
A. Clonal selection

B. Mitosis

C. Cytokinesis

D. Meiosis

6. The diagram shows a plasma membrane.



[Source: https://upload.wikimedia.org/wikipedia/commons/d/da/Cell_membrane_detailed_diagram_en.svg]

Which molecule is labelled X?

A. Cholesterol

B. Glycoprotein

C. Phospholipid

D. Amylase

7. Which always contains carbon, hydrogen and oxygen?

I. Carbohydrate
II. Protein
III. Fat

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

8. What is decreased when lactase is added to milk?

A. Sweetness

B. Disaccharides

C. Calcium

D. Monosaccharides

9. What is required to replicate DNA?

A. Temperature of 37 °C

B. Free nucleotides carrying A, C, G and T bases

C. Plasmids

D. Endonuclease

10. The image shows a lady picking tea (*Camellia sinensis*) leaves.

[Source: "SriLanka TeaHarvest (pixinn.net)" by Christophe Meneboeuf - Own work. More photos related to Sri Lanka on my photoblog: http://www.pixinn.net. Licensed under CC BY-SA 3.0 via Commons - https://commons.wikimedia.org/wiki/File:SriLanka_TeaHarvest_(pixinn.net).jpg#/media/File:SriLanka_TeaHarvest_(pixinn.net).jpg (cropped)]

Once the leaves have been picked, all further metabolism must be stopped. By what means could this be accomplished?

A. Heating

B. Adding water

C. Mechanical cutting

D. Spraying with anti-fungal agent

11. In a person who is heterozygous for sickle-cell anemia, where is the mutation found?

A. In every gamete produced

B. Only in gametes carrying an X chromosome

C. In all brain cells

D. In blood plasma

12. What is the chromosome number in a human gamete with non-disjunction?

A. 46

B. 45

C. 24

D. 23

13. In a human with type A blood, what determines the blood group?

A. Sex chromosomes

B. One or two alleles

C. Multiple alleles

D. Codominant alleles

14. How are enzymes used during gene transfer involving plasmids and chromosomal DNA?

	To cut plasmids	To extract gene from DNA	To rejoin DNA
A.	✓	✓	✓
B.	—	✓	—
C.	✓	✓	—
D.	✓	—	✓

15. The image shows a female Golden Orb-weaving spider (*Nephila plumipes*). They can grow as large as 4 cm and build webs strong enough to trap small birds for food.

[Source: © Mark Crocker. Used with permission.]

Which of the following describe(s) this spider?

I. Primary consumer
II. Heterotroph
III. Arthropod

A. I only

B. I and II only

C. II and III only

D. I, II and III

16. Which hypothesis is supported by evidence from ecological research?

A. Decomposers are the final stage in the food chain.

B. Producers depend upon consumers more than on decomposers.

C. Decomposers help to recycle energy from food chains.

D. Producers use nutrients that decomposers help to recycle.

17. What contributes to the enhanced greenhouse effect?

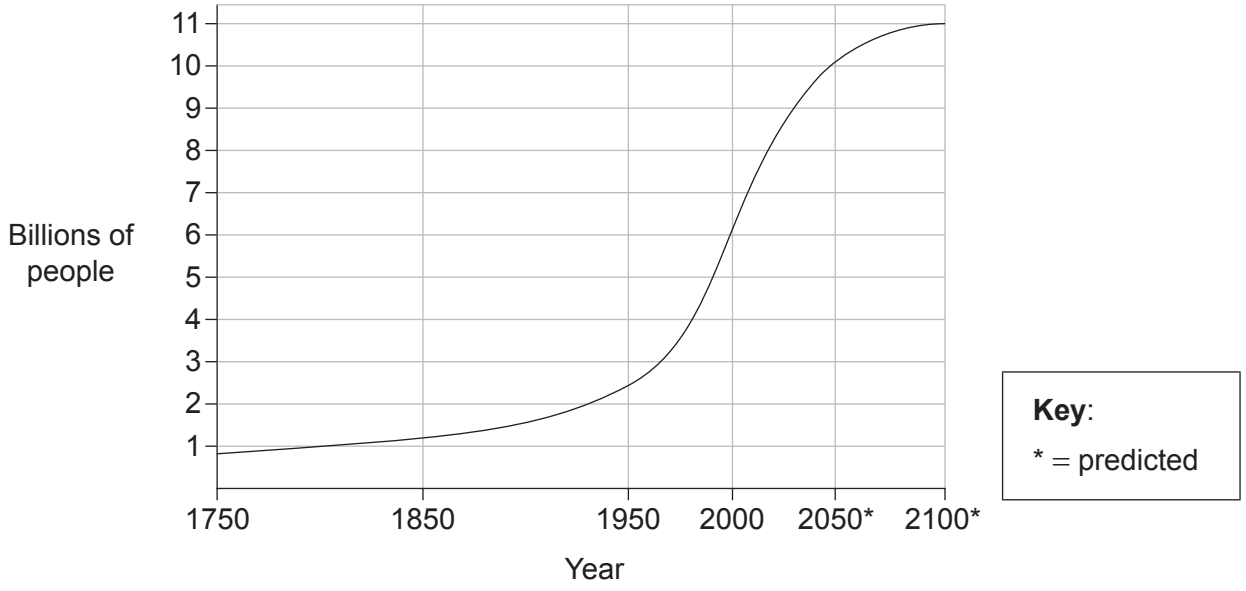
A. Ozone from violent thunderstorms

B. Carbon particles in diesel engine exhaust

C. Methane from agricultural sources

D. Carbon dioxide from active volcanoes around the world

18. The graph shows the world's population growth from 1750 to 2100*.



[Source: Data source: United Nations]

What would explain the difference between the predicted world population curve compared with the curve up to the present day?

A. Enhanced food production

B. Improved health care

C. Decreasing natality

D. Increasing emigration

19. The image shows an *Acacia tortilis* tree which is one of 13 species of *Acacia*. All such flowering trees are examples of Fabaceae.

[Source: "Eat267". Licensed under CC BY-SA 3.0 via Commons - https://commons.wikimedia.org/wiki/File:Eat267.jpg#/media/File:Eat267.jpg]

What is the highest level of taxa for *Acacia tortilis*?

A. *Acacia*

B. *Tortilis*

C. Fabaceae

D. Angiospermophyta

20. What structures in the small intestine transport most fats?

A. Collecting ducts

B. Capillaries

C. Veins

D. Lacteals

21. What causes heart ventricles to fill with blood?

I. Atrial contraction
II. Closing of atrio-ventricular valves
III. Opening of semilunar valves

A. I only

B. I and II only

C. II and III only

D. III only

22. Which is the correct statement concerning HIV and AIDS?

A. All HIV patients have AIDS.

B. HIV and AIDS are transmitted on the sex chromosomes.

C. All AIDS patients have HIV.

D. HIV and AIDS neutralize antibodies.

23. What happens first when a neurotransmitter binds to a postsynaptic neuron?

A. Ions diffuse

B. Electrophoresis begins

C. Ca^{2+} channels open

D. Repolarization

24. How does the hypothalamus respond to a very high body temperature?

A. Increases muscle contraction

B. Stops receiving sensory input

C. Causes dilation of skin arterioles

D. Slows the heart rate

25. What happens during transcription in eukaryotes?

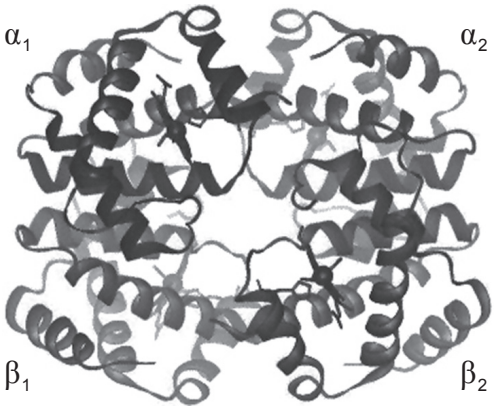
A. Polysomes move.

B. Nucleosomes are phosphorylated.

C. RNA polymerase separates DNA strands.

D. Okazaki fragments are produced.

26. The image shows the structure of hemoglobin.



[Source: http://upload.wikimedia.org/wikipedia/commons/b/ba/Hemoglobin_t-r_state_ani.g]

What determines the primary structure of hemoglobin?

A. Genetic information

B. Hydrogen bonding

C. Four polypeptide chains

D. Side chain interactions

27. What kind of binding changes the shape of an allosteric enzyme so it can slow down a metabolic pathway?

A. Substrate to active site

B. Substrate to allosteric site

C. End-product to active site

D. End-product to allosteric site

28. From which substrate is the first carbon dioxide molecule released during cellular respiration?

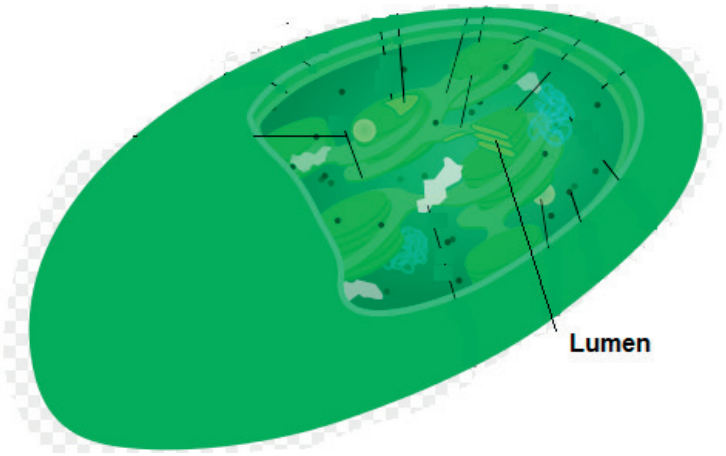
A. Glucose

B. Pyruvate

C. Acetyl CoA

D. Citrate (a C_6 intermediate compound in the Krebs cycle)

29. The image shows a chloroplast.



[Source: "Chloroplast mini" by Kelvinsong - Own work. Licensed under CC BY 3.0 via Wikimedia Commons - https://commons.wikimedia.org/wiki/File:Chloroplast_mini.svg#/media/File:Chloroplast_mini.svg]

During photosynthesis, what happens in the chloroplast at the location labelled lumen?

A. Protons accumulate.

B. Pyruvate undergoes decarboxylation.

C. NADH is oxidized.

D. Oxygen is produced.

30. What products of the light-dependent reactions are used in the light-independent reactions?

A. ATP and NADPH

B. NADPH and ribulose bisphosphate (RuBP)

C. CO_2 and ATP

D. ATP and O_2

31. When a plant stem bends towards sunlight, what change does auxin promote in the cells on the side of the stem away from the light?

A. Translocation

B. Cell differentiation

C. Cell elongation

D. Transcription

32. What could be an adaptation of xerophytes?

A. Stomata only in the lower epidermis

B. Extensive root system

C. Large surface area of leaves

D. Photosynthesis without light-dependent metabolism

33. Which set of conditions stimulates flowering in long-day plants?

	Dark period	Phytochrome
A.	continuous and more than critical night length	high concentration of P_{fr}
B.	continuous and more than critical night length	high concentration of P_r
C.	less than critical night length	high concentration of P_{fr}
D.	less than critical night length	high concentration of P_r

34. At which stage of meiosis does a pair of sister chromatids separate?

A. Metaphase I

B. Anaphase I

C. Metaphase II

D. Anaphase II

35. In a fruit fly experiment, grey body, normal winged (homozygous dominant) fruit flies were mated with black body, short winged (homozygous recessive) fruit flies. The F_1 dihybrid females were then used in a test cross. If the genes are always linked and no crossing over occurs, what would be the predicted ratio in the F_2 generation?

A. 9 : 3 : 3 : 1

B. 1 : 1 : 1 : 1

C. 3 : 1

D. 1 : 1

36. In the production of monoclonal antibodies, B-cells are fused to tumour cells to make hybridoma cells. What can hybridoma cells do?

A. Divide endlessly

B. Ingest antigens

C. Become memory cells

D. Bind to antibodies

37. A skeletal muscle contains bundles of elongated muscle fibre cells. What is the longest structure within each fibre?

A. A myosin filament

B. The sarcomere

C. A myofibril

D. The Z line

38. What is a function of synovial fluid in the elbow joint?

A. Joins the humerus to the radius and ulna

B. Grows red blood cells

C. Protects the biceps

D. Allows easy movement

39. Where are microvilli located in the nephron?

A. Glomerulus

B. Proximal convoluted tubule

C. Loop of Henle

D. Collecting duct

40. Through what process does a spermatid become a functioning spermatozoan?

A. Mitosis

B. Differentiation

C. Fertilization

D. Meiosis