

Mixed Bag I (60 points)-Solved

(Alternative answers, which are possible for some of the questions, have been provided one below the other)

Warm Up Questions (12 points)

This comprises a set of relatively easy questions. Try to score as best you can!

- 1) Unscramble : TCROAYDHBAER (2 points)

Ans: CARBOHYDRATE

- 2) Unscramble : HXORERTCAPAYE (2 points)

Ans: ARCHAEOPTERYX

- 3) I send 3 people out of the house and almost immediately, allow 2 other people to enter. I obviously consume energy to accomplish this formidable task. Who am I? (1 point)

Ans: SODIUM(I)/POTASSIUM(I) ATPASE PUMP

SODIUM(I)/POTASSIUM(I) ATPase PUMP

Na(I)/K(I) ATPASE PUMP

Na(I)/K(I) ATPase PUMP

SODIUM(I)/POTASSIUM(I)-ATPASE PUMP

SODIUM(I)/POTASSIUM(I)-ATPase PUMP

Na(I)/K(I)-ATPASE PUMP

Na(I)/K(I)-ATPase PUMP

- 4) Human beings have studied me extensively (yeah, in spite of being tiny, I am truly a celebrity!). You will easily find me in your body! You people call me 'negative' yet I am mostly beneficial. Enough hints, now tell my scientific name please! (1 point)

Ans: Escherichia coli

5) I come from the 'Golden Age of Dutch science and technology'. Mostly self-taught, I got fascinated by the tiny life-forms. Out of my curiosity to check the quality of the thread used in my draper shop, I developed intense passion for lensmaking. Back in those days, I was elected to the Royal Society of London. Can you guess my full name? (1 point)

Ans: ANTON VAN LEEUWENHOEK

ANTONI VAN LEEUWENHOEK

ANTONIE VAN LEEUWENHOEK

6) I am a technique widely used in biology laboratories to release the organelles from cells. You can also notice my use in factories, pharmacies and even kitchens! My origin can be dated back to the Stone Age. People use me to reduce the size of fat globules in milk and to disperse those uniformly. Tell my name. (1 point)

Ans: HOMOGENISATION

HOMOGENIZATION

MICELLE FORMATION

MICELLES FORMATION

7) We are social. Our skin is thick yet we do have emotions! Our upper lips and noses fuse to serve as specialized tools. Some of us possess an ever-growing pair of incisors (amazing, huh?). We use mud as sunscreen and insect-repellant. Who are we? (1 point)

Ans: ELEPHANT

ELEPHANTS

Elephas maximus

Elephas

Loxodonta

8) Find the odd one out and explain your answer in brief: A/H1N1, A/H5N1, MERS-CoV, HIV, SARS-CoV-2 (1 point)

Ans: HIV

9) Zoology : Aristotle :: Botany : ? (1 point)

Ans: THEOPHRASTUS

10) Polar bear and bearded seal : Predation :: Black walnut and maize : ? (1 point)

Ans: AMENSALISM

ALLELOPATHY

ANTIBIOSIS

Crossword (20 points)

Solve the crossword given below. Numbers in brackets indicate the number of letters in the word (If the answer has 2 words, it is mentioned within brackets). Write your answers in the space below.

In case you have a printer and would like to print it out, use the following PDF link to print the crossword (This is just provided for your convenience. You MUST use this form for submissions):

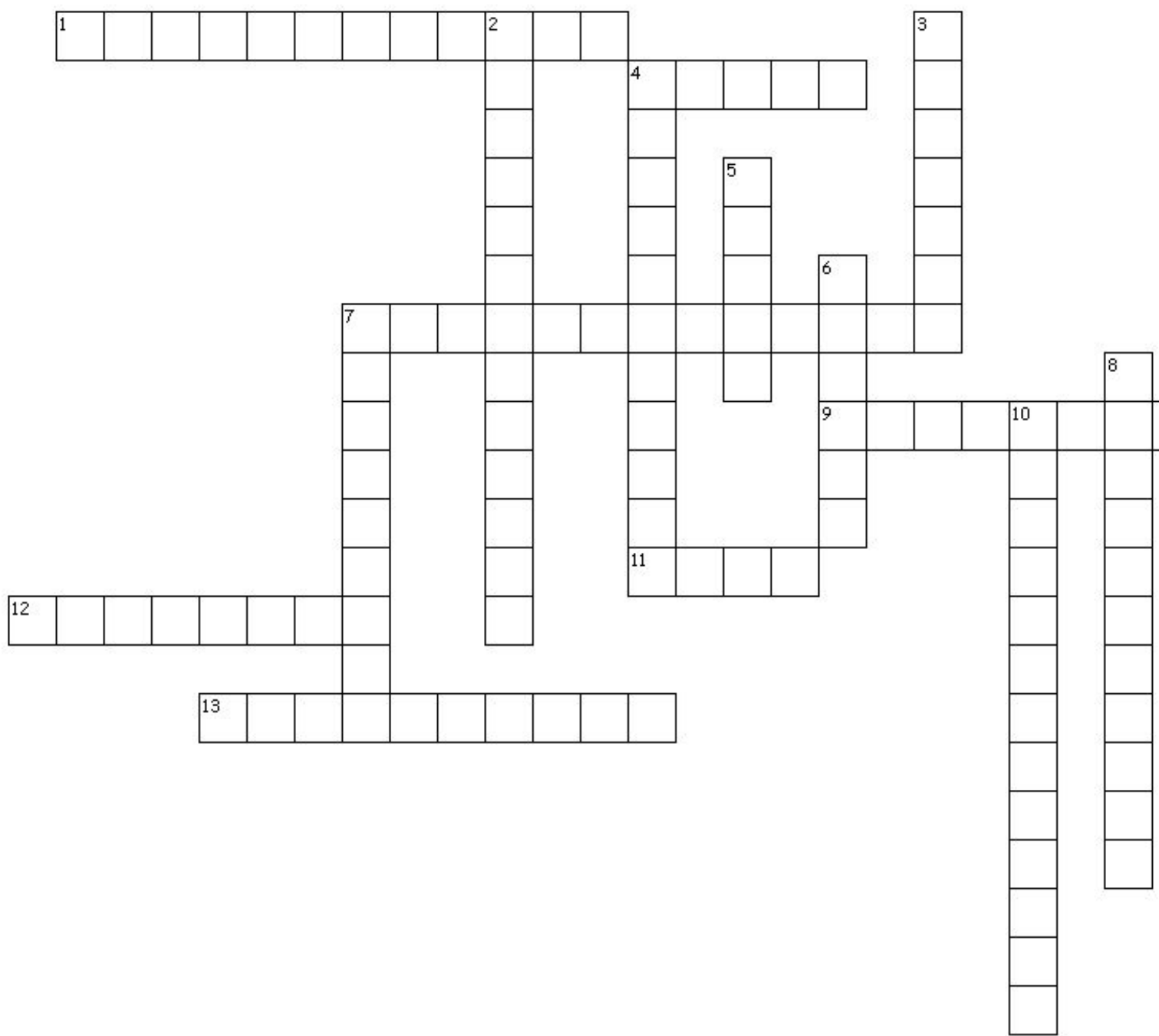
<https://drive.google.com/file/d/1kVJTEqVp7WZVrREhSVCR5lGtKTyNhuce/view?usp=sharing>

Across:

1. Where the power lies, though not quite autonomous (12; this is the number of letters. Same pattern followed for remaining hints) (1 point)
(MITOCHONDRIA)
4. Like a syringe of DNA, and perhaps just as dead (hint: eater) (5) (1 point)
(PHAGE)
7. Proteinaceous hydrogen chopper (13) (1 point)
(DEHYDROGENASE)
9. A pairing in preparation for ultimate reduction and divorce (8) (1 point)
(SYNAPSIS)
11. Abbreviated disease, putting the boy in the bubble (4) (1 point)
(SCID)
12. Prick me and the house is gone (8) (1 point)
(LYSOSOME/MEMBRANE)
13. A danger signal to protect my neighbours when foreigners invade! (10) (1 point)
(INTERFERON)

Down:

2. One in old but three in new
I can make long threads anew! (2 words; 3,10) (1 point)
(RNA POLYMERASE)
3. I am a free bird, but when needed can join hands with others (Hint: I have asphyxiated sugars in me!) (7) (2 points)
(EPISOME)
4. A cellular agreement invoked on drowning in distilled water (11) (1 point)
(PLASMOLYSIS)
5. A resin colour, but also a speed-breaker (5) (2 points)
(AMBER)
6. Jacket worn by some pathogens and ripped off before warm-up (all for sake of babies)! (6) (1 point)
(CAPSID)
7. When chromosomes get their wires crossed (9) (2 points)
(DIPLLOTENE)
8. Complex but Braun understands me (11) (2 points)
(LIPOPROTEIN)
10. Corridors of sol running through solid wall (2 points)
(PLASMODESMATA)



Buzz Your Brains (28 points)

This section comprises more involved and thought provoking questions than the previous ones. Best of Luck!

- 11) Consider a species of fish X. In the fish, males have a brood pouch. Female can produce a clutch of eggs in every 2 days. The eggs take 1.5 weeks to develop into mature individuals. Select the correct options from among True, False and Data Inconclusive: (5 x 2 = 10 points)

i) The theory of sexual selection fails here

Ans: False

ii) Females are expected to be ornamental

Ans: True

iii) Males expected to be ornamental

Ans: False

iv) Female choice shall drive the reproductive process

Ans: False

v) Males predicted to exert mate choice

Ans: True

- 12) Assume that you are a cell biologist, trying to investigate the role of a certain protein. The protein is arbitrarily assigned the name CXC. Temperature sensitive Yeast sec mutants are taken, and the DNA encoding CXC is cloned into it. The cells are homogenised and secretory vesicles are collected. Some fluorescently labelled phospholipids are taken and added to the mixture of previously obtained secretory vesicles. Choose the correct option for each of the corresponding statements (True/False): (10 points)

i) Treating secretory vesicle with protease + phospholipase causes loss of protein function. Treating vesicles with only protease causes similar loss of

function. This proves that the protein is a soluble protein destined for export.
(4 points)

Ans: False

ii) Cells with defective ATP synthesis pathway showed loss of CXC function. The secretory vesicles obtained in this experiment are treated with ATP, and fluorescence is observed. Those vesicles not treated with ATP also show fluorescence. However, on adding a quencher, fluorescence is highly diminished in both cases. CXC may therefore be a flippase (6 points)

Ans: True

13) While studying the frogs of a certain species in their natural habitat during the mating season, you observe a chorus of male frogs in which some individuals are calling while others remain silent. On further observation, you see the silent frogs are sitting closer to those that are calling. Which of the following is most likely to explain the behavior of this chorus of frogs? (4 points)

- A) The individuals who are not calling are staggering their calls with those of the others and are likely to call later in the season after the latter have finished mating.
- B) The silent frogs are close genetic relatives of the calling individuals and do not expend valuable energy in calling as the matings that the latter will receive would provide adequate indirect fitness to them.
- C) The silent frogs have evaluated that their calls are inadequate in attracting females, as compared to those of the calling individuals, and lie in wait to sneak matings with the females that approach the calling males.
- D) The silent frogs do not expend energy in themselves calling as the female frogs that are attracted to the calls of the others are anyway likely to visually inspect the closely-spaced males and then choose their mating partners.

Ans: C

14) In a 5-m-tall young Eucalyptus, a person stuck 2 long nails horizontally and opposite to each other in its trunk, at a height of 1.0 m. Today the tree is 10 m tall. Choose the correct option regarding the height above the ground and the distance between the two nails? (4 points)

- A) The height of the two nails above the ground increases.
- B) The height of the two nails above the ground remains unchanged.
- C) The distance between the two nails will increase.
- D) The height and distance between the two nails increase due to activity of the intercalary meristem.
- E) The distance between the two nails will increase due to activity of the primary meristem.
- F) Both B and C are correct.
- G) Both A and E are correct.

Ans: F