

IEA - Data Enhancement Project

Questionnaire printing

Study: SC2

Population: 3

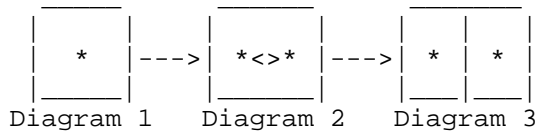
Instrument: STB_3

Student Achievement Test Biology (3B)

Population 3

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1 The following diagrams represent a cell process.



If the cell in Diagram 1 contains four chromosomes, how many chromosomes would be present in each cell in Diagram 3?

- A 1
- B 2
- C 4
- D 8
- E 16

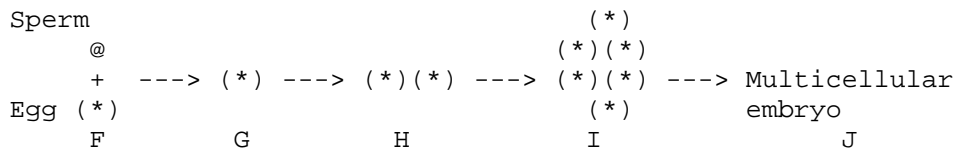
P3B01

2 What initially determines whether a human baby is going to be a male or a female?

- A The DNA in the sperm.
- B The DNA in the egg.
- C The RNA in the sperm.
- D The RNA in the egg.
- E The DNA and RNA in both sperm and egg.

P3B02

3



Where would the process which occurs between F and G normally take place in humans?

- A uterus
- B ovary
- C testis
- D oviduct
- E vagina

P3B03

- 4 The diagrams represent three cells with membranes of different permeability. The dots show sugar molecules which cannot pass through the cell membrane.

[3 diagrams]

Into which cell(s) will the most water molecules diffuse in from the outside?

- A 1 only
- B 2 only
- C 1 and 2 only
- D 2 and 3 only
- E 1, 2 and 3

P3B04

- 5 Similar fragments of a certain plant tissue were placed in 1%, 9% and 15% sugar solutions respectively. When viewed under the microscope after they had reached equilibrium with the bathing solution, single cells appeared as shown in the diagrams for the three solutions.

[Three cells]

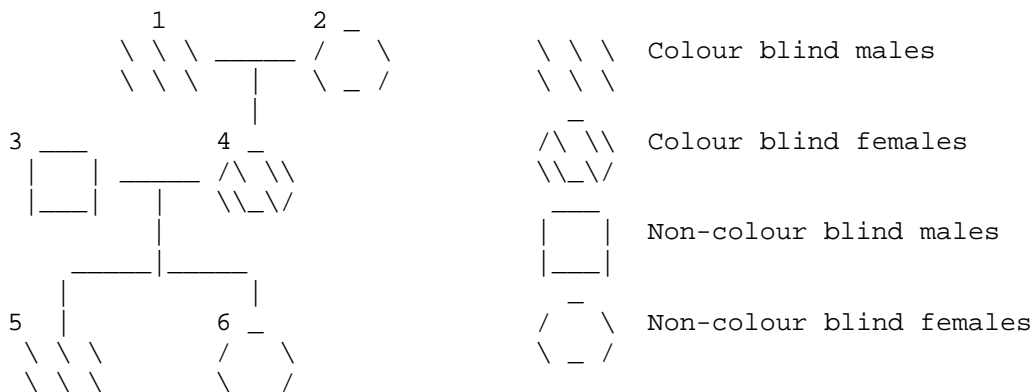
The differences shown in the three drawings are due to properties of the cell and its surrounding solution.

Suppose the same experiment is carried out using a salt solution instead of a sugar solution. What will fill the space between the cell wall and the protoplast in diagram 3?

- A water
- B air
- C salt solution
- D ectoplasm
- E cell sap

P3B05

- 6 The next question is based on the following human pedigree of a sex-linked trait, colour blindness.



Which person(s) could have no genes for colour blindness?

- A 2 only
- B 3 only
- C 2 and 3
- D 3 and 6
- E 6 only

P3B06

7 Two alternative colour characteristics in mice are "hooded" and "white". When homozygous parents of both colours are crossed all the offspring are hooded. If these F1 hooded rats are mated together and produce litters totalling 50 rats, which one of the following proportions is most likely?

- A 50 hooded : none white
- B 50 white : none hooded
- C 38 white : 12 hooded
- D 24 white : 26 hooded
- E 10 white : 40 hooded

P3B07

8 In a population of 1000 fruit flies, the percentages of gene pairs were:

TT = 15 per cent Tt = 51 per cent tt = 34 per cent.

If the fruit flies were free to breed normally, and if nothing happened to disturb the "gene pool", what would be the approximate percentage of tt two generations later?

- A 15 per cent
- B 34 per cent
- C 51 per cent
- D 68 per cent
- E 75 per cent

P3B08

9 In many breeds of cattle the polled condition (absence of horns) is dominant over the presence of horns, and homozygous red crossed with homozygous white produces roan (intermingled red and white hairs) colour. Which of the following crosses will produce only horned roan offspring?

- A Polled red x horned white
- B Horned roan x horned roan
- C Horned red x horned white
- D Polled roan x horned roan
- E Polled white x horned roan

P3B09

10 Which of these substances is found in every living cell?

- A protein
- B chlorophyll
- C cellulose
- D starch
- E haemoglobin

P3B10

11 How does lymph enter the tissues of humans?

- A by blood pressure
- B by the action of the liver
- C by the action on the intestinal villi
- D by the action of the kidney
- E by a diffusion gradient

P3B11

12 In an experiment with a certain plant, the photosynthetic rate per unit of leaf area was measured at different light intensities. The experiment was repeated at three different temperatures, 5°C, 15°C and 25°C. An adequate supply of carbon dioxide was maintained throughout the experiments. The graph shows the results.

[Graph of relative photosynthetic rate vs
light intensity (x 100 foot-candles)]

On the basis of the data given in the graph, what factor or factors determine the photosynthetic rate in light intensities more than 3,000 foot-candles?

- A light intensity
- B temperature
- C temperature and light intensity
- D water status of plant
- E no factor can be ascertained from the graph

P3B12

13 What happens first when chlorophyll absorbs light in a living plant cell?

- A Carbon dioxide is fixed into phosphoglyceric acid.
- B Carbohydrates are formed.
- C Adenosine triphosphate (ATP) is converted into adenosine diphosphate (ADP).
- D Adenosine diphosphate (ADP) is converted into adenosine triphosphate (ATP) and hydrogen is released from water.
- E Oxygen is released from carbon dioxide.

P3B13

14 The primary function of a kidney tubule is to reabsorb water. The diagrams show three types of kidney tubules (nephrons).

[3 diagrams with meandering tubule of increasing length]

Which kidney tubule (nephron) is most likely to occur in a desert animal?

- A 1
- B 2
- C 3
- D It will depend on whether the animal is cold blooded or warm blooded.
- E It will depend upon whether the animal is a herbivore or a carnivore.

P3B14

15 Tissue from a cow is shown on analysis to contain protein, a small amount of fat, some iron, and large quantities of vitamins A and D. Which part of the body did it come from?

- A muscles
- B kidney
- C liver
- D heart
- E brain

P3B15

16 In slightly diluted sea water, the small marine worm Gunda swells when deprived of oxygen and shrinks again when oxygen is supplied. What is the most likely explanation?

- A Lack of oxygen results in an incomplete oxidation of waste products.
- B The lack of oxygen increases water absorption.
- C Excess water is poisonous to the organism.
- D When less oxygen is available, there is not enough energy to oppose entry of water by means of osmosis.
- E An increase of surface area gives a better means of oxygen absorption.

P3B16

17 Which one of the following processes in plants is not controlled by hormones?

- A water uplift in the stem
- B downward growth of the radicle
- C flowering under the influence of increasing day length
- D falling of the leaves of deciduous trees in autumn
- E orientation of shoots towards lateral light

P3B17

18 Secretions of endocrine organs in animals are not directly responsible for which one of the following?

- A calcium metabolism
- B secretion by the adrenal cortex
- C changes in the uterine lining
- D changes of body temperature
- E general body growth

P3B18

19 Cobalt chloride paper is blue when dry. It gradually changes colour to pink in the presence of water vapour. Three 1 cm² dry cobalt chloride papers were treated as follows:

The first was fastened to the upper surface of a leaf by means of a clip, the second to the lower surface in a similar way, and the third hung free in the air. The time taken for the paper to achieve a standard pink colour was noted. The first took 9 minutes, the second 12 minutes, the third 18 minutes.

Which of the following conclusions is justified on this evidence alone?

- A There are more stomata on the lower surface of the leaf than on the upper.
- B No water vapour is given off from the lower surface of the leaf.
- C The upper leaf surface gives off more water vapour than the lower.
- D Both leaf surface give off water vapour at the same rate.
- E There are no stomata on the upper surface of the leaf.

P3B19

20 In order to obtain two crops in one growing season a farmer planted some seeds which he had harvested the previous week but the seeds failed to germinate. What can be concluded from this observation?

- A The farmer did not provide the right conditions for germination.
- B The seeds needed a longer period of maturation.
- C The farmer had not removed inhibiting substances.
- D The seeds required a period of low temperature.
- E The data are inadequate for a conclusion to be reached.

P3B20

21 The diagram shows a 33-hour chick embryo. Which structure brings food to the growing embryo?

[Picture with 5 choices A to E]

P3B21

22 Two students carried out the following procedure to find out whether they were of the same blood type. Each drew a small sample of blood; the samples were diluted with physiological salt solution and then mixed. Observations under a microscope showed no clumping of the corpuscles. The students came to the conclusion that they were of the same blood type. Which of the following is the best comment on their conclusion?

- A The conclusion is wrong.
- B The conclusion is not in agreement with the facts of the experiment.
- C There are not enough facts revealed by the experiment to make the conclusion valid.
- D Owing to the employment of poor experimental techniques, the observations prompted a conclusion in disagreement with accepted biological science.
- E The conclusion is justified.

P3B22

23 Where does most of the *physical* digestion of food occur in humans?

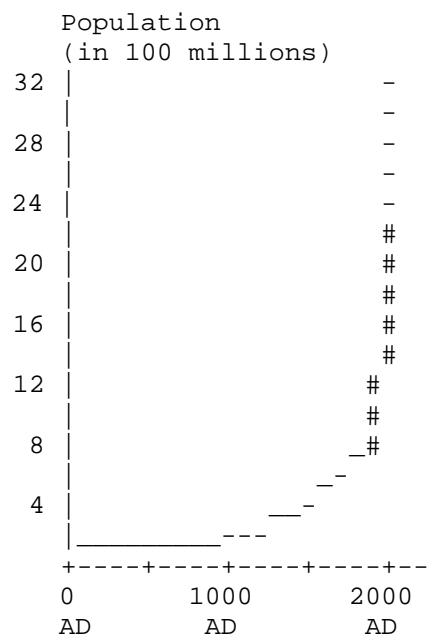
- A in the mouth and oesophagus
- B in the oesophagus and stomach
- C in the small intestine and stomach
- D in the mouth and stomach
- E in the small intestine and large intestine

P3B23

24 The graph refers to the growth of human population. The solid-line (#) section of the curve is based on actual data, while the dashed-line (-) sections are based on computer estimates.

Can the slope of the line representing actual data remain the same indefinitely?

- A Yes, man will find a way to produce an infinite food supply.
- B Yes, man will migrate to other planets.
- C Yes, man will find other energy sources.
- D No, the slopes of lines never remain the same.
- E No, when the limit of food supply and other resources of the earth is reached, the population will also reach its limit.



P3B24

25 What adaptation characteristics would one probably find in desert plants?

- A large leaf area and a thick impermeable leaf surface
- B large leaf area and a large absorbing root surface
- C small leaf area and a large absorbing root surface
- D small leaf area and a thin, permeable leaf surface
- E small leaf area and a small absorbing root surface

P3B25

26 It has been noticed in recent years that the proportion of insects surviving after exposure to certain insecticides has shown a gradual increase with succeeding generation. Of the following, which is the best explanation?

- A World changes in climate have provided a new environment.
- B Offspring of insects which have been exposed to the insecticide have inherited an immunity.
- C Elimination of the less resistant strains gives the resistant ones a greater chance of success.
- D Changes in the habits of the insects have enabled them to survive.
- E The insecticide causes favourable mutations.

P3B26

27 The Galapagos Islands in the Pacific are believed never to have been connected to the mainland. In the Islands there are about 14 species of finch-like birds with few obvious relatives except on the South American mainland. The finches vary from island to island. There is a close resemblance between species in plumage, calls, nests, and eggs, but each species differs greatly in beak structure according to the diet. The species do not interbreed and do not compete for food.

It is stated on this evidence that isolation from the South American mainland and different habitats on the Islands are important factors in the production of new species.

- A The statement is supported by the information given.
- B The statement is not supported by the information given.
- C The statement is contradicted by the information given.
- D The statement is known to be false but this is not supported by the information given.
- E No relevant information is given.

P3B27

28 The following item refers to the drawings and the descriptive paragraph below

X and Y represent two forms of the same moth, a light speckled form and a predominantly dark, or melanic, form.

[Moth X]

[Moth Y]

During the 19th century the air in some parts of England became increasingly polluted with soot through the growth of industry based on the burning of coal. One effect of this pollution was that lichens would no longer grow on the trunks and branches of trees as these became blackened with soot.

Until 1850 the only form of this moth that had been recorded was the light form X. Then in 1850 the dark form Y was reported from one of these industrial areas. By the end of the 19th century the dark form had become quite common and now it is, in many localities, the commoner of the two forms, especially in the vicinity of large towns, where it often comprises as much as 95% of the total population, although the light form predominates in areas away from large centres of population.

Which of the following best explains the appearance of the dark specimen in 1850?

- A The colour change was induced by air pollution.
- B The organisms adapted themselves to the change in external environment.
- C Air pollution affected the moths directly after their emergence from the pupal stage.
- D A mutation, that had occurred before but had failed to become established, became established because it was favoured by changes in the external environment.
- E The caterpillars ate soot contaminated leaves and dark moths developed from them.

P3B28

29 How does natural selection operate in a population?

- A The members are all alike.
- B The members are equally able to survive any environmental change.
- C The members differ so only some survive when the environment changes.
- D The members do not adapt to environmental changes.
- E The members of the entire population adapt to environmental changes.

P3B29

30 Which of the following does *not* provide evidence of evolution?

- A Green plants can be arranged in order from simple to complex.
- B Embryos of birds, reptiles, and mammals have gill clefts resembling those of a fish embryo.
- C The ancestry of animals like the horse can be traced through the fossil record.
- D The caecum is present in all mammals including man but is only functional in some.
- E The individuals within a species differ considerably one from another.

P3B30
