Name:_____ Period:_____

AICE Biology: Mitosis and Cancer Problem Set

Answer the following questions completely as practice for the upcoming mitosis, cell cycle, and cancer quest. This assignment is worth 20 points and is due the day of the quest.

1. Which statement is **incorrect** for mitotic cell division?

A DNA is replicated semi-conservatively during mitosis.

B DNA is normally unchanged from one generation of cells to the next.

C The daughter cells have the potential to produce the same enzymes as the parent cell.

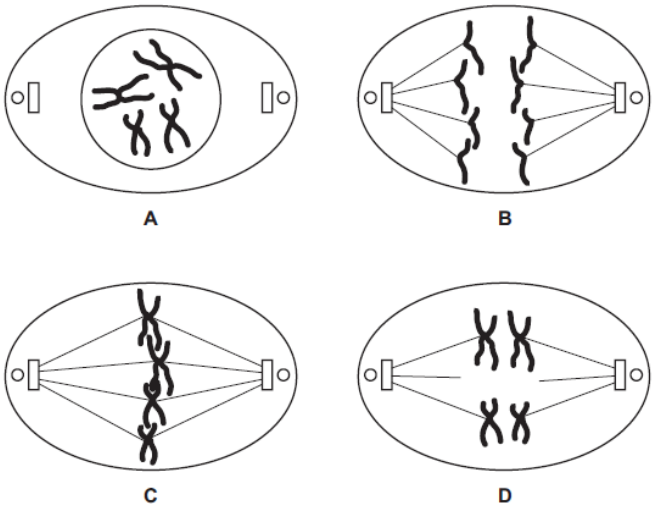
D The same quantity of DNA is distributed to the nuclei of two new cells.

2. The diagram shows the chromosomes of one cell which has been squashed during mitosis.

Which stage of mitosis is shown and what is the haploid chromosome number in this species?

	stage of mitosis	haploid chromosome number
A	anaphase	5
B	anaphase	10
C	metaphase	5
D	metaphase	10

3. Which diagram represents a cell undergoing metaphase of mitosis?



4. Colchicine is a substance which inhibits the formation of spindle fibres.

At which stage is the cell cycle interrupted?

A cell division

B DNA replication

C interphase

D mitosis

5. Which statement describes a cell that is capable of reproduction and belonging to a haploid organism?

A It has chromosomes that contain one polynucleotide chain.

B It is capable of carrying out a reduction division to form gametes.

C It possesses two copies of each gene as a result of fertilisation.

D It will undergo cell division by mitosis during asexual reproduction.

6. During which stage of the mitotic cell cycle is DNA replicated?

A anaphase

B interphase

C prophase

D telophase

7. Cancer cells divide out of control, forming tumours.

Which statement describes the difference between a cancer cell and a normal cell?

A Cancer cells do not undergo cytokinesis.

B Cancer cells have a shorter interphase.

C Cancer cells do not have metaphase.

D Only cancer cells have mutated DNA.

8. Which statement describes events during interphase of the mitotic cell cycle?

A Chromatids are pulled apart by spindle fibres.

B Chromosomes are replicated ready for the next division.

C Chromosomes line up on the equator of the spindle.

D Chromosomes start to coil, becoming shorter and fatter.

9. Chromosome telomeres promote DNA replication and are not completely replaced during mitosis. A substance **X** is known that completely replaces telomeres during mitosis.

What will be the effect of growing a cell culture with and without substance **X**?

	with substance **X**	without substance **X**
A	cells divide continually	cell division eventually slows and stops
B	cells divide more rapidly	cells divide continually
C	cell division eventually slows and stops	cell division stops immediately
D	cell division stops immediately	cells divide continually

10. What is a correct description of the centrioles, nuclear envelope and spindle during mitosis in animal cells?

	phase	centrioles	nuclear envelope	spindle
A	anaphase	replicate	absent	present
B	metaphase	present	reforms	present
C	prophase	move apart	breaks up	forms
D	telophase	replicate	breaks up	breaks up

11. The cell cycle includes mitosis.

Which are features of **nuclear** division?

1 forms cells of equal size to the parent cell

2 forms genetically identical cells

3 semi-conservative replication of DNA

A 2 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

12. In which process does mitosis **not** have an important role in living things?

A asexual reproduction

B growth of cells

C increase in size

D repair to damaged tissues

13. The diagram shows the chromosomes of a typical plant cell at the metaphase stage of mitosis.

Which row describes this cell during metaphase?

	diploid number (2n) for the plant	structures present at metaphase		
		cell wall	centriole	spindle
A	4	✓	✗	✓
B	8	✗	✓	✓
C	8	✓	✗	✓
D	16	✓	✓	✗

14. Which statement about a diploid cell is **not** correct?

A It can undergo a mitotic division to allow growth to occur.

B It can undergo a mitotic division to repair a cell.

C It can undergo a reduction division to form haploid cells.

D It is one that possesses two complete sets of chromosomes.

15. Laboratory mice whose *p53* genes had been switched off developed tumours.

When their *p53* genes were switched on again, the tumour cells stopped dividing and died within a few days. Healthy cells in the mice were unaffected.

What do these observations suggest?

A *p53* protein speeds up the mitotic cell cycle

B *p53* protein causes all cells to die

C the *p53* gene acts as a tumour suppressor gene

D the *p53* gene encourages the growth of tumours

16. A student examined the cells in the growing region (meristem) of an onion root and obtained the data below.

stage	number of cells
interphase	886
prophase	73
metaphase	16
anaphase	14
telophase	11

What percentage of cells contain chromosomes that appear as two chromatids?

A 97.5 % **B** 95.9 % **C** 8.9 % **D** 7.3 %

17. Which definitions of *diploid* and *haploid* are true for typical eukaryotic cells?

1 *diploid* – any cell with an even number of homologous chromosomes

2 *diploid* – any cell with two copies of each homologous chromosome

3 *haploid* – any cell with half the diploid number of homologous chromosomes

4 *haploid* – any cell with one copy of each homologous chromosome

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

18. Meiosis and mitosis are two types of cell division.

A cell has 10 chromosomes before it divides.

How many chromosomes will it have after dividing by meiosis or mitosis?

	meiosis	mitosis
A	5	10
B	5	20
C	10	5
D	20	5

19. Which statement about a diploid cell is **not** correct?

A It can undergo a mitotic division to allow growth to occur.

B It can undergo a mitotic division to repair a cell.

C It can undergo a reduction division to form haploid cells.

D It is one that possesses two complete sets of chromosomes.

20. A gene codes for the production of a protein, p53, that binds to damaged DNA during interphase and prevents its replication. A carcinogen in cigarette smoke mutates this gene.

Which statement explains why this mutation may cause cancer?

A Lack of p53 allows cells to undergo mitosis.

B Lack of p53 allows cells with damaged DNA to replicate.

C The carcinogen in cigarette smoke increases the rate of cell division.

D The p53 causes uncontrolled cell division.

21. Exposure to which of the following increases the risk of developing a cancerous growth?

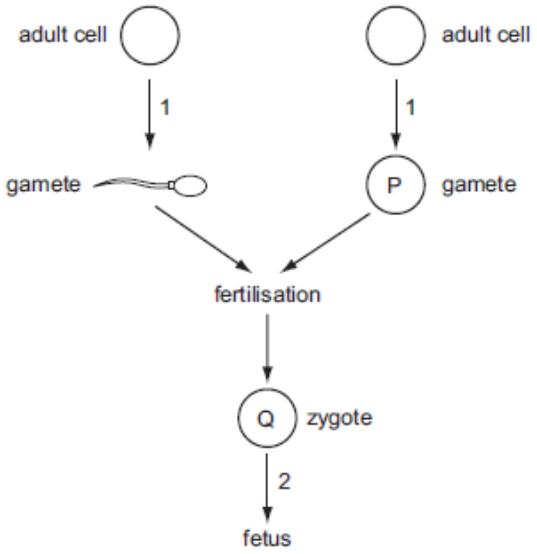
	ultraviolet light	viruses	carbon monoxide	X-rays
A	✓	✓	✗	✓
B	✓	✗	✓	✓
C	✗	✓	✓	✗
D	✓	✗	✓	✗

key

✓ increases risk

✗ does not increase risk

22. The diagram shows an outline of the process of sexual reproduction.



Which row identifies the type of cell division occurring during stages 1 and 2 and the number of chromosomes in cells P and Q?

	1	2	P	Q
A	meiosis	meiosis	diploid	haploid
B	meiosis	mitosis	haploid	diploid
C	mitosis	meiosis	haploid	diploid
D	mitosis	mitosis	diploid	haploid

23. **In the space below, diagram and label all steps of mitosis:**

24. Fig. 1.1 shows a bacterial cell dividing by binary fission.

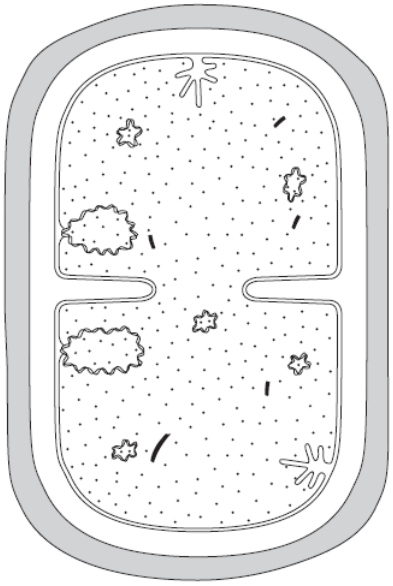


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Fig. 1.1

(a) With reference to Fig. 1.1, state three structural features of prokaryotic cells that are **not** shown by eukaryotic cells.

1 .....

2 .....

3 .....[3]

(b) Plant cells divide by mitosis, not by binary fission.

(i) State three roles of mitosis in plants.

1 .....

2 .....

3 .....[3]

(ii) Explain why cells that are produced as a result of mitosis are genetically identical.

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.....[3]

25. Fig. 3.1 is an electron micrograph of a lymphocyte in the process of cell division during an immune response.

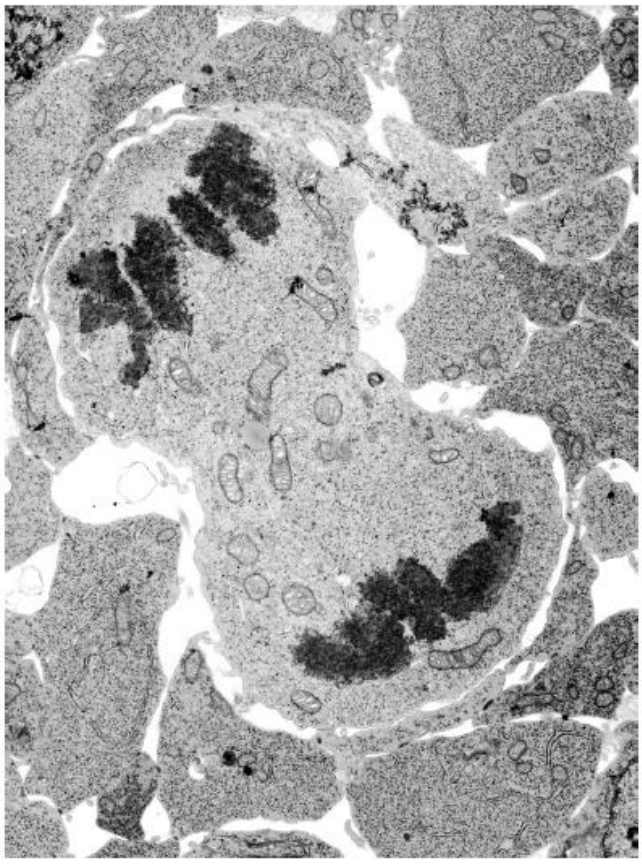

Fig. 3.1

(a) With reference to Fig. 3.1,

(i) name the stage of mitosis shown;

.....[1]

(ii) describe what is happening during this stage of mitosis;

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.....[2]

25. continued…

(iii) suggest the **disadvantages** of using an electron microscope to study mitosis.

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.....[2]

(b) Tumours may form inside the lungs of long-term smokers.

(i) Describe how a tumour develops in the lungs.

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26. **(a)** Explain why it is important that the daughter cells produced during a mitotic cell cycle in humans are genetically identical.

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.....[2]

(b) Name two factors that increase the chance that a cancer cell will develop.

1 .....

2 .....[2]

26. continued…

(c) Fig. 3.1 shows a cancer cell in the process of cell division.

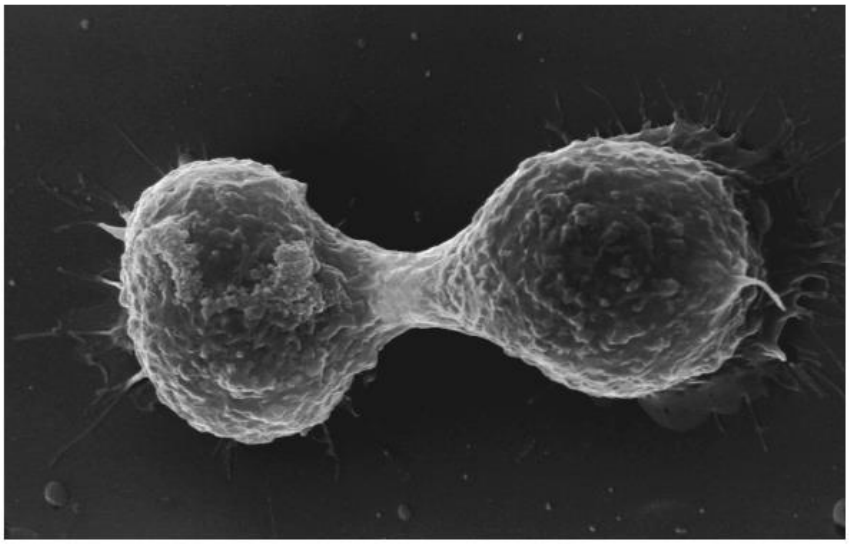

Fig. 3.1

With reference to Fig. 3.1,

(i) state the stage of cell division;

.....[1]

(ii) describe what is happening to the cell during this stage of cell division;

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.....[3]

(iii) describe how these cells develop into a tumour.

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.....[2]