



FACULTY OF SCIENCE

DEPARTMENT BOTANY AND PLANT BIOTECHNOLOGY

BIO1A2E

BIOLOGY 1A EXTENDED

APK CAMPUS

JUNE EXAM

MEMORANDUM

1 JUNE 2018

DATE:

1 JUNE 2018

SESSION:

8H30 – 11H30

ASSESSOR:

MS J. WILLIAMSON

INTERNAL MODERATOR :

DR. A. NEL

DURATION:

3 HOURS

TOTAL MARKS:

150

NUMBER OF PAGES: 19 PAGES

Please read the following instructions carefully

1. Answer all the questions in the question paper
2. Answer ALL of the questions in the test book.
3. Work neatly.
4. Read your questions carefully.
5. Good Luck

QUESTION 1

[21]

Choose the alternative that best completes the statement or answers the question. Only write down the correct letter next to the appropriate question number.

- 1.1 Which of the following most likely arose from endosymbiosis?
- A. Nuclear membrane and Golgi apparatus
 - B. ER and chloroplasts
 - C. Chloroplasts and mitochondria
 - D. Mitochondria and Golgi apparatus
 - E. None of the above.
- 1.2 Biologists have long been aware that the defunct kingdom Protista is paraphyletic. Which of these statements is both true and consistent with this conclusion?
- A. Many species within this kingdom were once classified as monerans.
 - B. Animals, plants, and fungi arose from different protist ancestors.
 - C. The eukaryotic condition has evolved only once among the protists, and all eukaryotes are descendants of that first eukaryotic cell.
 - D. Chloroplasts among various protists are similar to those found in prokaryotes.

E. Some protists, all animals, and all fungi share a protist common ancestor, but these protists, animals, and fungi are currently assigned to three different kingdoms.

- 1.3 Which organisms represent the common ancestor of all photosynthetic plastids found in eukaryotes?

- A. Autotrophic euglenids
- B. Diatoms
- C. Dinoflagellates
- D. Red algae

E. Cyanobacteria

1.4 All of the following statements regarding double fertilization in the angiosperms is true except which one?

A. The angiosperm embryo is diploid.

B. The pollen tube reaching the micropyle results in the death of one of the synergids.

C. The fertilized angiosperm ovule consists of diploid and triploid cells.

D. The megasporangium gives rise to four (4) haploid eggs through meiosis.

E. One (1) of the pollen nuclei contributes to the genome of the endosperm.

Question 1.5 and 1.6 refer to the following experiment:

One (1) unusual opportunity to test how long seeds can remain viable occurred when seeds from date palm trees (*Phoenix dactylifera*) were discovered under the rubble of a 2,000-year-old fortress near the Dead Sea. Scientists measured the fraction of carbon-14 that remained in three (3) of the ancient date palm seeds: two (2) that were not planted and one (1) that was planted and germinated. (For the germinated seed, the scientists used a seed-coat fragment found clinging to a root of the seedling.) The table shows their results:

Fraction of Carbon-14 Remaining	Seed 1 (not planted)	Seed 2 (not planted)	Seed 3 (germinated)
	0.7656	0.7752	0.7977

Data from S. Salton, et al., Germination, genetics, and growth of an ancient date seed. Science 320:1464 (2008).

1.5 An ancient date palm seed germinated and grew into a healthy plant. What was the source of nutrients for the young sporophyte embryo during germination of the date palm seed?

A. Sunlight.

B. Food stored within the seed.

C. Water taken up by the germinating seed.

- 1.6 Why is seed dormancy adaptive for many plant species?
- A. Seed dormancy increases the longevity of an individual sporophyte plant.
- B. Seed dormancy allows seeds to germinate when conditions are favourable for seedling growth.
- C. Seed dormancy ensures that a seedling does not compete with its parents.
- D. Seed dormancy ensures that a seedling does not germinate when a source of food is not available for the young seedling.

- 1.7 Which of the following most closely represents the male gametophyte of seed-bearing plants?

A. ovule

B. microspore mother cell

C. pollen grain interior

D. embryo sac

E. fertilized egg

- 1.8 The endodermis _____
- A. protects the stem's vascular cambium from insect damage and pathogens.
- B. is the layer of cells from which lateral roots develop.
- C. is a root tissue that selectively regulates passage of molecules into the vascular cylinder.
- D. is a tissue in the apical meristem that protects the flower bud.

- 1.9 Roots grow longer primarily by _____
- A. adding more derivative cells through mitosis in the apical meristem.
- B. secondary growth of lateral roots.

C. primary growth in the zone of elongation.

D. secondary growth in the zone of differentiation.

E. sloughing off of root cap cells.

1.10 The basis of transpiration pull in the xylem is _____

A. positive root pressure from differences in solute potential between soil and root.

B. hydrostatic pressure generated by the shrinking in diameter of the trunk or stem.

C. negative pressure at the air-water interface in the leaf.

D. pressure created by proton pumping of stomatal guard cells.

E. adhesion tension of water molecules to xylem cell walls.

1.11 Which inequality reflects the correct relationship of water potentials during a sunny day for a typical tree?

A. leaf Ψ < trunk Ψ < soil Ψ

B. outside air Ψ > leaf mesophyll Ψ < root Ψ

C. leaf Ψ > trunk Ψ > soil Ψ

D. soil Ψ < root Ψ > leaf Ψ

1.12 Water can follow two (2) pathways in plants, apoplastic and symplastic routes. How do these pathways differ?

A. The apoplastic route is for water and the symplastic route is for nutrients.

B. The apoplastic route is entirely external to cell membranes, while the

symplastic route is inside of cells.

C. The apoplastic route is for nutrients and the symplastic route is for water.

D. The apoplastic route is used in phloem and the symplastic route in xylem.

1.13 A radially symmetrical animal that has two (2) embryonic tissue layers probably belongs to which phylum?

A. Porifera

B. Cnidaria

C. Platyhelminthes

D. Nematoda

E. Echinodermata

1.14 While sampling marine plankton in a lab, a student encounters large numbers of fertilized eggs. The student rears some of the eggs in the laboratory for further study and finds that the blastopore becomes the mouth. The embryo develops into a trochophore larva and eventually has a true coelom. These eggs probably belonged to a _____

A. chordate.

B. echinoderm.

C. mollusc.

D. nematode.

E. arthropod.

1.15 Of the annelid classes below, which make castings that are agriculturally important?

A. Oligochaeta

B. Polychaeta

C. Hirudinea (leeches)

D. all three of these

E. two of these

1.16 If you gently twist your ear lobe it does not remain distorted because it contains _____

A. collagenous fibers.

B. chondrocytes

C. reticular fibers.

D. adipose tissue.

E. loose connective tissue.

1.17

Bones are held together at joints by _____

A. cartilage.

B. osteons.

C. loose connective tissue.

D. tendons.

E. ligaments.

1.18

The cells lining the air sacs in the lungs make up a _____

A. cuboidal epithelium.

B. simple squamous epithelium.

C. stratified squamous epithelium.

D. pseudostratified ciliated columnar epithelium.

E. simple columnar epithelium.

1.19

The formation of the fertilization membrane and the slow block to polyspermy are dependent on _____

A. the entrance of potassium ions into the egg.

B. the departure of sodium ions from the egg.

C. the entrance of calcium ions into the egg.

D. the departure of hydrogen ions from the egg.

1.20 Diploidy is first reestablished following _____

A. fertilization.

B. gastrulation.

C. parthenogenesis.

D. organogenesis.

E. ovulation.

1.21 Development must occur in the order of which of the following sequences?

A. cleavage ☐ blastula ☐ gastrula ☐ morula

B. cleavage ☐ gastrula ☐ morula ☐ blastula

C. cleavage ☐ morula ☐ blastula ☐ gastrula

D. gastrula ☐ morula ☐ blastula ☐ cleavage

E. morula ☐ cleavage ☐ gastrula ☐ blastula

QUESTION 2

[21]

Give the correct biological term for each of the following definitions. Only write down the correct term next to the appropriate question number.

2.1 Unicellular organisms which ingest soluble food. Osmotrophs / saprozoic feeders

2.2 Fusion of isogametes. Autogamy

2.3 The motile zygote formed during the sexual reproduction of *Plasmodium*. Ookinete

2.4 The zygote of a seed plant will develop into this structure. Diploid sporophyte

2.5 The site of pollination and fertilization in a plant. Ovule

2.6 Symbiotic relationship between fungi and plant root cells. Mycorrhizae

2.7 The formation of a diploid zygote and a triploid nucleus. Double fertilization

- 2.8 The diploid generation of a land plant. Sporophyte
- 2.9 A single carpel or a group of fused carpels. Pistil
- 2.10 The sticking together of molecules of the same kind. Cohesion
- 2.11 Waxy barrier that prevents the continuous flow of water, via the apoplastic route, through the root. Casparian strips
- 2.12 The part of the plant responsible for the absorption of water. Root hairs
- 2.13 The class in which a Salmon will be classified. Pisces
- 2.14 The structures used by embryonic Chordates to breath. Pharyngeal slits
- 2.15 Structure used by snails to feed. Radula
- 2.16 The urethra is part of which organ. Bladder
- 2.17 Tissue which stores fat in large, closely packed cells held in a matrix of fibres. Adipose tissue
- 2.18 Bone cells. Osteoblasts
- 2.19 The creation of genetically identical offspring by one parent. Asexual reproduction
- 2.20 The phenomenon in which an individual has both female and male reproductive systems. Hermaphroditism
- 2.21 A rapid series of cell divisions that produces a blastula. Cleavage
-
- 3.1 Fill in the missing word to formulate a paragraph which explains the life cycle of a *Paramecium*.
($14 \times \frac{1}{2} = 7$)
- Two compatible *Paramecium* cells align side by side and partially fuse. Each cell contains a 3.1.1 micronuclei (reproduction) and 3.1.2 macronuclei (food).
- 3.1.3 Meiosis of the 3.1.1 produces four (4) haploid (n) 3.1.1 in each cell

QUESTION 3

[17]

Three (3) 3.1.1 in each cell 3.1.4disintegrate

The remaining 3.1.1 in each cell undergoes 3.1.5mitosis to form a second 3.1.1(n).

The cells now 3.1.6 swap one 3.1.1 with its fused mate.

The two partly fused cells separate after the 3.1.1 have been 3.1.6

The two (2) different 3.1.1 in each cell fuse to form a 3.1.7single diploid (2n)

micronuclei

The 3.1.7 undergoes three rounds of 3.1.8 mitosis to produce 3.1.9 eight (8)

micronuclei (2n) in the end.

Four (4) of these 3.1.9 now become 3.1.10 macronuclei. THUS each cell now contains 3.1.11 four (4) micronuclei and four (4) macronuclei

The cell now undergoes two rounds of 3.1.12 cytokinesis which will yield four (4)

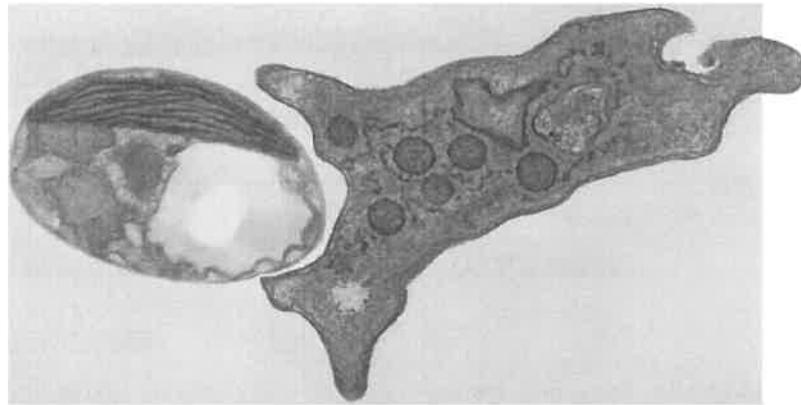
daughter cells each with 3.1.13 one (1) micronuclei and 3.1.14 one (1) macronuclei

The four daughter cells will find a compatible daughter cell and the cycle will start all over again

3.2

Give the classification of the organism in the photograph below.

(5)



© 2012 Pearson Education, Inc.

○ Kingdom: Protista

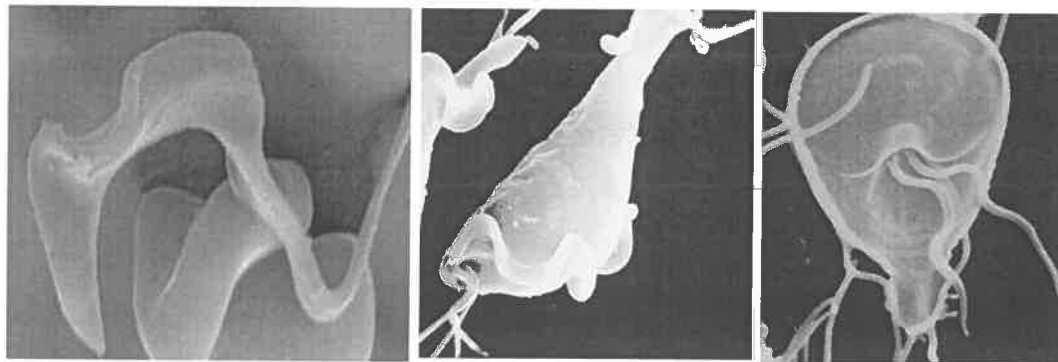
○ Subkingdom: Protozoa

○ Phylum 1: Sarcostigophora

○ Subphylum 2: Sarcodina

- Genus: *Amoeba*

3.3 What do the following organisms have in common? Identify the Genus name of each organism. (5)



Organism A Organism B Organism C

Organism A: *Giardia* Organism B: *Trichomonas* Organism C: *Trypanosoma*

- All organisms are categorised in the Class: Zoomastigophorea
- All have a flagella for movement

QUESTION 4

[16]

4.1 Name the four (4) key adaptations for life on land which distinguish the main lineages of the plant kingdom. (4)

- Dependent embryos are present in all plants.
- Lignified vascular tissues mark a lineage that gave rise to most living plants.
- Seeds are found in a lineage that includes all living gymnosperms and angiosperms.
- Flowers mark the angiosperm lineage.

4.2 Briefly discuss each of the following terminologies to ensure the meaning is highlighted.

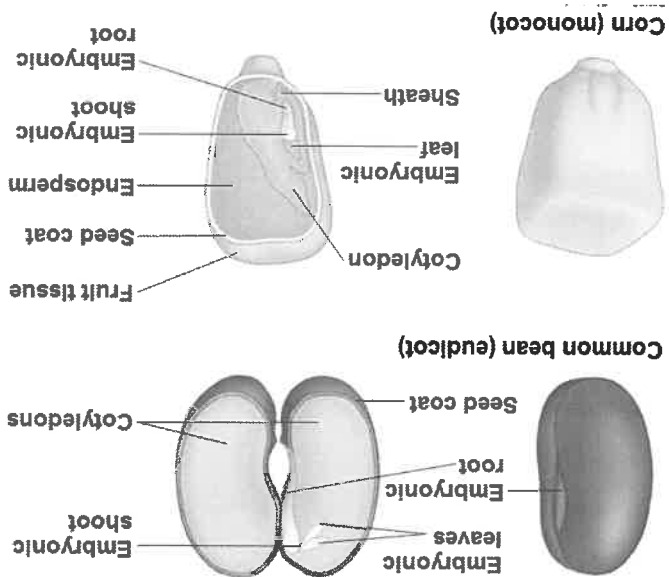
4.2.1 Pollination

(1)

The transfer of pollen from the anther to the stigma.

4.2.2	Fruits	(1)	<u>Fruits are ripened ovaries of flowers and adaptations that disperse seeds.</u>
4.2.3	Carpels	(5)	<u>The female reproductive structure, which produce eggs. Consist of a stigma, style and ovary.</u>
4.2.4	Vascular tissue	(5)	<u>Consist of cells which transport water and other substances. Xylem transports water and minerals and Phloem transports sugar.</u>
5.1	The seeds of Eudicots and Monocots differ from one another. Distinguish between the seeds of a Eudicot and a Monocot. Include diagrams to enhance the clarity of the differences.	(10)	○ <u>Eudicot seeds have</u> ▪ <u>two cotyledons,</u> ▪ <u>apical meristems that lack protective sheaths, and</u> • <u>no endosperm because the fleshy cotyledons absorbed the endosperm nutrients as the seed formed.</u> ○ <u>Monocot seeds have</u> ▪ <u>a single cotyledon,</u> ▪ <u>an embryonic root and shoot with protective sheaths, and</u> ▪ <u>endosperm.</u>

QUESTION 5 [15]



5.2 Discuss secondary growth of land plants briefly. (5)

- **Secondary growth**
 - **is an increase in thickness of stems and roots and occurs at lateral meristems.**
 - **Lateral meristems are areas of active cell division that exist in two cylinders that extend along the length of roots and shoots.**
 - **Vascular cambium is a lateral meristem that lies between primary xylem and primary phloem.**
 - **Cork cambium is a lateral meristem that lies at the outer edge of the stem cortex.**

QUESTION 6 [13]

6.1 The Earth's atmosphere consists of about 80% nitrogen. However, nitrogen deficiency is the most common nutritional problem in plants. Why is that? (2)

- **Plants cannot absorb nitrogen directly from the air.**
- **Instead, to be used by plants, nitrogen must be converted to ammonium (NH_4^+) or nitrate (NO_3^-).**

6.2 What are micronutrients? Name the micronutrients needed by plants. (10 x ½ = 5)

- Micronutrients often act as cofactors and are needed by plants in small amounts
- and include:

- chlorine,
- iron,
- manganese,
- boron,
- zinc,
- copper,
- nickel, and
- molybdenum.

6.3 It is important for a plant to regulate the amount of water lost through transpiration, therefore one (1) of the most crucial regulatory structures of the plant is the stomata. Discuss the functioning of the stomata. (6)

- Stomata open when guard cells take up water in the following process:
- Potassium is actively taken up by guard cells from nearby cells.
- This creates an osmotic gradient and water follows.
- Uneven cell walls of guard cells cause them to bow when water is taken up.
- The bowing of the guard cells causes the pore of the stomata to open.
- When guard cells lose K⁺ ions, the guard cells become flaccid and the stomata closes.

QUESTION 7

[16]

7.1 Name and distinguish between the type of body cavities found in Platyhelminthes, Nematoda and Annelida. (6 x ½ = 3)

Platyhelminthes - Acoelomates – No body cavity

Nematoda - Pseudocoelomate – Body cavity derive from

mesoderm and endoderm

Annelida - Eucoelomate- Body cavity derive from mesoderm only

7.2 Briefly name and describe to two (2) simplest (Invertebrate) sub-phyla of Chordata.

$$(6 \times \frac{1}{2} = 3)$$

The simplest chordates are

Subphylum: Cephalochordata (lancelets)

Subphylum: Urochordata (tunicates)

Tunicates and Lancelets, which do not have a backbone

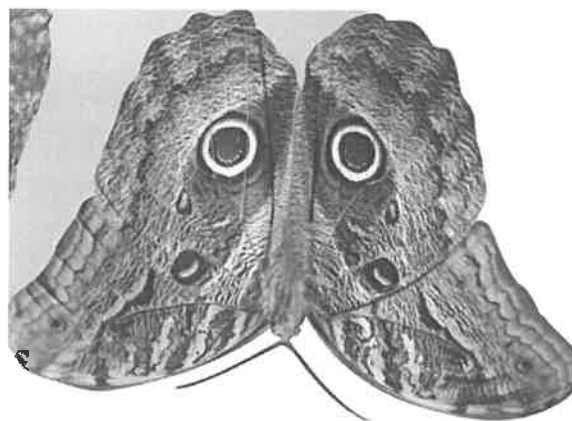
and use their pharyngeal slits for suspension feeding.

Adult tunicates are stationary and attached, while the tunicate larva is a tadpole-

like organism.

Lancelets are small, blade-like chordates that live in marine sands.

7.3 Study the organism in the diagram below and answer the questions that follow.



7.3.1 To which Phylum, sub-phylum and class does the organism in the diagram belong?(3)

- Phylum: Arthropoda
- Subphylum: Hexapoda
- Class: Insecta

7.3.2 Why does the organism in diagram belong to the sub-phylum answered in question 7.3.1?

(1)

It has 6 limbs (legs)

- 7.3.2 The diversity and success of the phylum answered in question 7.3.1 are due to three (3) important characteristic displayed by this group of organisms. Name these three (3) characteristics.

○ Segmentation = tagmatisation,

○ a hard exoskeleton, and

○ jointed appendages, for which the phylum is named

- 7.4 Give the class name to which each of the following organisms in the various diagrams below belong.

Diagram a

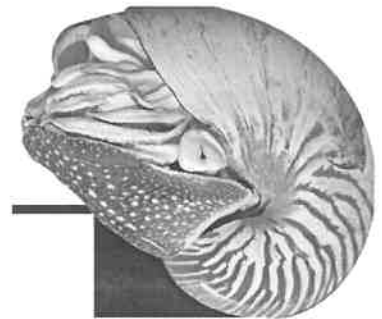
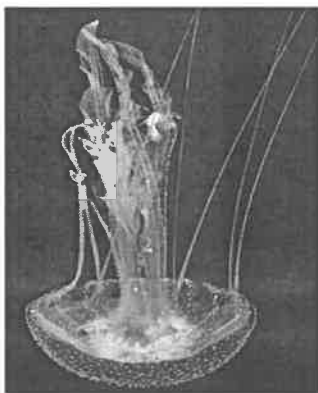


Diagram b



Diagram c



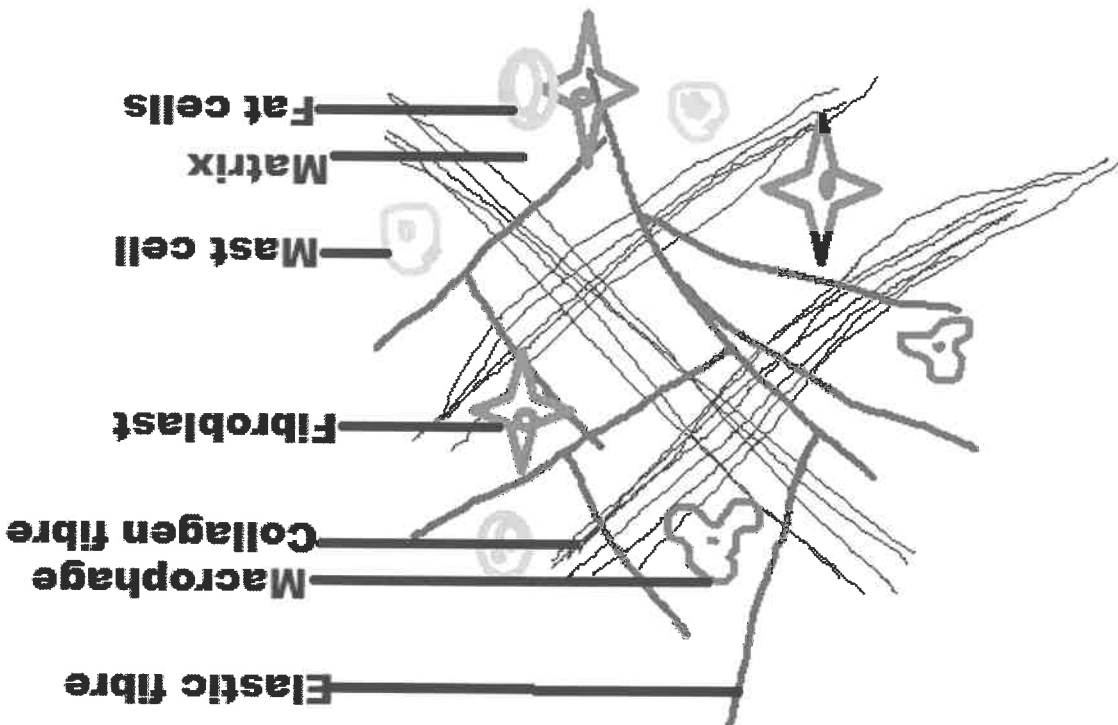
- Diagram a – Cephalopoda
 ○ Diagram b – Tubellaria
 ○ Diagram c - Scyphozoa

- 8.1 Draw and label the tissue which connects organs together. Give the functions of each part of the tissue.

(9)

QUESTION 8

[15]



- Elastic fibres – elasticity and flexibility
- Collagen fibres – strength
- Fibroblasts – produce fibres
- Macrophages – Engulf foreign particles
- Mast cells – Produce histamine (anticoagulant) and matrix
- Fat cells – Store fat and oil

8.2

If a person is in a motor vehicle accident and he damages his small intestine, which tissues will have been destroyed, what will be the effect and which other organs will also be affected? Give reasons for your answers.

(6)

The tissue which will be damaged is:

Simple columnar epithelial tissue – because it lines the villi which lines the small intestine. No absorption of nutrients will take place

Smooth muscle tissue under the epithelial layer – No peristalsis can occur

– food not digested properly and no absorption of nutrients.

Areolar connective tissue found in villi – no absorption of nutrients

Other organs which will be affected is part of the digestive system

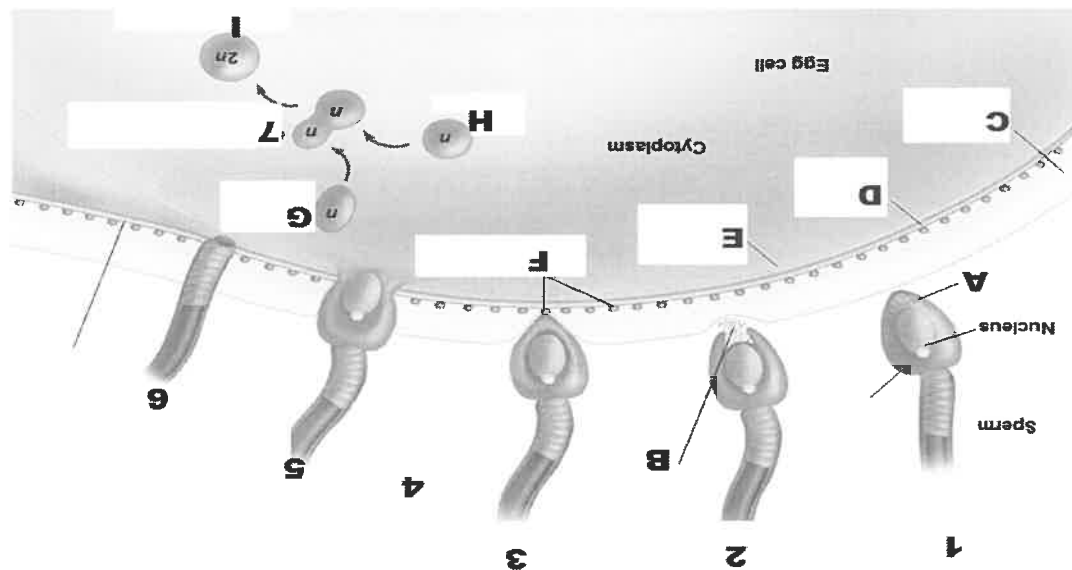
the large intestine and

rectum which get fed with undigested food from the small intestine.

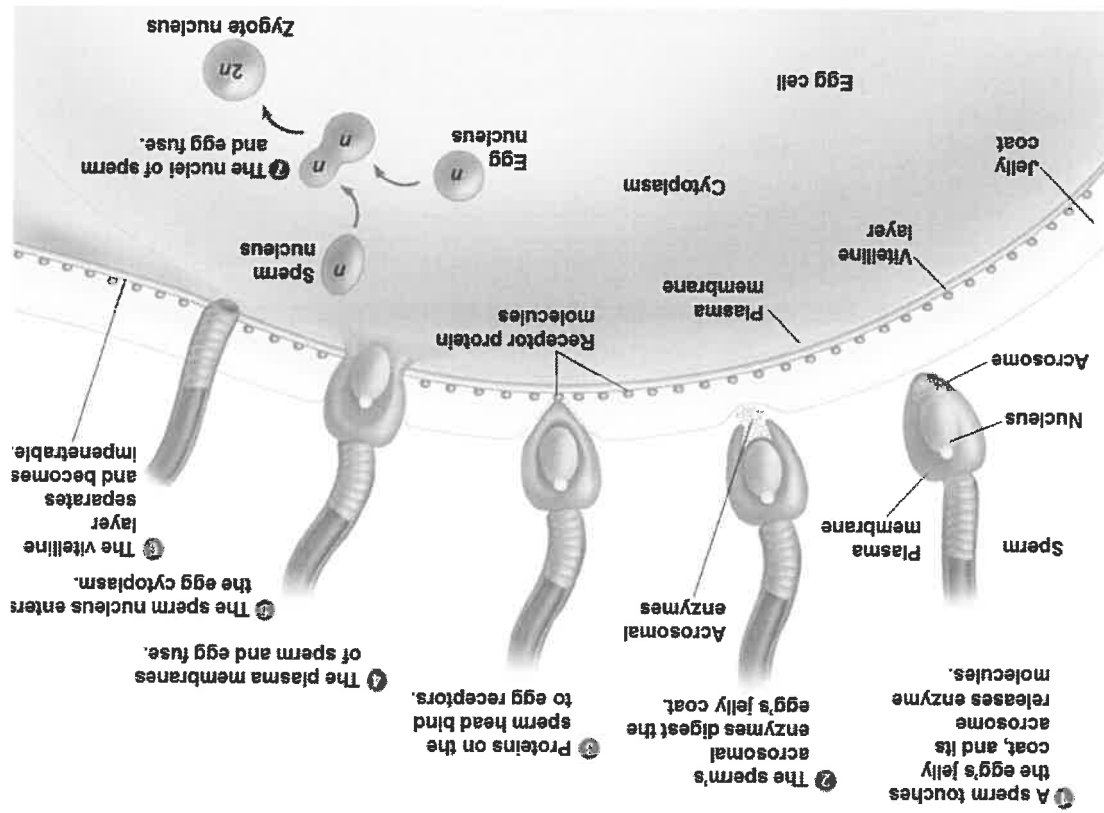
QUESTION 9

[16]

9.1 Study the diagram below which shows the fertilization process of a sea urchin, and answer the questions that follow.



- 9.1.1 Explain briefly what happens at each step (labelled 1-7) of this process. (7)
- 9.1.2 Label parts A – I. (9)



0000000000

