SOALAN ULANGKAJI
BAB 5
BIOLOGI TINGKATAN 4
SECTION A: OBJECTIVES

QUESTIONS

1. Diagram 1 shows the phases in a cell cycle.

![Diagram 1](image)

What is V?
A Mitosis
B Cytokinesis
C Stage S
D Stage G1

2. The chromosomal number of an organism is 12. What is the chromosomal number of gamete cells, somatic cells and embryonic cells of the organism?

<table>
<thead>
<tr>
<th></th>
<th>Game te cells</th>
<th>Somat ic cells</th>
<th>Embryon ic cells</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>12</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

3. Diagram 3 shows two stages in meiosis.

![Diagram 3](image)

What is the chromosomal behaviour at stage P?
A Chromosomes thicken and condense
B Chromosomes arrange themselves around equatorial plane
C Homologous chromosomes pair together and crossing-over occurs
D Homologous chromosomes separate and move to the opposite poles

4. Diagram 4 shows an animal cell during Anaphase I of meiosis.

![Diagram 4](image)

What is the number of chromosome in the parent cell?
A 2
B 4
C 8
D 16
5. **Diagram 4** shows a phase in mitosis.

   ![Diagram 4](image)

   What is this phase?
   
   A  Prophase  
   B  Metaphase  
   C  Anaphase  
   D  Telophase  

6. **Diagram 5** shows the chromosomes in the liver cell of organism X.

   ![Diagram 5](image)

   How many chromosomes are in a gamete of organism X?
   
   A  10  
   B  20  
   C  40  
   D  80  

7. **Diagram 6** shows cell at one particular stage of meiosis.

   ![Diagram 6](image)

   Which of the cell is produced by the cell division?

   A  
   B  
   C  
   D  

8. The following are stages in cytokinesis in plant cells.

   I. The vesicles fuse to form a continuous barrier
II. The golgi apparatus produces vesicles
III. The vesicles migrate to the equator of the cell
IV. The carbohydrate content in the vesicles is used to form the cell wall

Which of the following is the correct sequence of these stages?

A  I, II, III, IV
B  II, III, I, IV
C  II, I, III, IV
D  IV, II, III, I

9. **Diagram 7** shows the phases in a cell cycle.

Which phase do synthesis of mitochondria and chloroplast occur?

A  G1
B  S
C  G2
D  M

10. Which of the following human cells is produced through meiosis?

A  Muscle cell
B  Nerves cell
C  Sperm cell
D  Epithelial cell

11. **Diagram 9** shows the life cycle of frogs.

What is the chromosomal number of P, Q and R?

<table>
<thead>
<tr>
<th></th>
<th>P (Egg)</th>
<th>Q (Tadpole)</th>
<th>R (Adult frog)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Haploid</td>
<td>Haploid</td>
<td>Diploid</td>
</tr>
<tr>
<td>B</td>
<td>Haploid</td>
<td>Diploid</td>
<td>Diploid</td>
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<tr>
<td>C</td>
<td>Diploid</td>
<td>Haploid</td>
<td>Diploid</td>
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<tr>
<td>D</td>
<td>Diploid</td>
<td>Diploid</td>
<td>Diploid</td>
</tr>
</tbody>
</table>

12. In meiosis the points at which the exchange of chromatid materials occurs are known as ………

A  Synapses
B  Chiasmata
C  Bivalents
D  Synapsis

13. **Diagram 10** shows the process of cloning a sheep.
14. **Diagram 11** shows a stage in one of the phases in meiosis.

![Diagram 11](image)

What is the importance of R?

- A Replace dead cells
- B Variation among the species
- C Maintains diploid chromosome number in a zygote
- D Causes genetically identical from the parent cell to the next generation

15. **Diagram 12** shows a diploid cell. This cell undergoes meiosis.

![Diagram 12](image)

If one of the homologous chromosomes pairs does not separate during meiosis I, how many chromosomes can be found in the gametes?

- A 8
- B 4
- C 5
- D 7

16. A diploid number of chromosomes in plant cell are 16. Which of the following is true about the number
of chromosomes in a guard cell and a pollen grain?

<table>
<thead>
<tr>
<th>Number of chromosomes</th>
<th>Guard cell</th>
<th>Pollen grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>8</td>
<td>8</td>
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<tr>
<td>B</td>
<td>8</td>
<td>16</td>
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<tr>
<td>C</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>D</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

17. At which stage in a meiotic division the number of chromosomes in the cell is halved?
   A  Anaphase I
   B  Anaphase II
   C  Telophase I
   D  Telophase II

18. If the nucleus of a cell in an organism has 30 chromosomes, how many chromosomes are there in the new daughter cells that are formed through meiosis?
   A  15
   B  30
   C  45
   D  60

19. Mitosis produces two genetically identical cells. Which of the followings involve mitosis?
   A  Formation of clone
   B  Formation of new species
   C  Formation of pollen grain
   D  Formation of sperm cells

20. **Diagram 13** shows a micrograph of an animal cell undergoing mitotic cell division.
SECTION B: STRUCTURE

1. Diagram 1 shows the example of the cell undergoing the division of cell.

Diagram 1

(a) How many chromosomes are there in the cell?

.................................................................................................................................................................................................................................................. 

[1 mark]

(b) Draw one daughter cell at the end of the cell division through:

i. Mitosis

[2 marks]

ii. Meiosis

[2 marks]
(c) Explain why the chromosomes numbers are different in daughter cells of mitosis and meiosis.

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[2 marks]

(d) Explain one difference of importance of mitosis and meiosis to organisms.

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[2 marks]

(e) In a population of buffaloes, there are normal buffaloes and white buffaloes or known as ‘kerbau balar’. Why is it happen?

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[3 marks]

2 Diagram 2 shows the stages in a cell division.
(a) (i) Name stages X and Y.

X : ……………………………………………………………………………………………..
Y : ……………………………………………………………………………………………..

[2 marks]

(ii) Based on Diagram 2, state two differences between the chromosomal behavior in stage X and stage Y.

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[2 marks]

(b) Number of chromosomes in somatic cells in this organism is 24.

(i) State the chromosomal number of each daughter cell produced at the end of the division shown in Diagram 2

…………………………………………………………………………………………

[1 mark]

(ii) Based on your biological knowledge, give a reason for your answer.

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…………………………………………………………………………………………

[1 mark]

(iii) Explain one important event that takes place during stage X.

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[2 marks]
(c) Based on **Diagram 2**, draw one of the daughter cells produced at the end of the division.

[2 marks]

(d) Explain what will happen in human if the chromosomes fail to separate during stage Y.

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[2 marks]
3 Diagram 3 shows a cell cycle.

(a) Name phase X.

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[1 mark]

(b) What happen during subphase S?

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[3 marks]
(c) M is mitosis. Suggest how M will be affected phase X does not occur.

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[3 marks]

(d) Phase M is important in making new cells. Support this statement with more information.

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[2 marks]

(e)(i) Name process Y.

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[1 mark]

(ii) Proses Y in plant cell is different from that occurs in animal cell. Give your opinion.

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[2 marks]
Section C: Essays

1(a) According to the stages metaphase, anaphase and telophase in cell division, differentiate the events happening during mitosis and meiosis. [4 marks]

(b) Diagram 1.1 is a new variety of vegetable which has a great commercial value. Diagram 1.2 is the original parent of the plant.

Diagram 1.1

Diagram 1.2

Based on the above diagram and with your biological knowledge, explain how a farmer can propagate this variety to give a large scale of yield and at the same time maintains its quality. [6 marks]

(c) Discuss how mutation can lead to the formation of tumor. [10 marks]

2(a)(i) What is meant by cloning? [2 marks]

(ii) Describe one cloning technique to produce a commercial plant of desirable characteristics. [6 marks]
(b) Diagram 2 shows a group of cells that is exposed to ultraviolet ray.

![Diagram 2]

The exposure drives the cell cycle malfunctions. Based on **Diagram 2** describe effect of cell cycle malfunctions to the body.

[6 marks]
ANSWER SCHEME

SECTION A: OBJECTIVE

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<td>C</td>
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<td>20</td>
<td>C</td>
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</table>

Question 1

<table>
<thead>
<tr>
<th>Num</th>
<th>SCORING CRITERIA</th>
<th>MARK</th>
</tr>
</thead>
<tbody>
<tr>
<td>3(a)</td>
<td>Able to state number of chromosomes in the cell</td>
<td>1</td>
</tr>
<tr>
<td>3(a)</td>
<td>Answer: 6 chromosomes</td>
<td></td>
</tr>
<tr>
<td>3(b)</td>
<td>Able to draw one daughter cell of mitosis and meiosis</td>
<td></td>
</tr>
<tr>
<td>3(b)</td>
<td>Answer:</td>
<td></td>
</tr>
<tr>
<td>3(b)</td>
<td>(i) mitosis</td>
<td></td>
</tr>
<tr>
<td>3(b)</td>
<td>Number of chromosomes are 6</td>
<td>1</td>
</tr>
<tr>
<td>3(b)</td>
<td>Same pattern and same size of chromosomes as parent cell</td>
<td>1</td>
</tr>
<tr>
<td>3(b)</td>
<td>(ii) meiosis</td>
<td></td>
</tr>
<tr>
<td>3(b)</td>
<td>Number of chromosomes are 3</td>
<td>1</td>
</tr>
<tr>
<td>3(b)</td>
<td>Pattern and size of chromosomes is different compare to parent cell</td>
<td></td>
</tr>
<tr>
<td>3(c)</td>
<td>Able to explain why the chromosomes numbers are different</td>
<td></td>
</tr>
<tr>
<td>3(c)</td>
<td>Suggested Answer:</td>
<td></td>
</tr>
<tr>
<td>3(c)</td>
<td>In mitosis:</td>
<td></td>
</tr>
<tr>
<td>3(c)</td>
<td>- (During anaphase) chromosome / sister chromatids separated and move to the opposite poles (cause the number of chromosome in daughter cell remain the same)</td>
<td>1</td>
</tr>
<tr>
<td>3(c)</td>
<td>In meiosis:</td>
<td></td>
</tr>
<tr>
<td>3(c)</td>
<td>- (During anaphase) homologous chromosomes separated and move to the opposite poles (cause the number of chromosome in daughter cell become half form the parent cell)</td>
<td>1</td>
</tr>
</tbody>
</table>
### Question 2

<table>
<thead>
<tr>
<th>No</th>
<th>Marking Criteria</th>
<th>Marks</th>
</tr>
</thead>
</table>
| (a)(i) | X : Prophase I  
   Y : Metaphase I                                                              | 2     |
| (ii)  | **Prophase 1**  
   **Metaphase 1**  
   D1 – Homologous chromosomes are arranged randomly  
   D2 – The centromeres of the chromosomes are not hold by / attached to any spindle fibre  
   D3 – Crossing over takes place between the non-sister chromatids  
   Homologous chromosomes are arranged on the metaphase plate / equatorial plane  
   The centromeres of the chromosomes are hold by / attached to the spindle fibres  
   Crossing over has already taken place between the non-sister chromatids | 2     |
| (b)(i) | 12 chromosomes                                                                   | 1     |
| (ii)  | E1 : During meiosis, the cell undergoes two nuclear divisions but the chromosomes /DNA of each chromosome only replicates once  
   E2 : Each daughter cell receives half of the number of chromosomes from the parent cells | 2     |
| (iii) | F1 : Crossing over  
   E1 : An exchange of segments of DNA between non-sister chromatids of homologous chromosomes | 2     |
E2 : which results in new combinations of genes on a chromosomes

<table>
<thead>
<tr>
<th>C)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Any one daughter cell with the correct combination of chromosome</td>
<td>2</td>
</tr>
<tr>
<td>Correct drawing of chromosome (number and combination ) – D1 √</td>
<td></td>
</tr>
<tr>
<td>Correct drawing of the cell (chromosomes are enclosed in a nuclear membrane ) – D2 √</td>
<td></td>
</tr>
</tbody>
</table>

d) E1 : One of the daughter cells produced might contain one extra chromosome / one lesser chromosome
E2 : During fertilisation, if the cell with an extra / lesser chromosome fuses with a normal sperm, the zygote shall contain one extra/ 47 // one lesser/ 45 chromosome/s
E3 : producing Down’s / klinefelter’s // Turner’s Syndrome baby / offspring

| Question 3 |
|---|---|---|
| No | Marking Criteria | Marks |
| (a) | Interphase | 1 | 1 |
| (b) | P1 – S is synthesis phase | 1 | 3 |
| | P2 – by using nucleic acid / nucleotide | 1 |  |
| | P3 – in DNA replication | 1 |  |
| | P4 – DNA in the cell doubled | 1 |  |
| (c) | P1 – There will be no nutrients / no proteins | 1 | 3 |
P2 – and no cytoplasmic organelles produced which are needed for mitosis
P3 – to prepare for cell division // cell growth // duplicating its DNA
P4 – as a result, mitosis cannot proceed / occurs

(d) P1 – Phase M / mitosis increases the number of cells (within organism)
P2 – (results in the ) development of multicellular body (from a single cell//growth)
P3 - (new cells are formed by mitosis can) replace old/damaged cells
P4 – (because mitosis produce the) exact copies of the cells being replaced
P5 – (the production of new cells helps in the) regeneration of some body parts of organism such as star fish

(e)(i) Cytokinesis
P1 – Plant cells have cell walls
P2 – cytokinesis cannot occurs with a cleavage furrow (like animal cells)
P3 – (Instead) during telophase, a cell plate forms across the cell (in the location of the old metaphase plate)

Section C: Essays

Question 1

<table>
<thead>
<tr>
<th>Stages</th>
<th>Mitosis</th>
<th>Meiosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Metaphase</td>
<td>- homologous chromosome are arranged in linear sequence /randomly at the metaphase plate</td>
<td>- homologous chromosome line up side by side at the metaphase plate</td>
</tr>
<tr>
<td>2. Anaphase</td>
<td>- separation of sister chromatids to the opposite pole // the centromere of each chromosome divides into two and allows sister chromatid to move to opposite pole.</td>
<td>- separation of the homologous chromosome to the opposite pole // sister chromatids still remain attached to each other during movement to the opposite pole</td>
</tr>
</tbody>
</table>
3. Telophase

- two daughter nuclei are formed
- diploid (2n) number of chromosome is remained
- daughter cells are genetically identical to each other and to the parent cell.

- four daughter nuclei are formed
- diploid (2n) number of chromosome is reduced to haploid (n)
- daughter cells are differ from the parent and from each other// variation occurs among daughter cells.

1m each = max 4 marks

6(b) Able to explain how a farmer can propagate this variety to give a large scale of yield and at the same time maintains its quality.

- The technique used is tissue culture technique
- A piece of tissue/explant is taken from the young part of the parent plant eg. Shoot/ root and cut into smaller pieces
- The tissues are sterilized (with dilute sodium hypochlorite solution) to prevent the growth of pathogens / bacteria /fungus.
- Each pieces of sterilised tissue is placed onto a growth medium/ gel containing nutrients (eg. Glucose, amino acid, minerals etc.) and hormone/auxin with optimum pH level

1 1 1
- The apparatus and culture medium used must be in sterile conditions and kept under the suitable temperature/ 30-35 °C.
- The tissue cells then divide repeatedly by mitosis to produce a mass of undifferentiated cells/callus
- After several weeks, callus differentiated to produce shoots and roots/organogenesis.
- Once the roots grow, the plantlets/little plant are removed and transferred to the soil for growth into the adult plant.
- All the plantlets produced this way are genetically identical and known as clones.
- Therefore, all adults plants that develop from them share the same traits, for example has large fruits.

<table>
<thead>
<tr>
<th>1 point - 1 mark</th>
<th>10 point - 10 marks Max: 6 marks</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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</tr>
<tr>
<td>Max</td>
<td>6</td>
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<td>1</td>
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</table>

6(b) Discuss how mutation can lead to the formation of:
- certain substance/carcinogen such as benzo - A - pyrene etc...
- can cause the change in DNA structure (that control the cell cycle)
- an abnormal cell is formed/ cancer cell / mutant cell
- this change disrupts the coded DNA genetic instruction for mitosis control
- this leads to uncontrolled mitosis (which is non-stop division of the cell) producing a mass of new daughter cells called tumour
- tumour cells have no function, but instead compete with surrounding normal cells to obtain nutrients and energy for their own growth
- some tumours remain inactive and are relatively harmless (not cancerous) and called benign tumour
- Benign tumour cells remain at its original site and do not spread to other part of the body. It can be removed by surgery.

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<thead>
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</tbody>
</table>
Other tumour, called malignant tumours are very active (cancerous), spread locally and some cancer cell migrates through bloodstream to invade other organ.

when this happens, secondary tumours develop in other body tissue, then lead to the malfunction of the tissue and ultimately death.

An individual with a malignant tumour is said to have cancer.

Question 2

No | Marking Criteria | Marks
--- | --- | ---
(a) | Able to explain what cloning is: | 
Sample answer:

P1: Cloning is an asexual reproductive process of producing clones/does not involve gamete 1
P2: A clone is a group of cells/organism/a population of organisms produced from a single ancestral cell 1
P3: A clones genetically identical 1
P4: The technique can be used to produce high quality of organism/oil palm/cocoa plants 1

Any 2 P 2

(b) | Able to describe tissue culture technique. | 
Sample answer:

P1: Tissue culture technique 1
P2: Tissue culture technique is used to produce (high quality of seedling) oil palm seedlings in vitro/any suitable example 1
P3: The leaves/shoot/stem/root tissues are cut out (These cut out plant tissues are called explants) 1
P4: The pieces of meristematic tissue (explants) are cultured in sterile nutrient medium, in suitable pH and with addition of plant growth substances (at least 2 factors) 1

HTTPS://WICKEDBIOLOGY.WORDPRESS.COM
<table>
<thead>
<tr>
<th>P5</th>
<th>The flasks containing the tissue are stored in an incubator at 37°C for 2/3 weeks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6</td>
<td>The cell divide by mitosis to produce callus.</td>
</tr>
<tr>
<td>P7</td>
<td>The callus is then cut into small pieces.</td>
</tr>
<tr>
<td>P8</td>
<td>The small pieces of callus tissues are then cultured in sterile nutrient medium.</td>
</tr>
<tr>
<td>P9</td>
<td>When it has grown to a suitable size, the clone is transferred to the nursery.</td>
</tr>
</tbody>
</table>

Any 6 P  6

(c) Able to describe the effect of cycle malfunctions to the body.

Sample answer
P1: The exposure damage the DNA of the cell
P2: A cell divides through mitosis repeatedly.
P3: Produces cancerous cell
P4: Due to (severe ) disruption to the mechanism that controls the cell cycle
P5: Cancerous cells divide freely / uncontrollably heeding the cell cycle control
P6: (these cells ) compete with surrounding normal cells to obtain nutrient / energy (for growth)
P7: Invade / destroy neighbouring cells
P8: (they can spread to other organ and) initiate cancers there.

Any 6 P  6