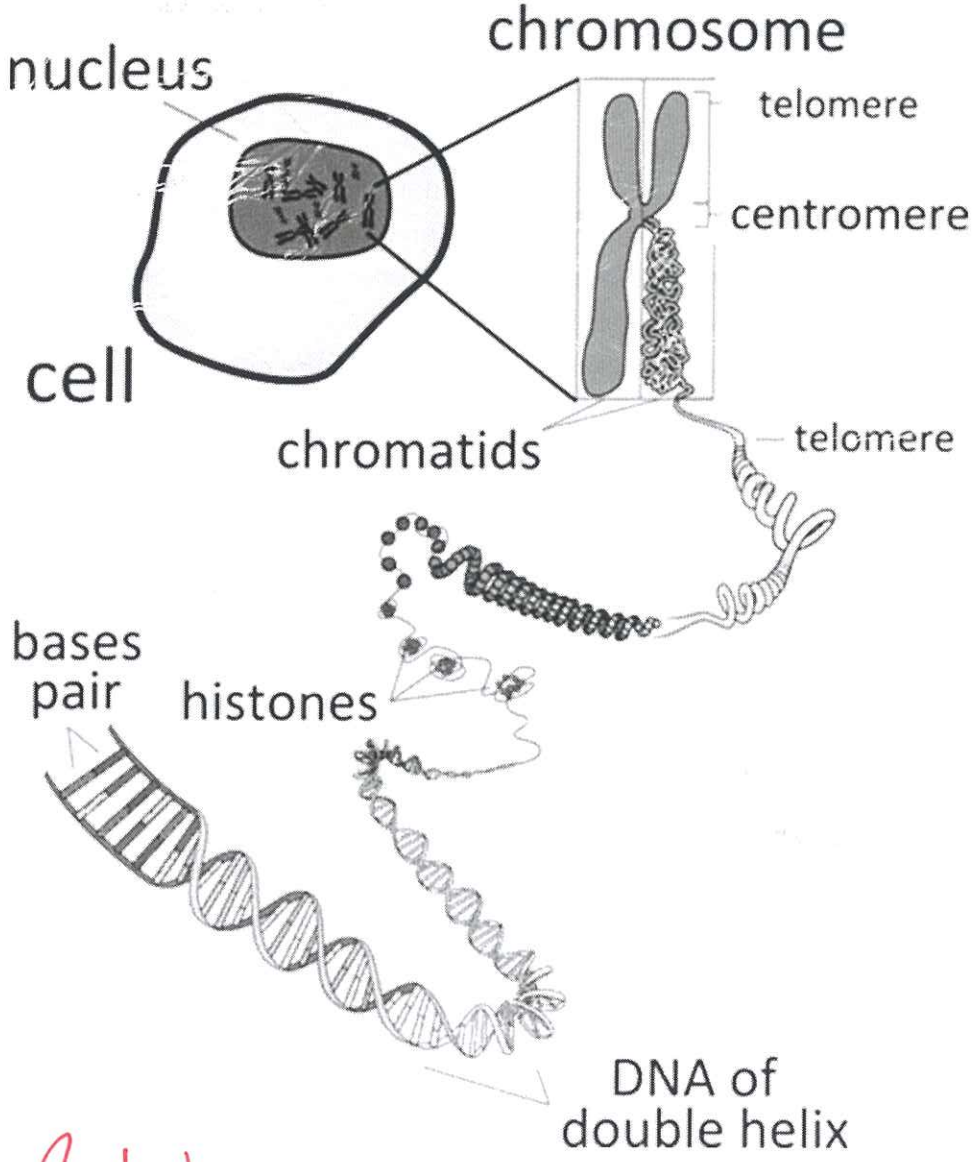
BIOLOGY WORKBOOK

Unit 2 AOS 1

How does reproduction maintain the continuity of life?



Name: Solutions

Teacher: _____

Date: _____

Unit 2 AOS 1: Study Design

KEY KNOWLEDGE

The cell cycle

- derivation of all cells from pre-existing cells through completion of the cell cycle
- the rapid procession of prokaryotic cells through their cell cycle by binary fission
- the key events in the phases (G1, S, G2, M and C) of the eukaryotic cell cycle, including the characteristics of the sub-phases of mitosis (prophase, metaphase, anaphase and telophase) and cytokinesis in plant and animal cells.

Asexual reproduction

- the types of asexual reproduction including fission, budding, vegetative propagation and spore formation
- the biological advantages and disadvantages of asexual reproduction
- emerging issues associated with cloning, including applications in agriculture and horticulture.

Sexual reproduction

- how an offspring from two parents has a unique genetic identity
- the key events in meiosis that result in the production of gametes from somatic cells including the significance of crossing over of chromatids between homologous chromosomes in Prophase 1 and the non-dividing of the centromere in Metaphase 1
- the biological advantage of sexual reproduction, specifically the genetic diversity in offspring.

Cell growth and cell differentiation

- the types and function of stem cells in human development, including the distinction between embryonic and adult stem cells and their potential use in the development of medical therapies
- the consequences of stem cell differentiation in human prenatal development including the development of germ layers, types of tissues formed from germ layers and the distinction between embryo and foetus
- the disruption of the regulation of the cell cycle through genetic predisposition or the action of mutagens that gives rise to uncontrolled cell division including cancer and abnormal embryonic development.

TEXTBOOK SUMMARIES

8.1, 8.2, 8.3, 8.4, 9.1, 9.2

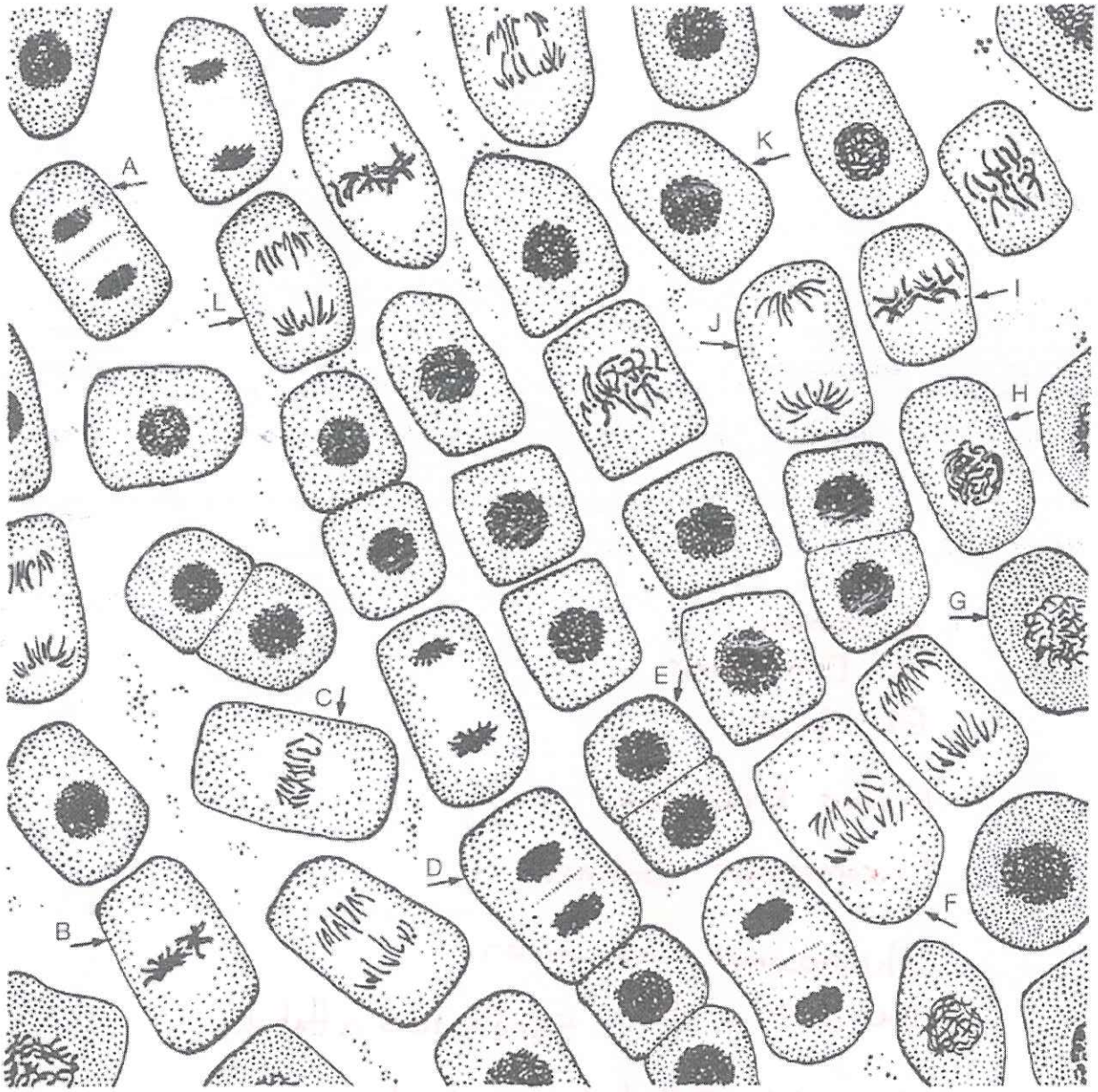
BIOZONES

159	160	161	162	163	131	165	166	169	170	172
173	174	175	176	178	179	180	181	182	183	

Date: _____

Activity #1: Stages of the cell cycle

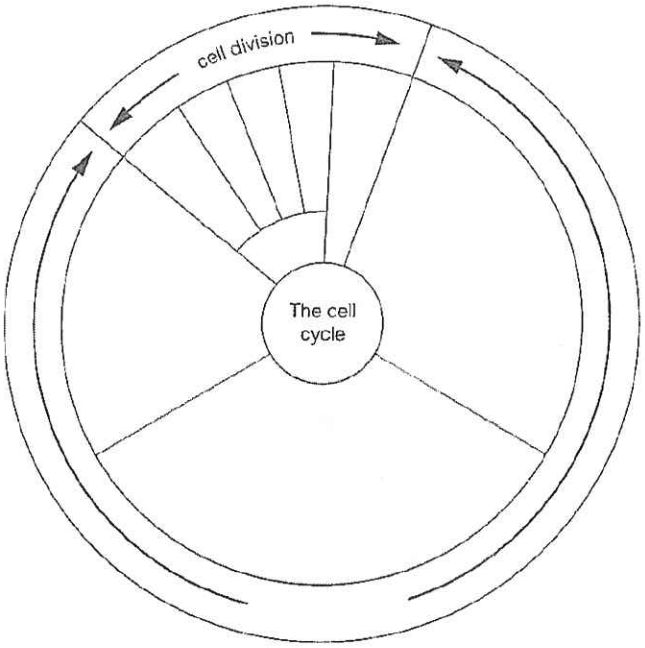
1. Examine the cells at the different stages of the cell cycle below. Some of the cells have been labelled with a letter of the alphabet. Identify the stage of the cell cycle represented by these cells in the table below:



Stage of cell cycle	Cells in stage
Interphase	K
Prophase	G + H
Metaphase	B + C
Anaphase (early)	I + F
Anaphase (late)	L + J
Telophase	A, D + E

Date: _____

2. Label the stages shown in the cell cycle below.



3. Complete the summary table below to outline the major events in each stage of the cell cycle

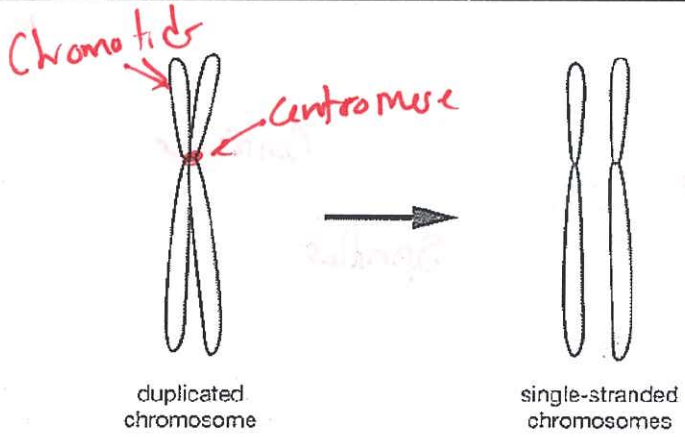
Stage	Description
Interphase (G1, S, G2)	G1 - Growth S - DNA synthesis G2 - Grows
Prophase	Nucleus breaks down Chromosomes Condense
Metaphase	Chromosomes line up on metaphase plate Spindle fibres attatch
Anaphase	Chromotids Pulled to opposite sides
Telophase	Nuclear membrane becomes visable Cell starts to separate
Cytokinesis	Cell splits into two

Date: _____

Activity #2: Cell cycle – replication

1. The genetic material in the nuclei of cells is contained in strands called chromosomes.
   a. Label the centromere and a chromatid on the diagram below
   b. Explain the difference between a chromosome and a chromatid

Chromatids are the 'legs' of the entire chromosome



2. Outline the significance of cell replication. Include three key points.

- Provides new cells
- Used for growth + development
- Reproduction

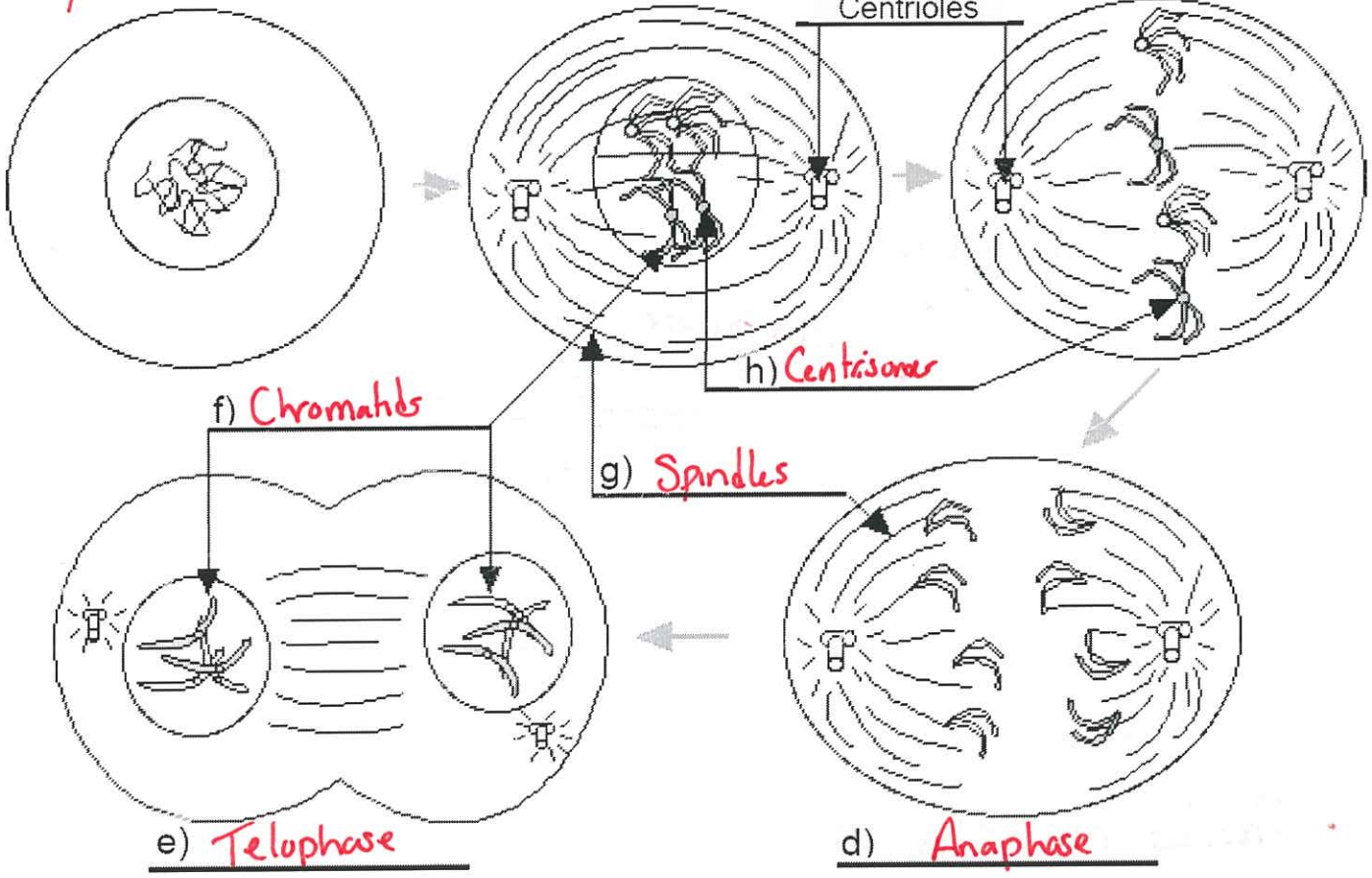
3. Complete the table below on the differences between Binary fission and Mitosis

Feature	Binary fission	Mitosis
Cell type	Prokaryotes	Eukaryotes
Rate and complexity	Fast not complex	Slower + complex
Structural changes	No	No

Date: _____

Activity #3: Mitosis

1. Label the following diagram with the phase of mitosis (a) through to (e), or the type of cell structure, (f) through (h), seen during mitosis.



2. In terms of genetic makeup, describe the results of mitosis.

2 Cells that are genetically identical to the Parent cell

3. Interphase is sometimes called the 'resting phase' of the cell cycle. Outline what is happening in the nuclei of interphase cells.

The chromosomes become double stranded ready for cell division.

Date: _____

4. During which stage of a cell's cycle do the replicated chromosomes thicken and become visible?

Prophase

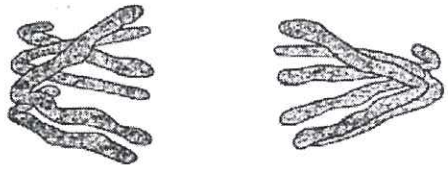
5. During which stage of a cell's cycle do the replicated chromosomes line up on the equator of the cell?

Metaphase

6. During which stage of a cell's cycle do the chromosomes replicate?

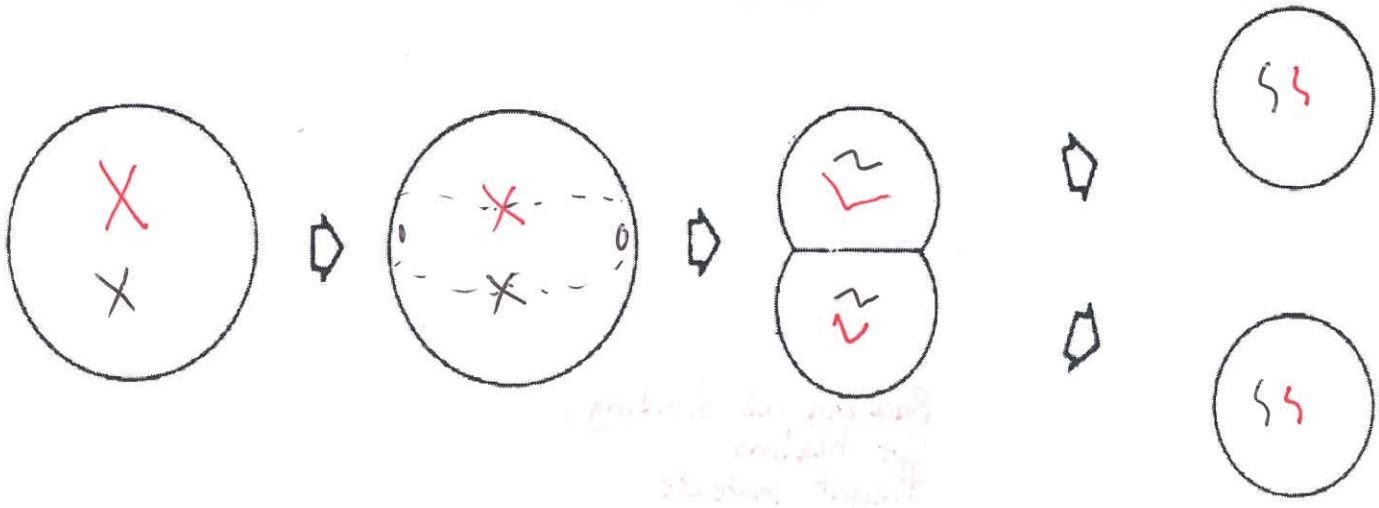
Interphase S1

7. The drawing below has been made from a photograph showing a cell undergoing mitosis. Based on the picture, what stage must the cell have been in?



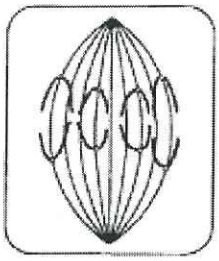
Anaphase

8. Using coloured pens or pencils, show how 2 chromosomes are passed from parent cell to two daughter cells.

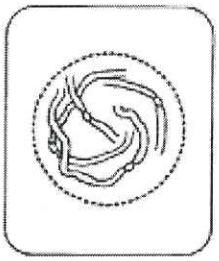


Date: _____

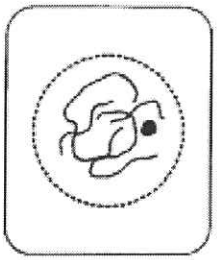
9. The drawings A – E show stages of mitosis in a plant cell.



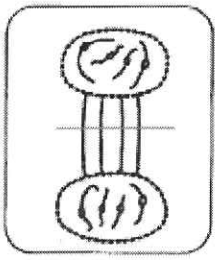
A



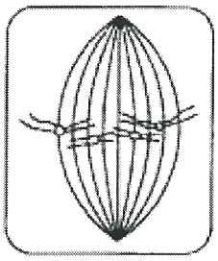
B



C



D



E

a. Which of the drawings A – E shows

i. Interphase C

ii. Prophase B

iii. Metaphase E

iv. Anaphase A

v. Telophase D

vi. Cytokinesis D

b. Give two processes which occur during interphase and which are necessary for mitosis to take place:

Growth of the cell and replication of the DNA.

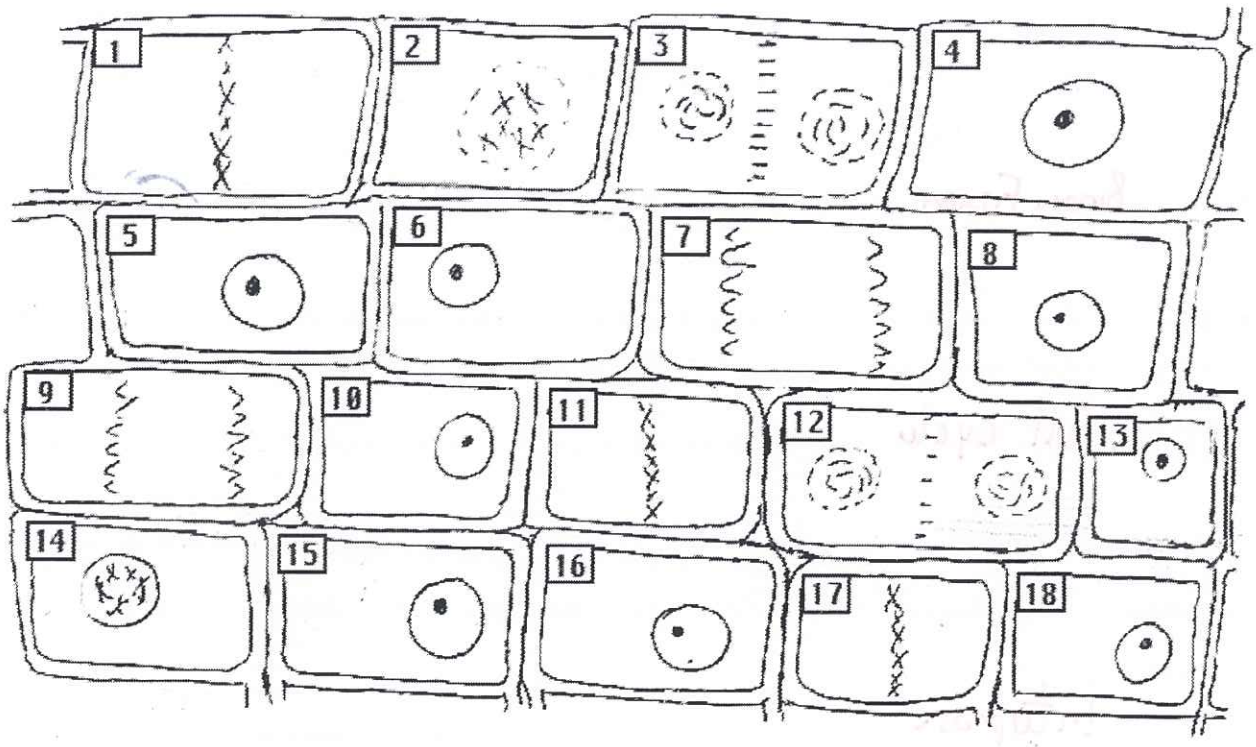
10. Classify the examples of cell replication into the correct purpose:

- Toddlers height increasing by 2 cm
- Cut healing
- Bacteria cell dividing
- Embryonic cell dividing
- Seed germinating
- Unicellular Protista organism dividing

Purpose	Example
Reproduction	Bacteria cell dividing,
Repair and maintenance	Cut healing
Growth and development	Height increase
Restoring nucleus-to-cytoplasm ratio	

Date: _____

11. This drawing shows various stages of mitosis in a fast growing onion root tip.



Identify the cell (by number) which are in the following stages of mitosis:

Interphase 4 5 6 8 10 13 15 16 18

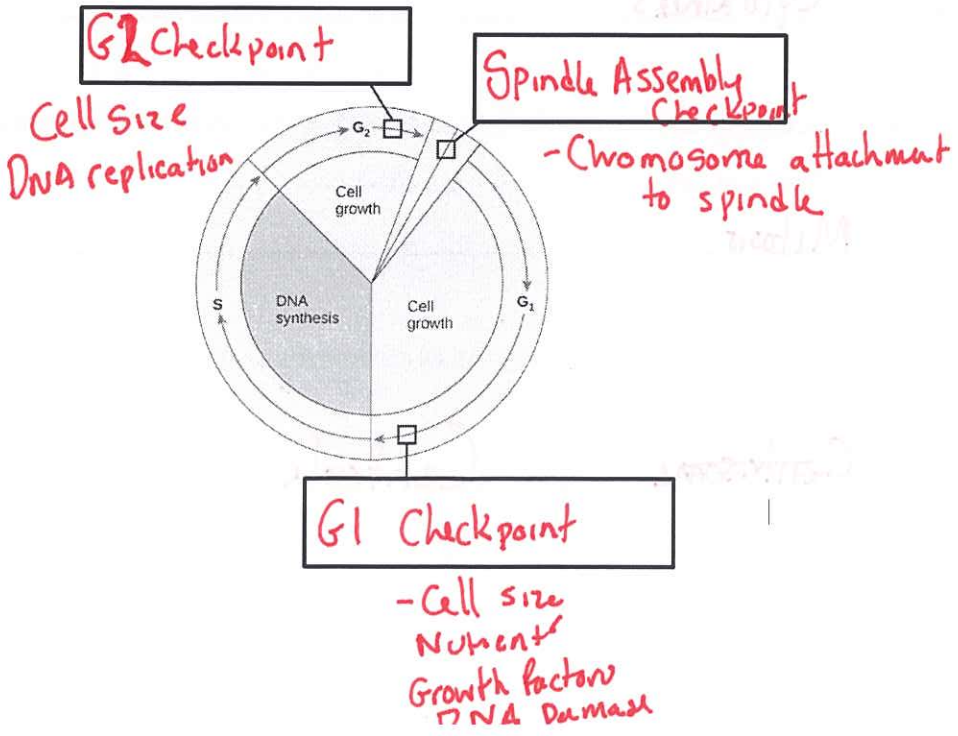
Prophase 2 14

Metaphase 1 11

Anaphase 7 9 17

Telophase 3 12

12. Label the following checkpoints with a brief description of what they do.



Date: _____

Activity #4: What am I?

1. I am a relatively rapid form of reproduction. I produce a new genetically identical organism from the parent. I start with just one DNA molecule and have a simple method of reproducing. I do not have membrane bound organelles or spindle fibres. Prokaryotes use me to create more of themselves.

   What am I? Binary Fission

2. I have 3 main phases; interphase, mitosis and cytokinesis. I go through this cycle my whole life. I begin with a single cell that grows and the divides into two daughter cells through replication.

   What am I? Cell cycle

3. I begin immediately after a cell has divided. During my phase cells will grow larger and copy its chromosomes in preparation for cell division. I have 3 main stages; G1, S, G2. I take up approx. 90% of the cell cycle.

   What am I? Interphase

4. I am an arrangement of microtubules that bind to a centromere of a chromatid. I enable the chromosome to be divided equally between two daughter cells during mitosis AND meiosis. You will see me during metaphase.

   What am I? ~~Metaphase plate~~ Spindle (Microtubules)

5. I am the division of a cell following mitosis and meiosis. I occur when the cytoplasm divides and the cell splits into two daughter cells.

   What am I? Cytokinesis

6. I am the division of a nucleus that results in two cells that are genetically identical to the parent cell. Asexual reproduction and cell replication for growth occur by me.

   What am I? Mitosis

7. I make the spindle fibres contract splitting the centromeres and pull the separated chromosomes to opposite poles.

   What am I? ~~Centrosome~~ Centriole

Date: _____

8. Chromosomes condense and become visible during me. Centrioles move to opposite sides of the nucleus to form the poles and spindle fibres begin to form.

What am I? Prophase

9. I occur due to uncontrolled cell division. I am an abnormal growth of tissue that usually forms a mass.

What am I? Tumor Neoplasm

10. I am a highly regulated form of cell death that is vital for the normal functioning of every organism. Webbed toes are a result of me not doing my job properly. I am commonly known as programmed cell death.

What am I? Apoptosis

11. I am known as a cancer causing agent. I am an environmental factor that can damage DNA. I have three types; chemical, physical and biological. Tobacco, UV rays and X-rays are an example of me.

What am I? Carcinogen

12. I am a tumour that is a localised mass that will not transform into cancer.

What am I? Benign

13. I form a mass due to uncontrolled cell division. I invade other tissues and transform into cancer.

What am I? Malignant

14. I am a complex structure of DNA strands coiled around histone proteins. I carry the hereditary information of the cell in the form of genes. All body cells in a particular species have the same number of me.

What am I? Chromosome

15. I am one of two copies of a chromosome formed during the S stage of interphase. The two copies of me are joined at a centromere.

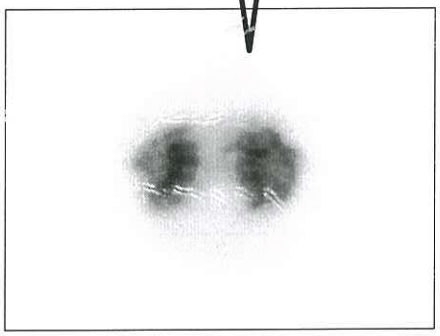
What am I? Chromatid

16. I control the cell cycle. If a cell does not adhere to my criteria it is destroyed.

What am I? ~~Nucleus~~ ~~Cell Cycle~~ Checkpoint

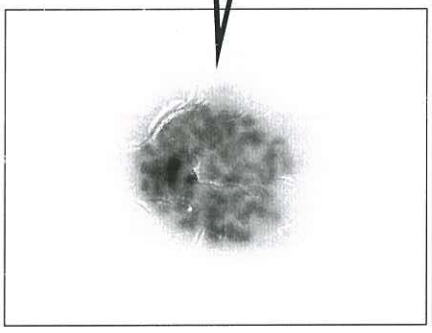
Date: _____

Activity #5: Recognising stages of mitosis



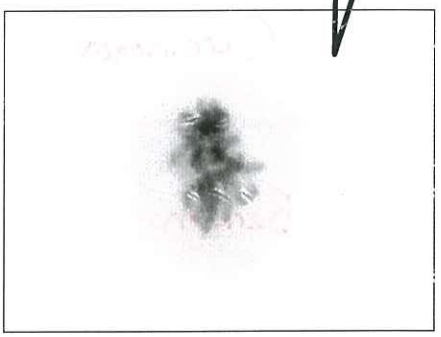
Stage: Telophase

Reason: Cell splitting



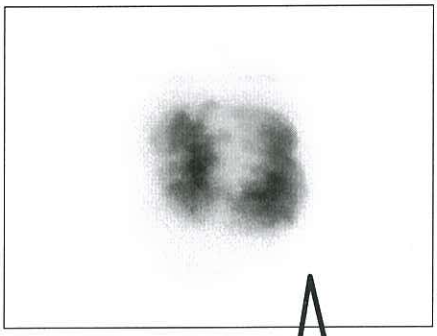
Stage: Prophase

Reason: Chromosomes condensing



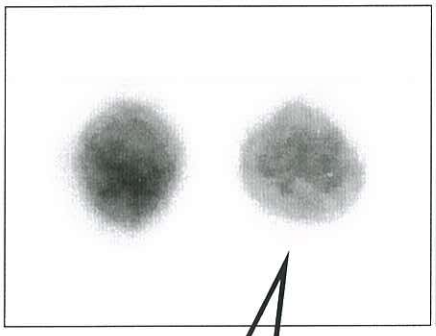
Stage: Metaphase

Reason: Chromosomes in the middle



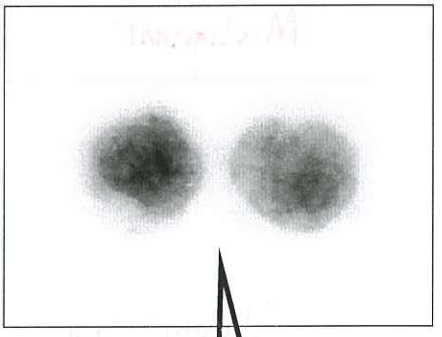
Stage: Anaphase

Reason: Chromosomes being pulled away



Stage: G1

Reason: large nucleus



Stage: G2

Reason:

Date: _____

Activity #6: Stem cells

1. Select appropriate terms from the following list to complete the table. Describe the differentiation potential that occurs at each stage of embryonic development (Can use terms more than once).

Pluripotent Foetus Morula Unipotent
Mesoderm Adult stem cell Totipotent

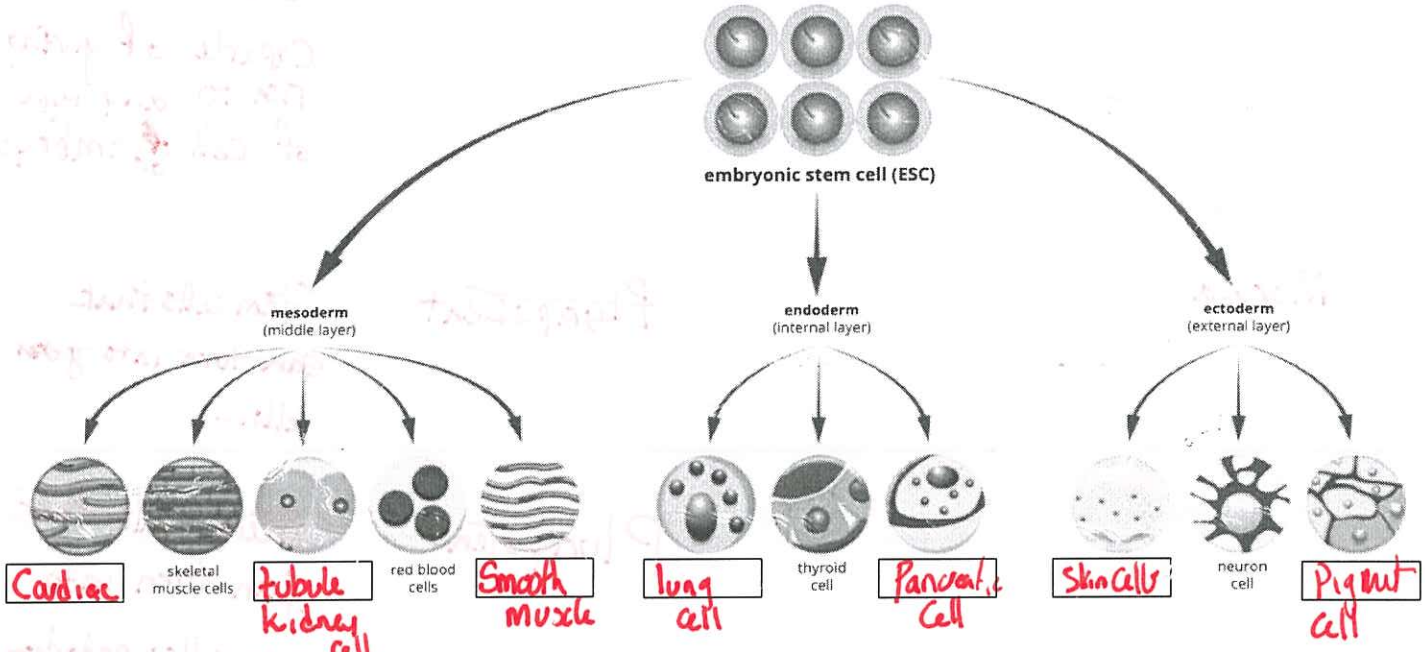
Type of cell	Diagram	Potency potential	
		Name	Description
Zygote ○ Fertilised egg ○ 1 cell	 fertilised egg (day 1)	○ Totipotent	Stem cells capable of giving rise to any type of cell or embryo
Morula ○ 16 cells	 morula (day 3)	~~Pluripotent~~	~~Stem cells that can turn into germ cells~~
Blastocyst ○ Endoderm ○ Mesoderm ○ Ectoderm	 blastocyst (day 5)	Pluripotent	Stem cells that can turn into germ cells: endoderm, mesoderm, ectoderm
Gastrula	 gastrula (day 12)	Multipotent	Stem cells give rise to multiple but limited cell types
Embryo Foetus	 embryo (week 3)  foetus (week 8)	Multipotent / Unipotent	Stem cells that can only differentiate into one cell type

Date: _____

2. Explain what happens to the potential of embryonic stem cells to differentiate as the embryo grows and matures.

As the embryo grows the potentcy of stem cells decrease to specialise in cell production

3. Fill in the blanks for the specific germ layers that give rise to specialised cells.



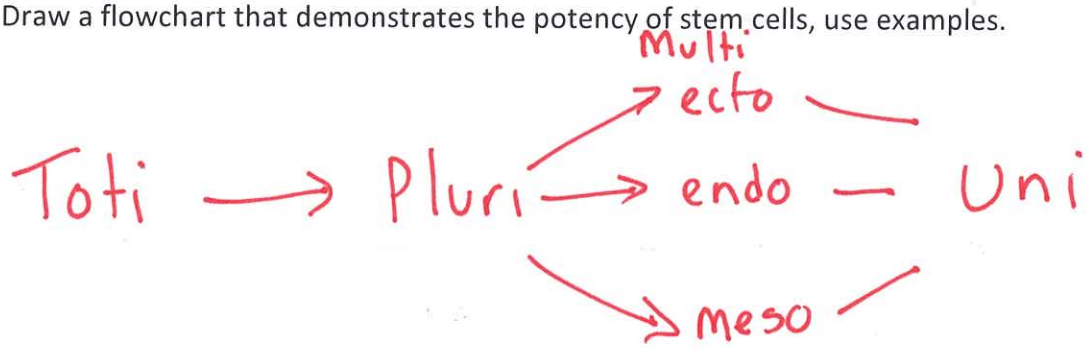
4. Fill in the table below

	Embryonic stem cells	Adult stem cells	Induced pluripotent stem cells
Advantages	• Unlimited supply • Cell division • Can grow into large quantities • Can differentiate into any cell	• Already programmed to make particular cell type + Can be used for specific treatment	• Use normal somatic cells • Use cells from person • no immune rejection
Disadvantages	• Can't train stem cells to become every type • ethics • Potential for uncontrolled	• No indefinite growth • limit on cell types • difficult to obtain • Potential for uncontrolled growth	• time + tech required • maybe limited differentiation • Potential for uncontrolled growth • Objections to genetic reprogramming of human cells

Date: _____

Activity #7: Stem cell consolidation

1. Draw a flowchart that demonstrates the potency of stem cells, use examples.



2. What is the name given to embryonic cells that self-renew and remain undifferentiated when removed from the embryo?

Embryonic stem cells

3. Name the three germ layers, from outermost to innermost.

ecto, meso, endo

4. a. What are adult stem cells?

Cells that give rise limited No. of cells for repair + regeneration

b. What is their role?

repair + regen of aged tissues skin/liver

c. How do they differ from embryonic stem cells?

They cannot replicate

5. State the four types of stem cells. How do the different types of stem cells differ?

Bone marrow - create RBCs

Intestinal - creates new layer in digestive tract

Epidermal - creates new skin cells

Embryonic - Pluripotent

6. Skin stem cells replicate rapidly, so how could they be useful in stem cell therapies?

Can grow epidermis in labs skin can be grafted

Date: _____

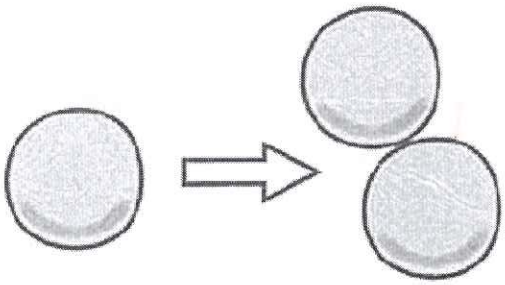
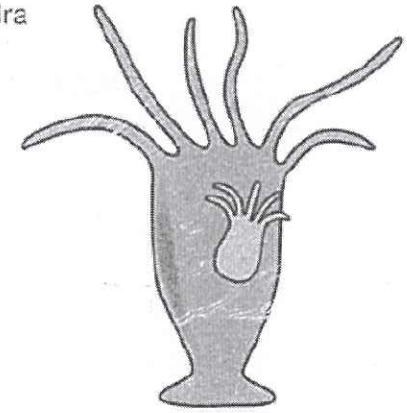
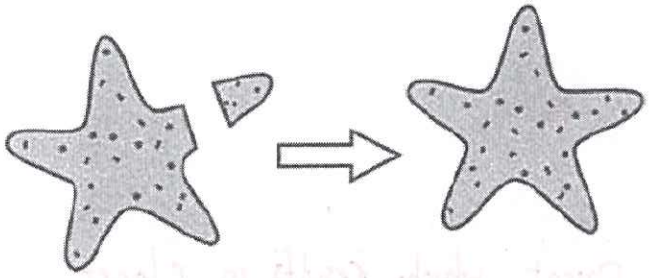
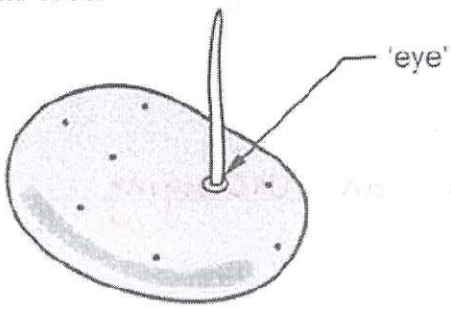
7. Outline the ethical and biological advantages and disadvantages concerning stem cells research.

In table on p 14

Date: _____

Activity #8: Asexual reproduction

1. Identify and describe the method of asexual reproduction involved in each case.

Bacteria 	Process: Fission Description: Single parent splits into 2 equal parts.
Hydra 	Process: Budding Description: New individual arises of outgrowth + grows
Sea star 	Process: Fragmentation Description: Body breaks and regenerates into new complete individual
Potato tuber 	Process: Vegetative reproduction Description: Growth From specialised Plant tissue Rhizomes- underground stems Stolons- above ground stems Tubers- large buds underground bulbs- lateral buds

Date: _____

2. Match each type of asexual reproduction to its correct description.

budding 1	Separation of structures from a parent plant to form a new, independent plant, without the formation of seeds or spores. 4
fission 2	Form of asexual reproduction in which the new organism arises as an outgrowth or bud from the parent. 1
fragmentation 3	Development of an egg in the absence of fertilisation by sperm; a normal part of the life cycle of some insects and crustaceans. 5
spore formation 4 6	Form of asexual reproduction of unicellular organisms where the parent cell divides into two approximately equal parts. 2
parthenogenesis 5	Formation of structures that are resistant to adverse environmental conditions and can give rise to complete organisms when conditions become favourable. 5
vegetative reproduction 5	Form of asexual reproduction of multicellular organisms in which an organism breaks into two or more parts, each of which regenerates the missing pieces to form a complete new organism. 3

3. Define 'asexual reproduction'. What is the relationship between mitosis and asexual reproduction?

Production of offspring from one parent which results in clones. Mitosis is similar to a type of Asexual repro as all chromosomes are passed from Mother to daughter. They are genetically identical

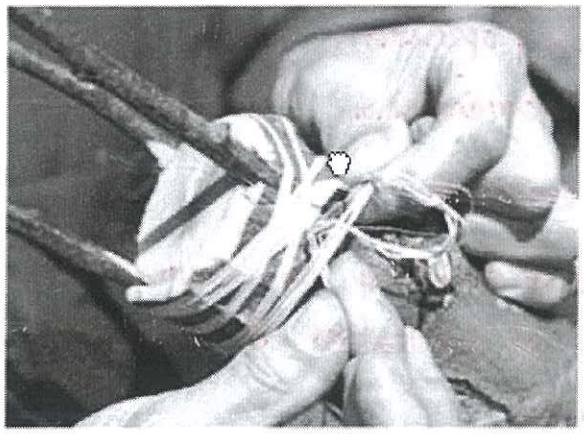
4. What are the ideal environmental conditions for asexual reproduction?

When there is plenty of resources and an unchanging environment

Date: _____

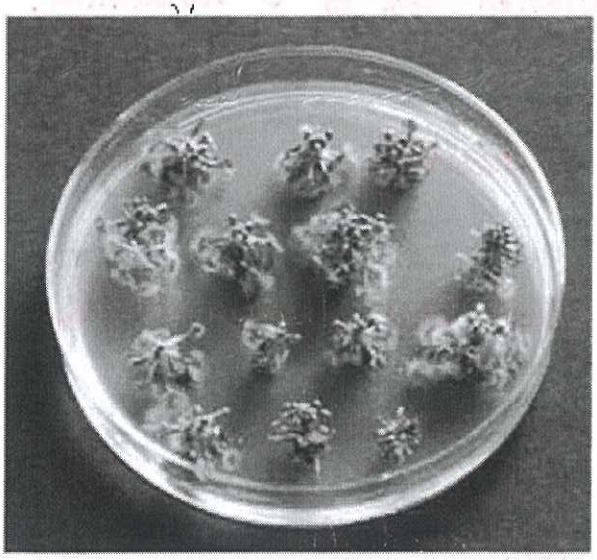
5. What must connect for a grafting on a plant to be successful?

Well connected roots



6. What is tissue culture used for, and what are two advantages of using this technique?

Large number of plants rapidly. New genes can be introduced on a large scale, Can control growth conditions and obtain plants with preferred characteristics



7. Define 'embryo splitting' and explain why it is not possible to do this after 32-cell stage of embryonic development.

Can create multiple genetically identical embryos which are then implanted At 32-cell-stage cells specialise and therefore are no longer able to be implanted

Date: _____

Activity #9: Asexual application

1. Complete the table below contrasting the advantages and disadvantages of asexual reproduction.

Advantages	Disadvantages
• Efficient form of reproduction • The amount of time + energy needed is minimal • Population sizes can increase rapidly • Offspring are genetically identical + are therefore well suited to the Environment	• Rapid population growth can lead to overcrowding. • No variation • Lack of diversity can cause death of population if conditions change.

2. Discuss some of the emerging issues with cloning.

Susceptibility to disease - change in environmental conditions or disease can wipe out population due to ↓ variability.

High failure rate - only a 0.1-3% success rate.

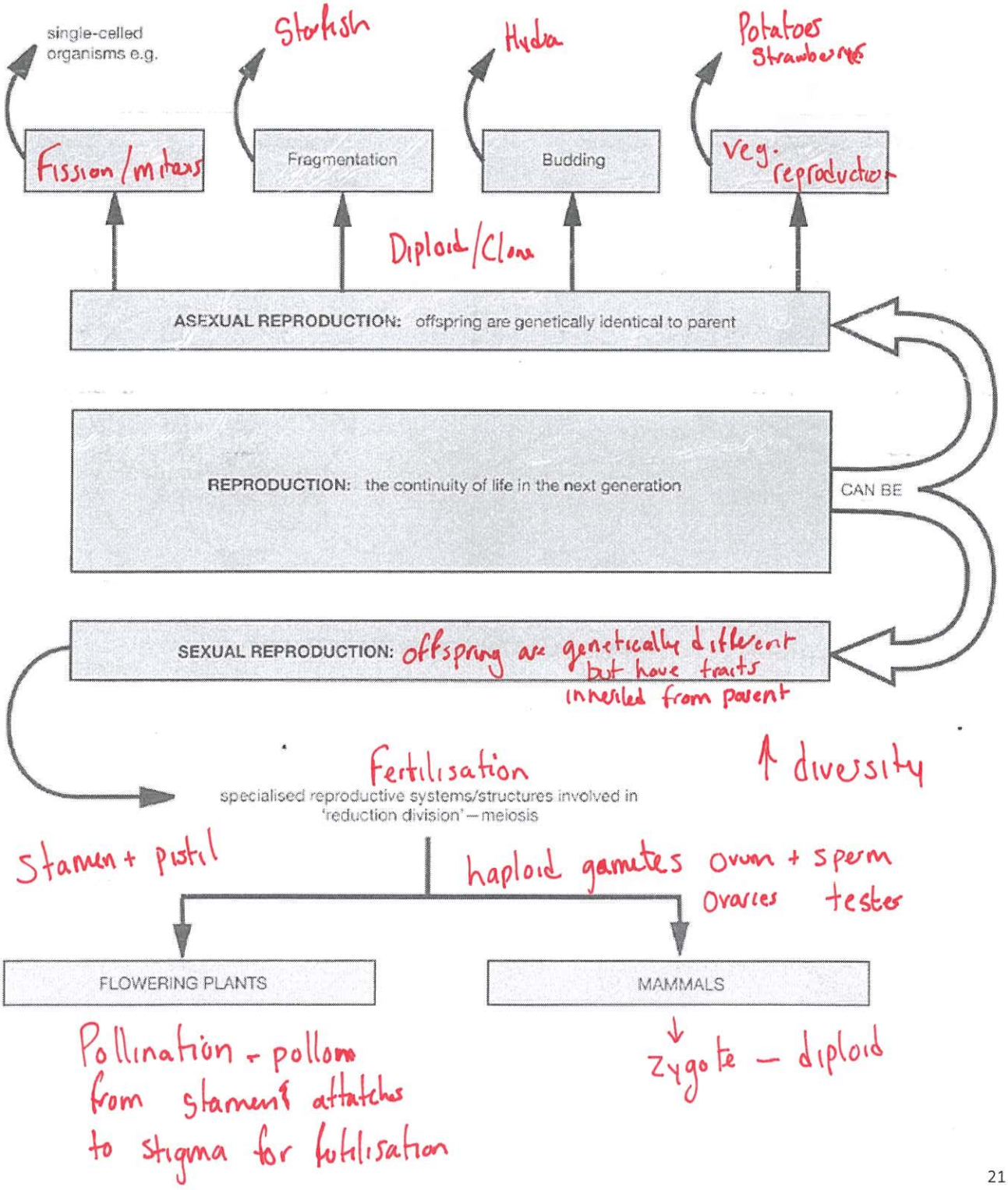
Premature ageing - Clones have adult DNA therefore already 'old' at birth

Consumer concern about cloned food products

Date: _____

3. Use the key words listed to complete the concept map summarising the key ideas about sexual and asexual reproduction. Write along the link lines between words and phrases to show the relationships between ideas in your concept map.

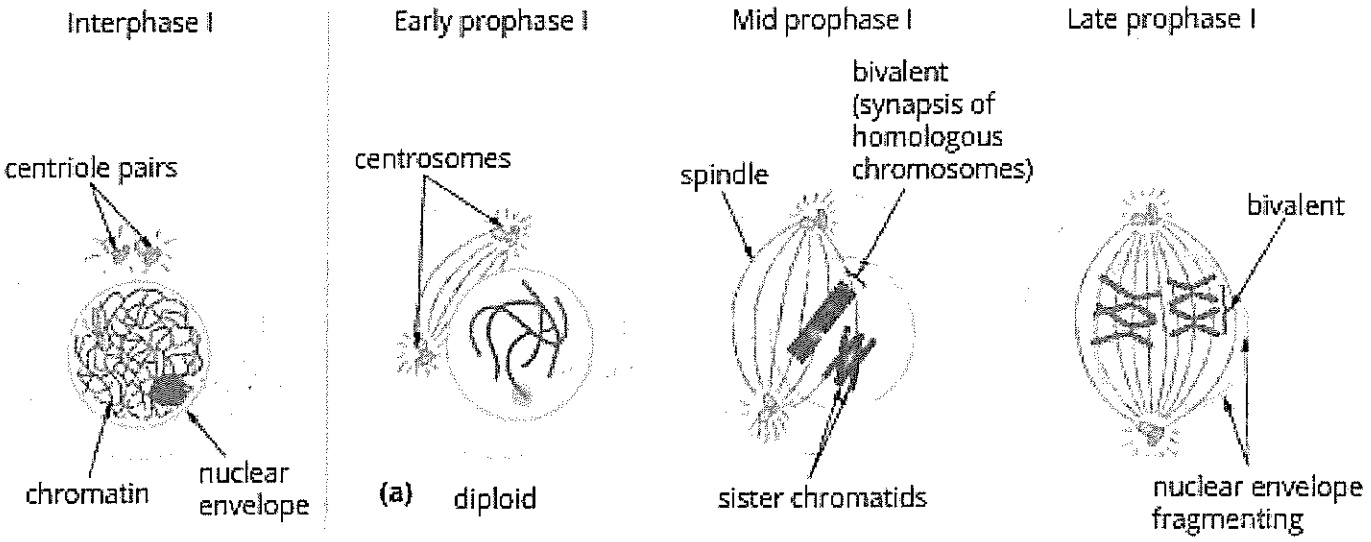
Flower	budding	haploid	stigma	fertilisation	pistil
Diversity	mitosis	stamen	gametes	zygote	uterus
Pollination	testes	implantation	pollen	ovaries	fission
Clone	diploid	vegetative reproduction			



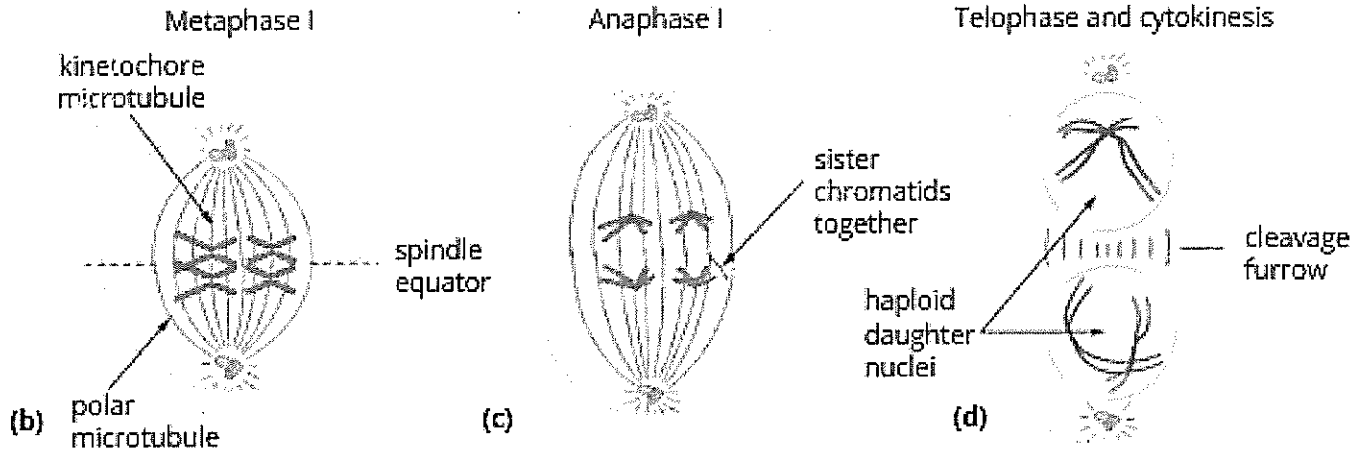
Date: _____

Activity #10: Stages of meiosis

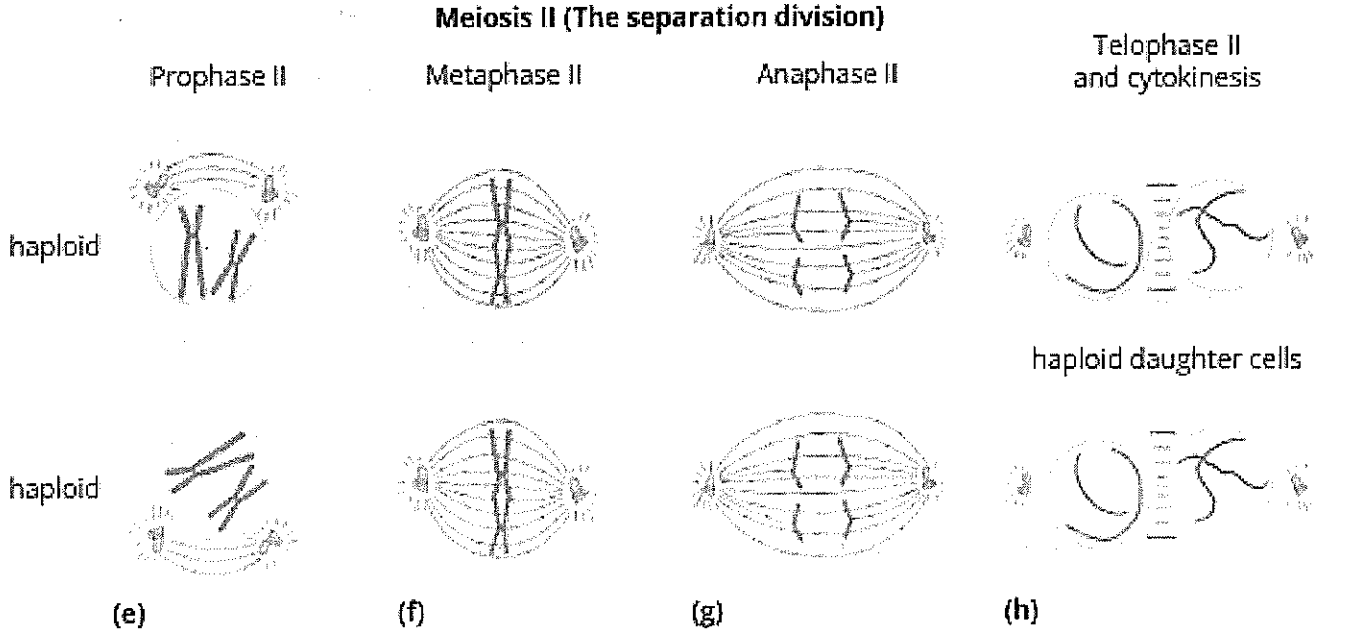
Meiosis I (The reduction division)



Meiosis I continued

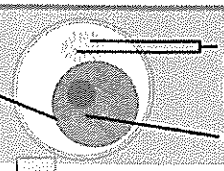
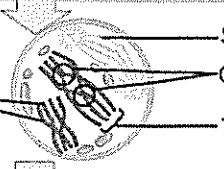
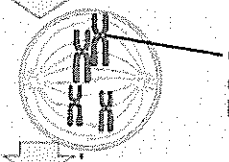
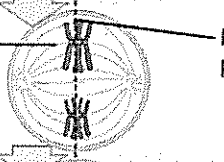
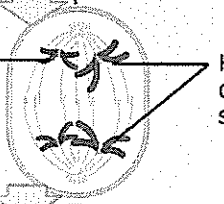
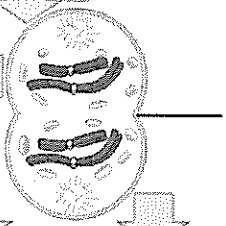
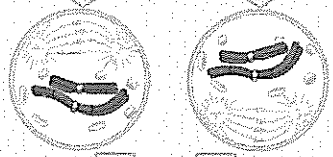
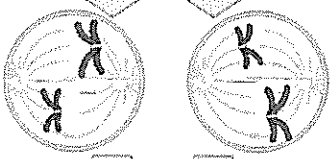
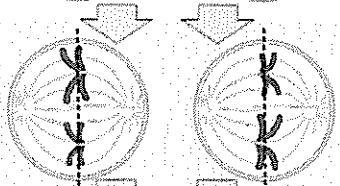
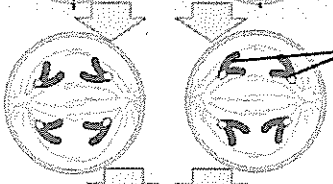
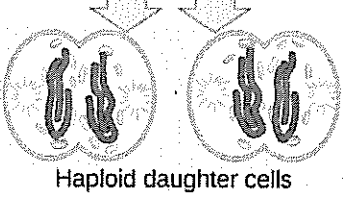


Meiosis II (The separation division)



Date: _____

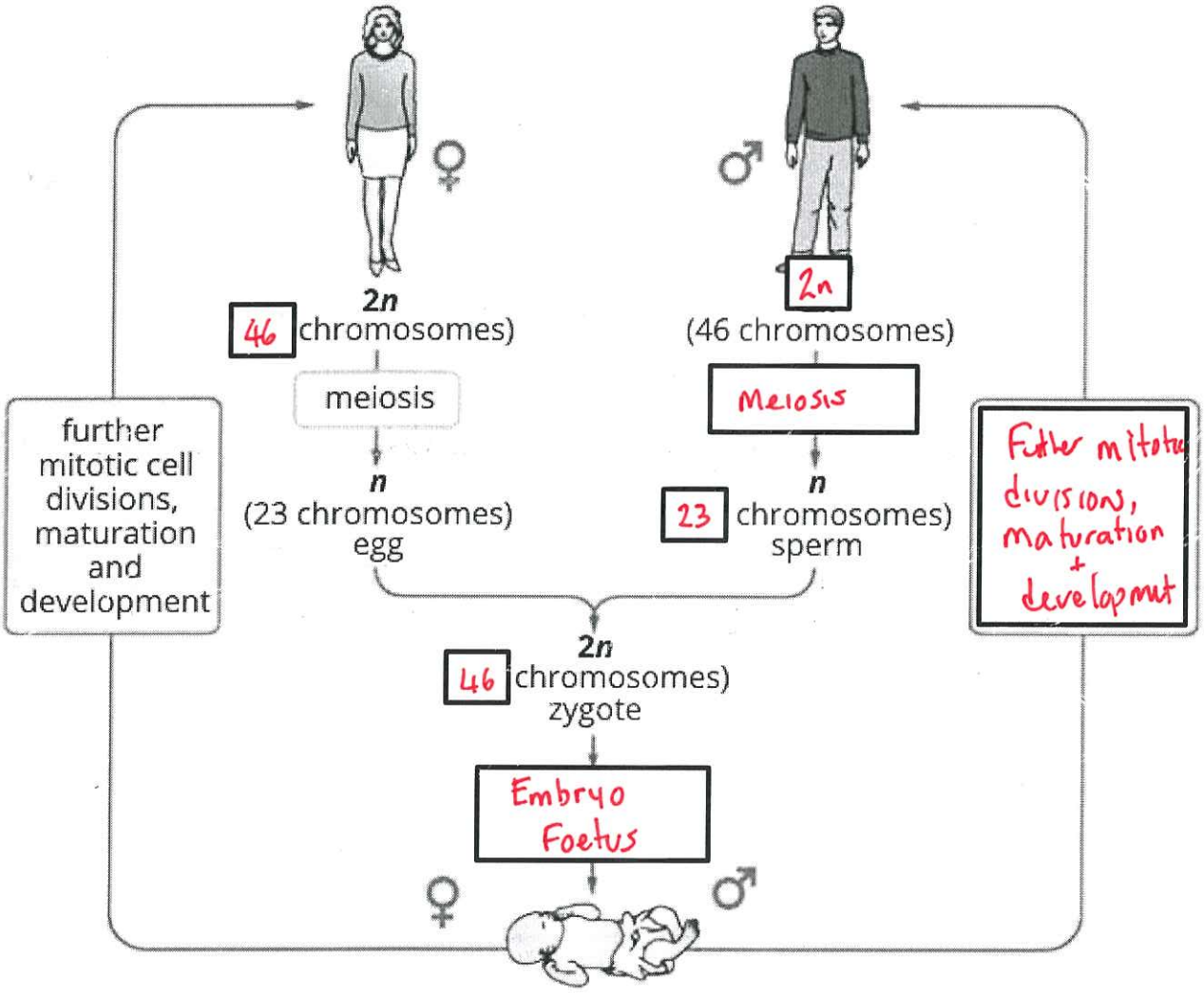
1. Summarise the steps of meiosis cell division below.

	Stage	Event	Outcome
INTERPHASE	S phase		Chromosomes are duplicated during interphase. The resulting sister chromatids are held together at the centromere. The centrosomes are also duplicated.
MEIOSIS I	Prophase I		Chromosomes condense, and the nuclear envelope fragments. Homologous chromosomes bind firmly together along their length, forming a tetrad. Chiasmata form between non-sister chromatids. Crossing over occurs at the chiasmata. Spindle fibers emerge from the centrosomes.
	Prometaphase I		Homologous chromosomes are attached to spindle microtubules at the fused kinetochore shared by the sister chromatids. Chromosomes continue to condense, and the nuclear envelope completely disappears.
	Metaphase I		Homologous chromosomes randomly assemble at the metaphase plate, where they have been maneuvered into place by the microtubules.
	Anaphase I		Spindle microtubules pull the homologous chromosomes apart. The sister chromatids are still attached at the centromere.
	Telophase I and Cytokinesis		Sister chromatids arrive at the poles of the cell and begin to decondense. A nuclear envelope forms around each nucleus and the cytoplasm is divided by a cleavage furrow. The result is two haploid cells. Each cell contains one duplicated copy of each homologous chromosome pair.
MEIOSIS II	Prophase II		Sister chromatids condense. A new spindle begins to form. The nuclear envelope starts to fragment.
	Prometaphase II		The nuclear envelope disappears, and the spindle fibers engage the individual kinetochores on the sister chromatids.
	Metaphase II		Sister chromatids line up at the metaphase plate.
	Anaphase II		Sister chromatids are pulled apart by the shortening of the kinetochore microtubules. Non-kinetochore microtubules lengthen the cell.
	Telophase II and Cytokinesis		Chromosomes arrive at the poles of the cell and decondense. Nuclear envelopes surround the four nuclei. Cleavage furrows divide the two cells into four haploid cells.

Date: _____

Activity #11: Introducing variation

1. Meiotic cell divisions in females and males give rise to haploid (n) ova and sperm. When fertilisation occurs, an ova and sperm fuse to form diploid (2n) zygotes. The zygote develops in a new organism after many mitotic divisions and cellular differentiation. Fill in the blanks below.



2. Define the following:

- Gamete

A mature haploid male or female germ cell which can unite with the opposite sex cell and produce a zygote which is diploid

- Haploid

Half the number of chromosomes for that organism eg human 23

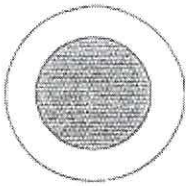
- Diploid

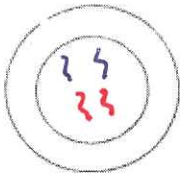
The full amount of chromosomes for that organism eg human 46

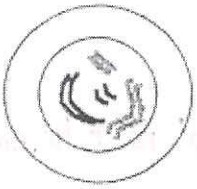
Date: _____

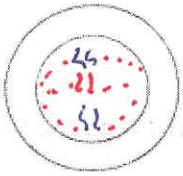
Activity #12: Meiosis

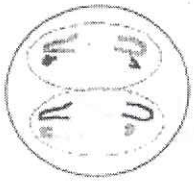
1. Below is a series of diagrams that depict a single meiotic division. Your task is to fill in the blank diagrams as well as indicate which box applies to which diagram.

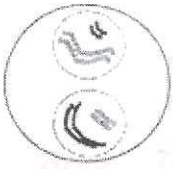


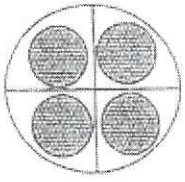












The two pairs chromosomes thicken so that they become visible

Each chromosome duplicates to form two chromatids.

A normal cell prior to Meiosis.

The chromatids move away from each other

Two nuclei form each with one of each type of chromosome.

Four new nuclei, each genetically differeot to the original nucleus have been formed.

The two pairs of chromosomes move to the centre of the nucleus

The similar chromosomes of each pair move to opposite sides of the cell.

New cell membranes form. Each cell has now 1/2 the number of chromosomes.

2. What is the difference between a somatic cell and a gamete? Give an example of each.

Somatic (body) cell are diploid + divide by Mitosis - Skin, liver all

Gamete (sex) cell are haploid + divide by Meiosis

Date: _____

3. Explain how an error in meiosis can lead to Down syndrome.

C'some 21 undergoes non-disjunction. This is when the C'somes do not split in meiosis resulting in one gamete with 2 of the same C'some. Also called aneuploidy.

4. Outline how:

a. Prophase I differs from prophase II

Prophase I C'somes cross over

b. Metaphase I differs from metaphase II

Metaphase I Homologous C'somes line up next to each other

c. Anaphase I differs from anaphase II

Anaphase I pulls double stranded homologous c'somes to either side where A2 is single

d. Telophase i differs from telophase II

T1 both cells are diploid T2 4 cells are haploid.

5. a. When a cell with chromosome number n=24 undergoes mitosis, how many daughter cells are produced, and what is their chromosome number?

2 daughter cells with 48 c'somes (2n)

b. When a cell with chromosome number n=24 undergoes meiosis, how many daughter cells are produced, and what is their chromosome number?

4 daughter cells with 24 c'somes (n)

6. List the advantages and disadvantages of sexual reproduction.

Advantages	Disadvantages
Long term evolutionary potential Unfavourable traits 'bred out' Generates genetic variation with 'select for' variation efficiently Populations are better adapted to survive	Slower reproductive rate Recombination can introduce deleterious variation to population Spread of STDs Energetically costly and ongoing as a parent

Date: _____

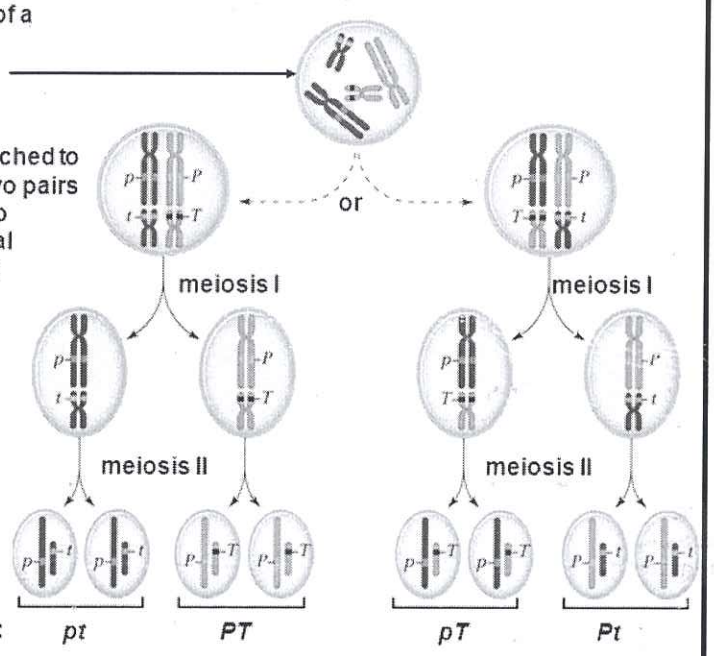
Activity #13: Independent assortment

A This example shows just two pairs of homologous chromosomes in the nucleus of a diploid ($2n$) reproductive cell. Maternal and paternal chromosomes, shown in *pink* and *blue*, have already been duplicated.

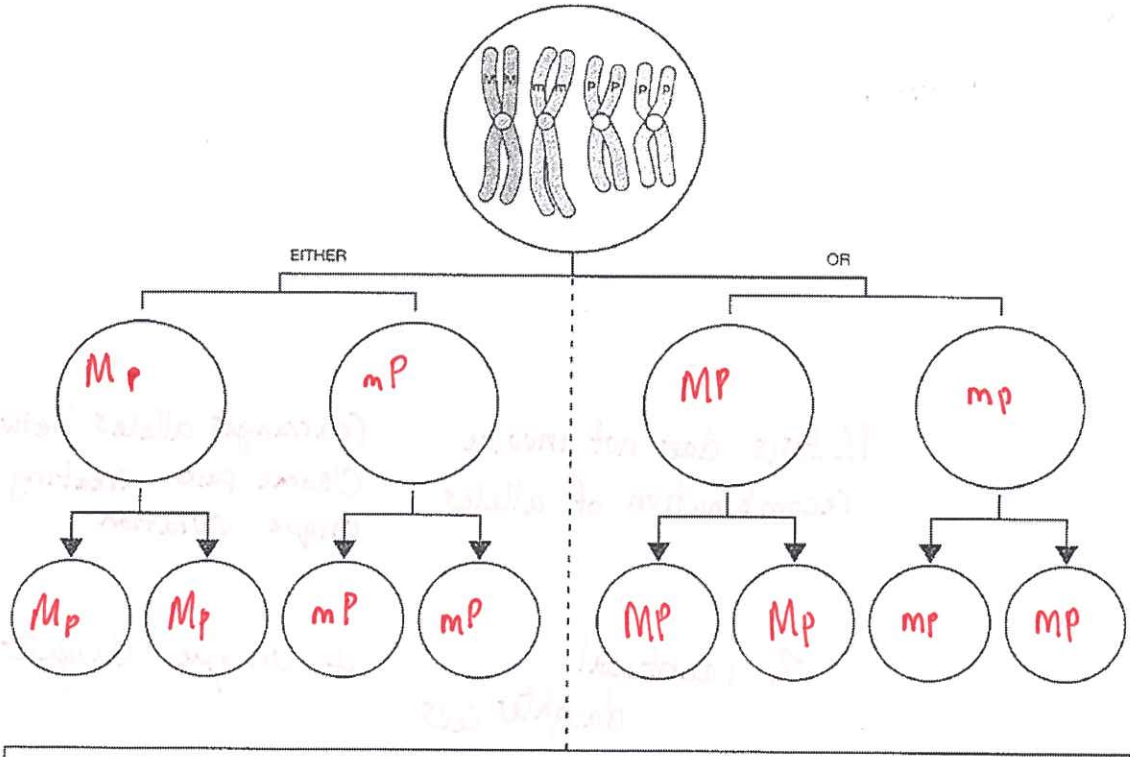
B Either chromosome of a pair may get attached to either spindle pole during meiosis I. With two pairs of homologous chromosomes, there are two different ways that the maternal and paternal chromosomes can get attached to opposite spindle poles.

C Two nuclei form with each scenario, so there are a total of four possible combinations of parental chromosomes in the nuclei that form after meiosis I.

D Thus, when sister chromatids separate during meiosis II, the gametes that result have one of four possible combinations of maternal and paternal chromosomes.



1. Carry through the notation used to complete the steps illustrating independent assortment of these alleles. Use the boxed space to explain what is meant by the term 'Principle of Independent Assortment'.

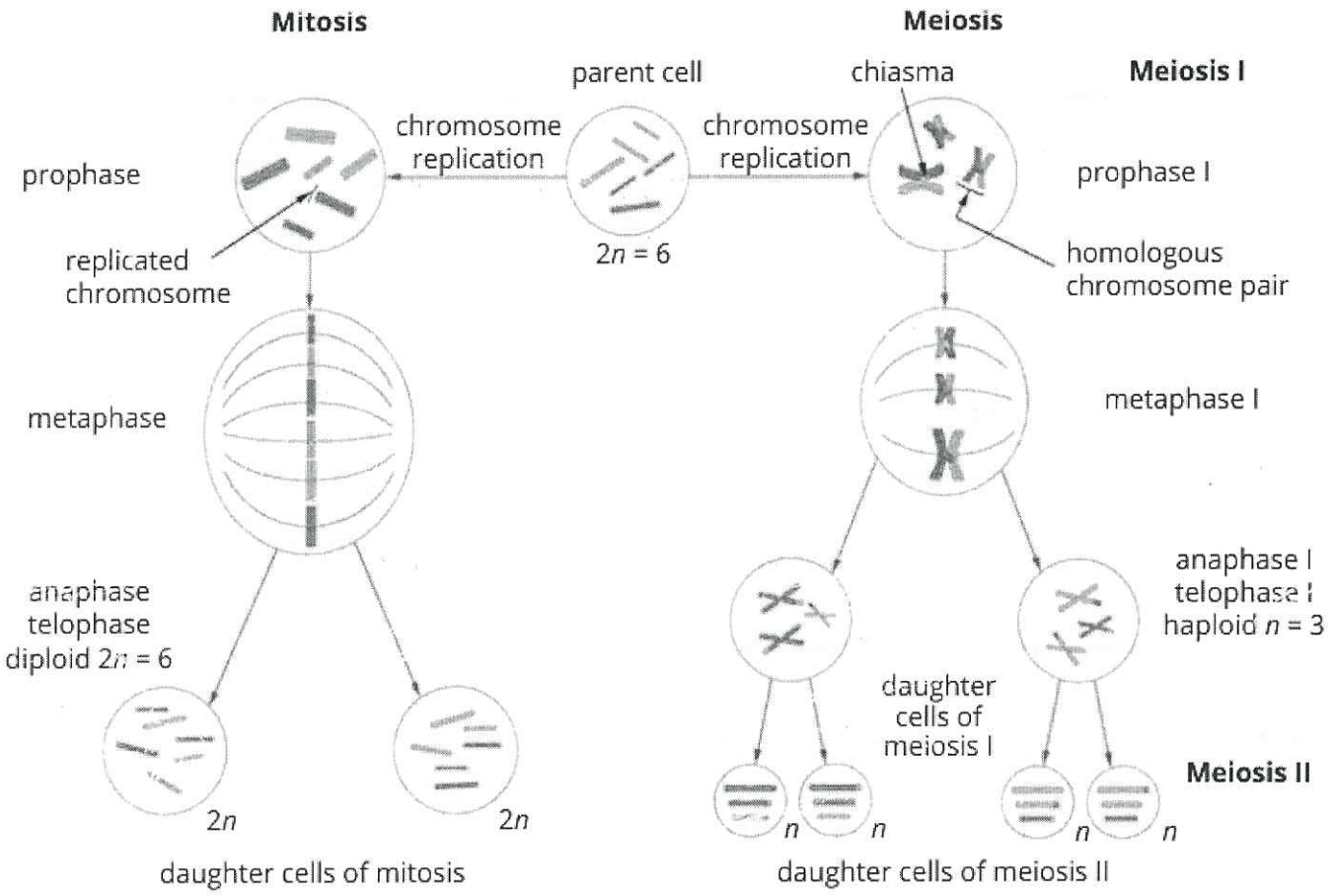


Depending on the orientation of the chromosomes will result in the specific alleles in the gametes

Date: _____

Activity #14: Meiosis vs Mitosis

1. Mitosis and meiosis are both processes of cell division, but they are different in a number of important ways. Us the diagram to help you complete the table below.



	Mitosis	Meiosis
Genetic recombination	Mitosis does not involve recombination of alleles	rearranges alleles between C'some pairs creating unique variation
Number of cells	2 identical daughter cells	4 unique daughter cells
Number of chromosomes	Diploid (46)	Haploid (23)

Date: _____

Activity #15: Fill in the blanks

MITOSIS

1. The human body is made out of cells. All of our bodies began as a single cell, produced by the fusion of an Sperm and a Egg/Ovum. The process by which cells grow and divide is known as Mitosis. As they grow the cell contents replicate so that when division occurs, the two new cells contain an equal amount of genetic material. Chromosomes usually occur in pairs. Humans have 23 pairs of chromosomes. Normal body cells contain 46 chromosomes and are described as being Diploid. Sex cells have 23 unpaired chromosomes and are called Haploid. Mitosis begins when the DNA replicates. The Chromosomes become visible and line up on the equator. The chromosomes then separate and move towards the poles. The cell then splits and forms 2 cells. The new cells contain 23 pairs of chromosomes and these new cells are identical to the parent cell that they came from.

Diploid	Chromosomes	23	2	Mitosis	Egg cell
Equator	Haploid	Equal	Sperm	23	Poles

MEIOSIS

2. Both the egg cell and the sperm are haploid that is they have 23 single chromosomes. During fertilisation two sex cells join together and results in a child that has 23 pairs of chromosomes, i.e. has a diploid number. Meiosis is the process that produces sex cells. This division is similar to Mitosis except that there are 4 divisions and results in 4 haploid cells produced. During the first stage of Meiosis pairs of double stranded homologous chromosomes line up on the equator. Double stranded chromosome of each pair moves to the poles. The two cells then divide. In the second stage double-stranded chromosomes line up on the equator. The Chromatids then separate and move to the poles of the cell. The cell divides and results in 4 cells with a haploid number of 23. Each of the cells are genetically different.

4	chromatids	23	Double-stranded
Equator	chromosomes	23	Haploid
4	Meiosis	2	Homologous

Date: _____

Activity #16: Sexual reproduction

1. Why is asexual reproduction more likely to be successful in the short term rather than the long term?

In short term environment generally stay the same where fast reproduction leading to large populations. In long term environment may change, ↓ variation could lead to extinction of popul^{n}. Also ↑ popul^{n} require lots of resources - All wed up in long term.

2. Which type of reproduction is common in many invasive species? Discuss why this strategy makes organisms successful invaders of new habitat and what impact it has on the native species in that environment.

Rapid sexual reproduction or both asexual + sexual

3. What type of reproduction and reproductive structures are responsible for the mouldy bread in your pantry?

Rhizopus (black breadmould) reproduces asexually by making spores in a sporangium

4. Arrange the following stages of meiosis in the correct order from first to last.

- Metaphase II
- Telophase II
- Prophase I
- Anaphase I
- Metaphase I
- Anaphase II

· PI
· MI
· MI
· TI
· MII
· AII
· TII

5. What is the significance of crossing over in meiosis?

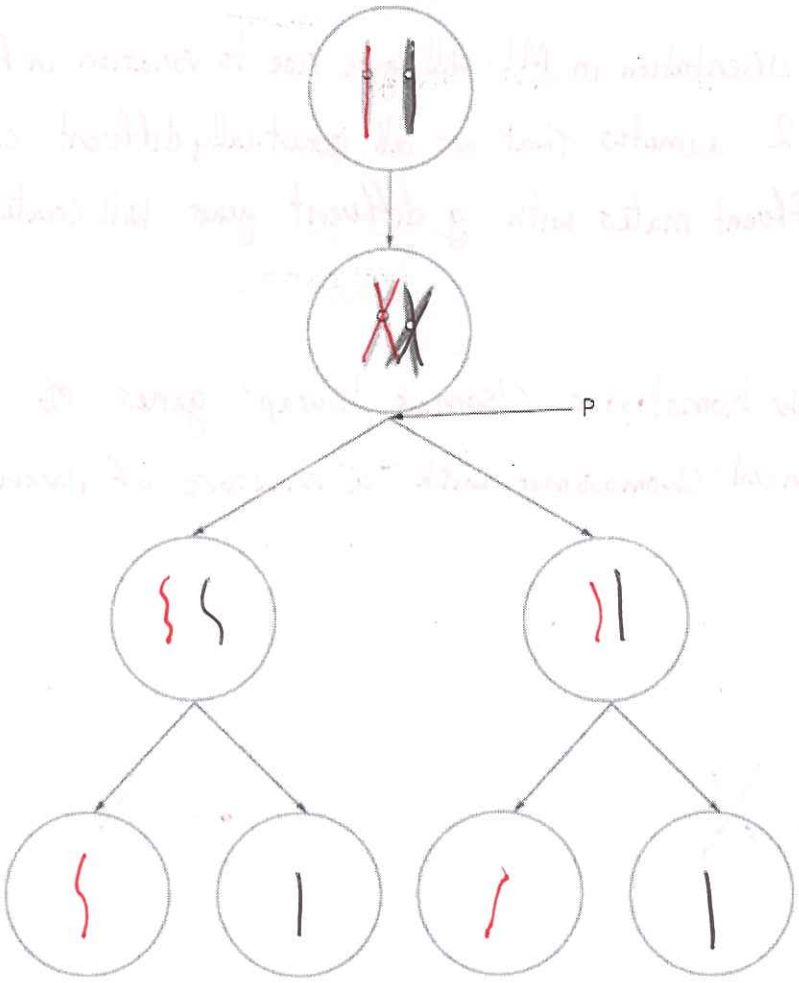
Creates genetically diverse offspring mixing parental genes on the two homologous chromosomes

Date: _____

6. How are monozygotic twins produced, and are they truly identical? Explain your answer.

When a fertilised zygote splits into 2 and starts developing into 2 separate zygotes. Their DNA is identical but over time environmental factors will shape twins differently.

7. The following diagram shows a stage during meiosis. The circles represent the cell and the structures within represent a homologous pair of chromosomes.



a. Complete the diagram by drawing the chromosomes in the cells.

b. Explain what is happening at P.

Cytokinesis

c. Explain how meiosis promotes variation in a species.

Meiosis has 2 stages Crossing over where genes are mixed up on homologous chromosomes and Independent assortment where the direction of chromosomes lead to random combinations of chromosomes

Date: _____

8. Describe the behaviour of chromosomes in the different phases of meiosis.

P1 - find homologous M1 - line up in middle next to homologous A1 - homologous c'somes seperated. T1 - Split into 2. MII - c'somes line up AII - chromatids separated TII separate into 4.

9. Analyse the roles of random segregation into gametes, fertilisation of gametes and sexual reproduction in variability of offspring.

R.S - the orientation in M1 will give rise to variation in AII

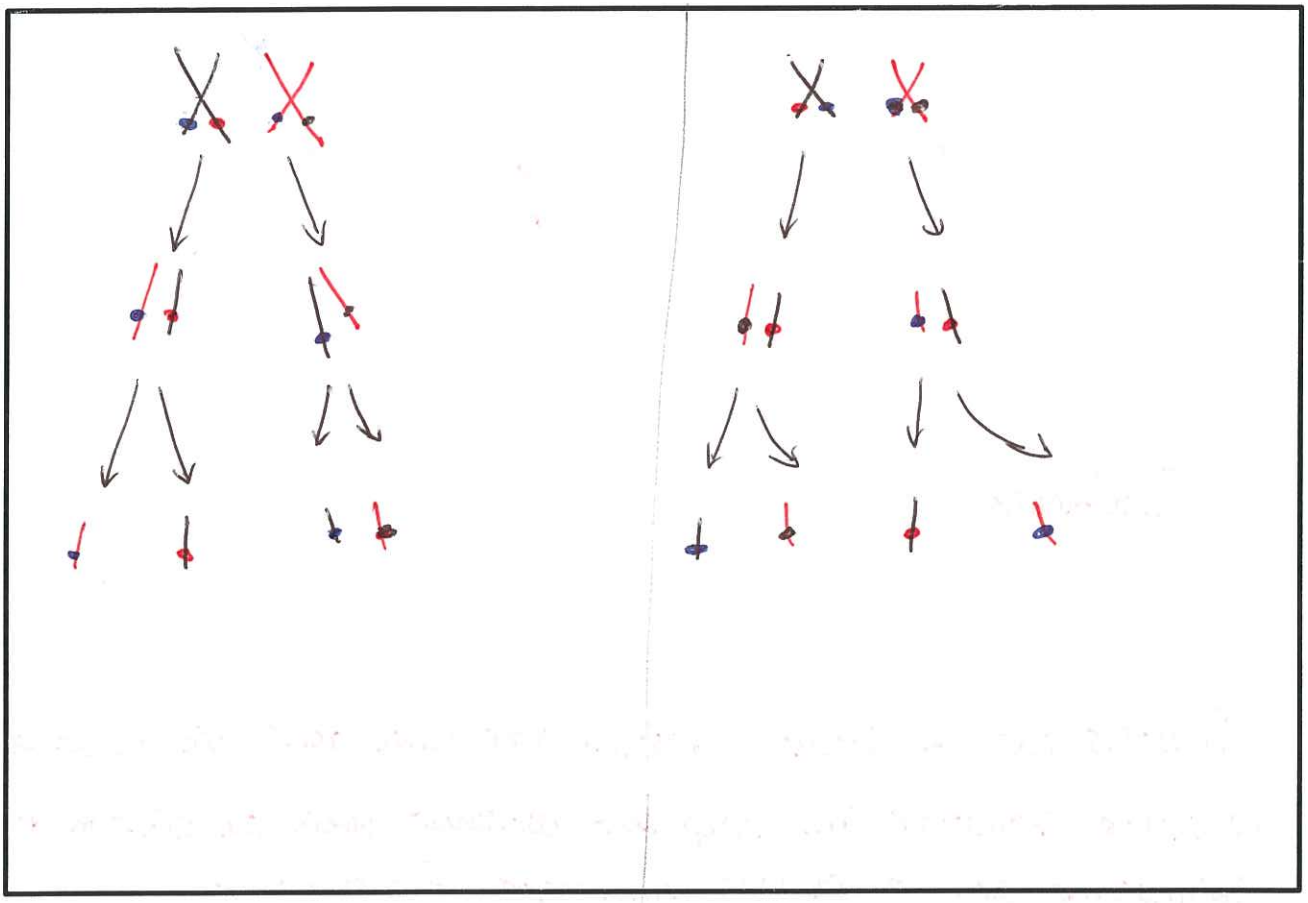
F - Any 2 gametes that are all genetically different can fuse

S.R - 2 different mates with g different genes will create a genetically unique individual

10. Outline the process of crossing over during meiosis.

In P1 the homologous C'somes 'swap' genes & creating unique single stranded chromosomes with a mixture of parental DNA/Genes

11. Draw diagrams to show two possible outcomes for two genes next to each other on the same chromosome during crossing over in meiosis.



Date: _____

Activity #17: AOS 1 Multi choice

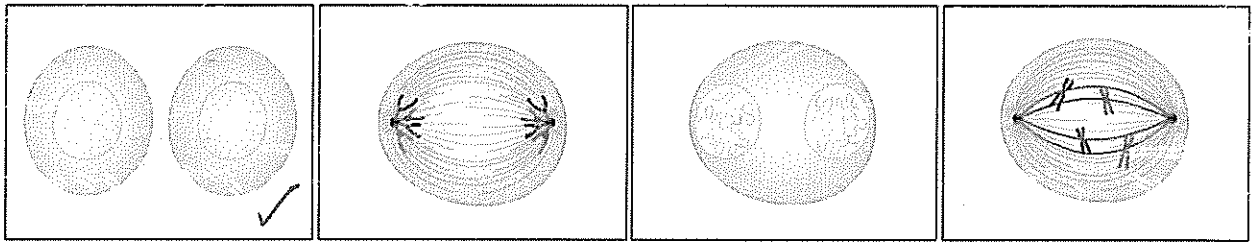
1. During which stage of mitosis is the nuclear membrane broken into fragments?

● Early Prophase
O Metaphase
O Anaphase
O Late Prophase

2. Equatorial plate of the mitotic spindle is formed during the _____.

● metaphase
O anaphase
O late prophase
O early prophase

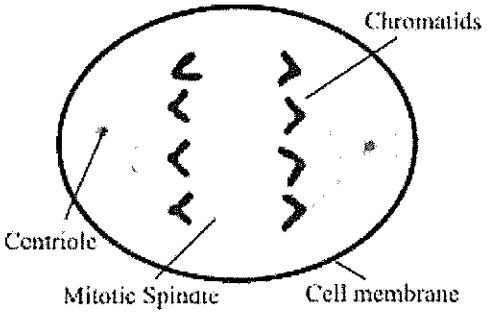
3. Which one of the diagrams shows the end of mitosis?



4. Mitotic cell division is initiated in the _____.

O centriole
O centromere
● nucleus
O mitotic spindle

5. Which stage of mitosis is depicted in the diagram below?



● Anaphase
O Metaphase
O Telophase
O Prophase

Date: _____

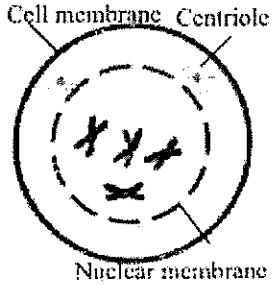
6. During which stage of mitosis do nucleoli reappear?

● Telophase
O Anaphase
O Early Prophase
O Late Prophase

7. The number of chromosomes in a human cell is _____.

O 2
O 4
O 23
● 46

8. Which stage of mitosis is depicted in the diagram below?



● Prophase
O Anaphase
O Metaphase
O Telophase

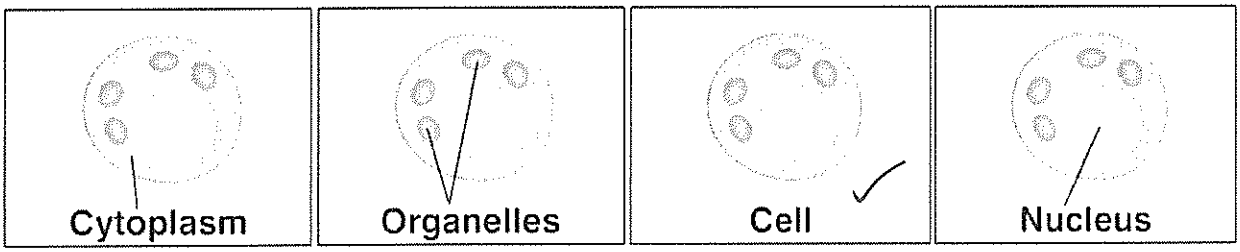
9. The resting stage of the cell is known as the _____.

● interphase
O telophase
O anaphase
O prophase

10. During which stage of mitosis do chromatids separate to form two sets of daughter chromosomes?

● Anaphase
O Telophase
O Prophase
O Interphase

11. Which one of the following structures divides during the process of mitosis?

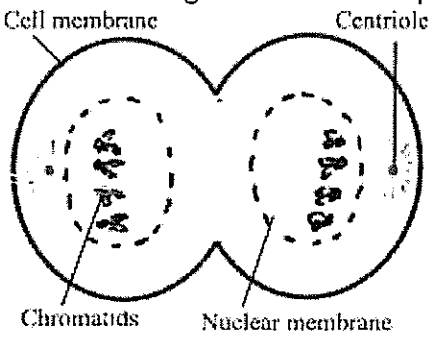


Date: _____

12. Genetic information is transferred from parent to daughter cells through the _____.

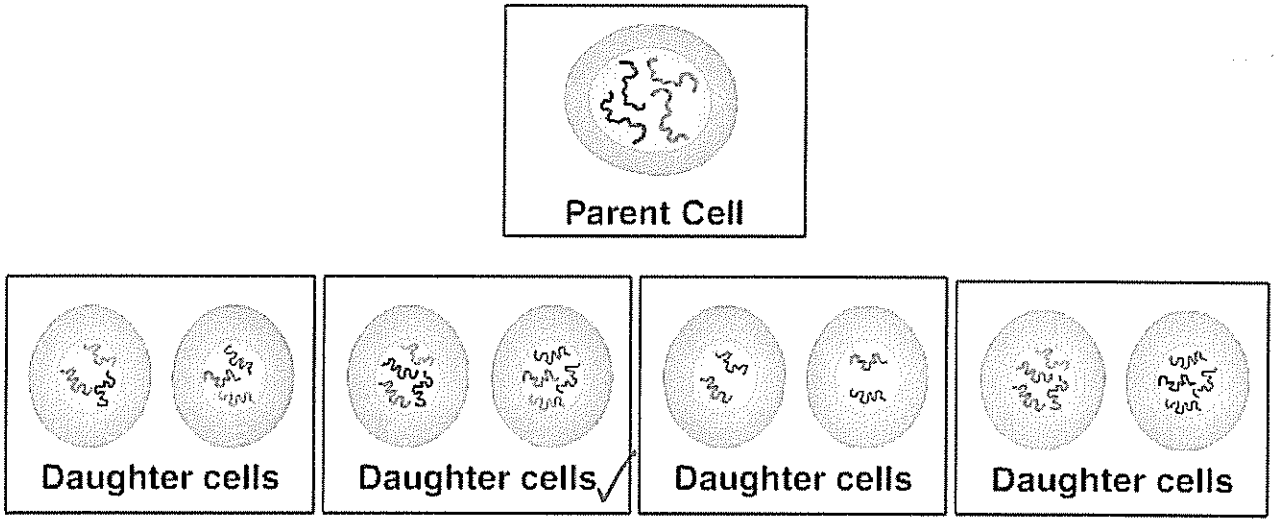
● nucleus
O mitochondria
O endoplasmic reticulum
O centrioles

13. Which stage of mitosis is depicted in the diagram below?



● Telophase
O Metaphase
O Anaphase
O Prophase

14. In the case of the parent cell shown below, which pair of cells represents the daughter cells created by mitosis and cytoplasmic division?



15. During which stage of mitosis does longitudinal splitting of the chromosomes occur?

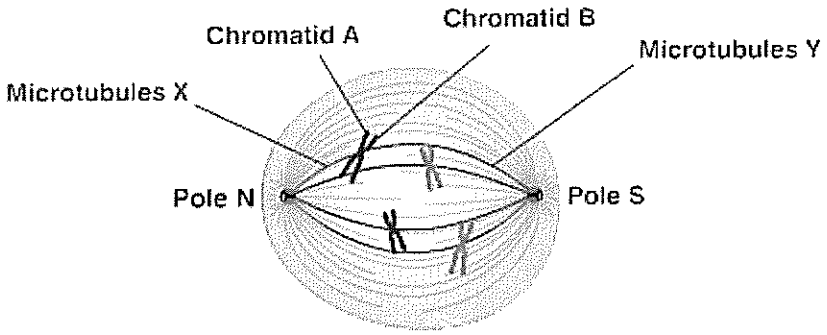
● Anaphase
O Prophase
O Telophase
O Metaphase

16. The interphase and mitosis together constitute the cell cycle.

● True
O False

Date: _____

17. Which statement about this diagram is not true?

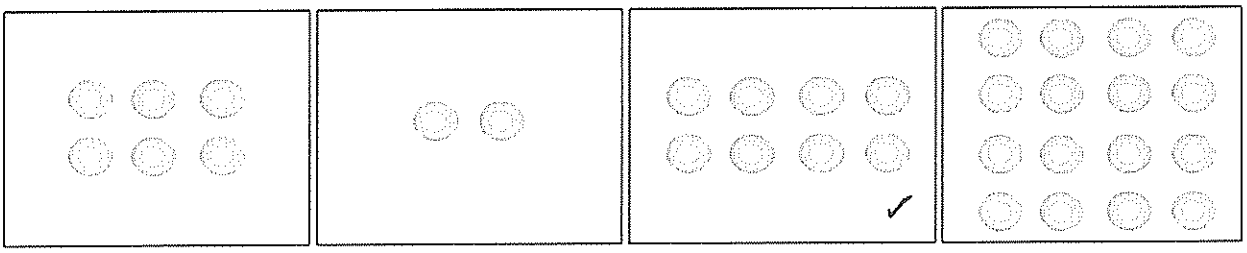


● Microtubules X are attached to pole S
O Microtubules X are attached to chromatid A
O Microtubules Y are attached to chromatid B
O Microtubules Y are attached to pole S

18. The nuclear membrane is formed around the newly-formed sets of daughter chromosomes during the telophase.
● True
O False

19. During mitosis, loosely arranged strands of chromosomes become coiled, shortened and distinct during the metaphase.
O True
● False

20. How many cells are produced from one cell following three transitions through the cell cycle?

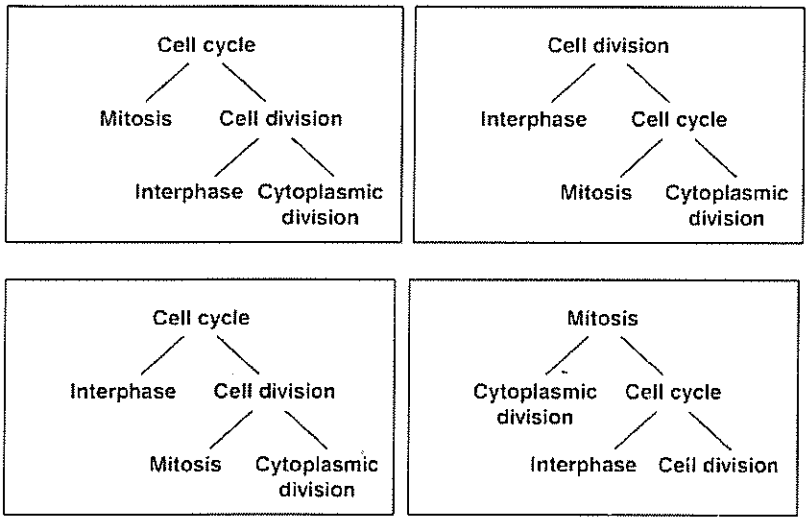


21. Which of the following events takes place during interphase?
O Mitosis
● DNA replication
O Nuclear division
O Cell division

22. What happens to chromosomes in mitosis which enable them to move about without becoming entangled with each other?
O They become more tightly coiled and thinner
O They become less tightly coiled and shorter
O They become less tightly coiled and thinner
● They become more tightly coiled and shorter

Date: _____

23. Certain cellular processes can be subdivided into other processes. Which diagram correctly shows the relationship between these processes?



24. Which of the following is the longest stage of mitosis?

● Prophase
O Telophase
O Metaphase
O Anaphase

25. Which of the following is not a purpose of cell replication by mitosis in multicellular organisms?

O growth
O repair
● reproduction
O restoring the nucleus-to-cytoplasm ratio

26. Which of the following statements is true?

O Cytokinesis is also called binary fission
O Cytokinesis involves the division of the nucleus
O Cytokinesis occurs during meiosis
● Cytokinesis occurs after mitosis

27. Which organelle divides into two during mitosis?

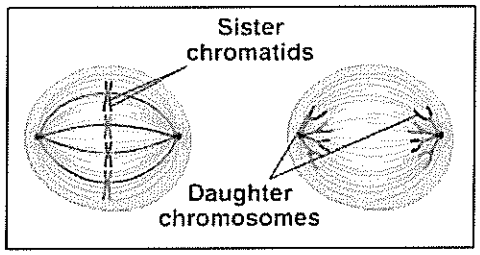
O Nucleus
O Vacuole
O Mitochondrion
O Chloroplast

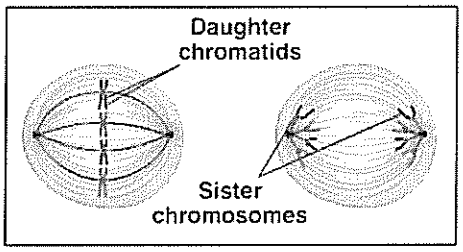
28. Which of the following is not correct?

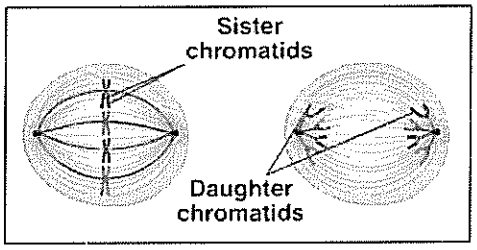
O Although it is divided into stages, mitosis is a continuous process
O Cytokinesis marks the beginning of two new cells
O DNA is replicated during interphase
● Mitosis is the longest phase of the cell cycle

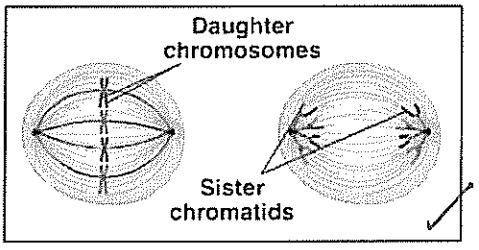
Date: _____

27. Which pair of diagrams is correctly labelled?









28. Which of the following is not checked during the G1 checkpoint of the cell cycle? Select the correct answer.

O DNA

● the attachment of spindle fibres to the centromeres

O The amount of resources in the cell

O The size of the cell

29. Which one of the following conditions is necessary for successful stem cell therapy?

O The stem cells must be embryonic

● The stem cells must be able to replicate themselves within a laboratory

O The stem cells must be able to produce embryos

O The stem cells must be able to be able to repair themselves

30. Which process is not associated with cell division?

● Cytokinesis

O DNA replication

O Pairing of homologous chromosomes

O Formation of two diploid daughter cells

31. Which of the following statements shows a correct sequence of events for mitosis?

O Chromatids separate, chromosomes duplicate, cytokinesis occurs

O Cytokinesis occurs, chromosomes duplicate, chromosomes line up at the equator

● chromosomes line up at the equator, Chromatids separate, cytokinesis occurs

O chromosomes duplicate, cytokinesis occurs, Chromatids separate

32. In which phase of meiosis does crossing over occur?

● Prophase I

O Anaphase I

O Metaphase II

O Anaphase II

Date: _____

33. Which one of the following processes does not occur in meiosis?

O Cytokinesis

O DNA replication

O Pairing of homologous chromosomes

● Formation of two diploid daughter cells

34. Which of the following statements about chromosomes in mammalian gametes is correct?

O They are all identical to those in the parent cell

O They are different to those in the parent cell but only because of mutation

O They are all identical to those in the parent cell because crossing-over and recombination between homologues does not create new combinations of alleles

● They are different to those in the parent cell partly because of the effects of independent assortment

35. Why is meiosis a necessary process in living organisms?

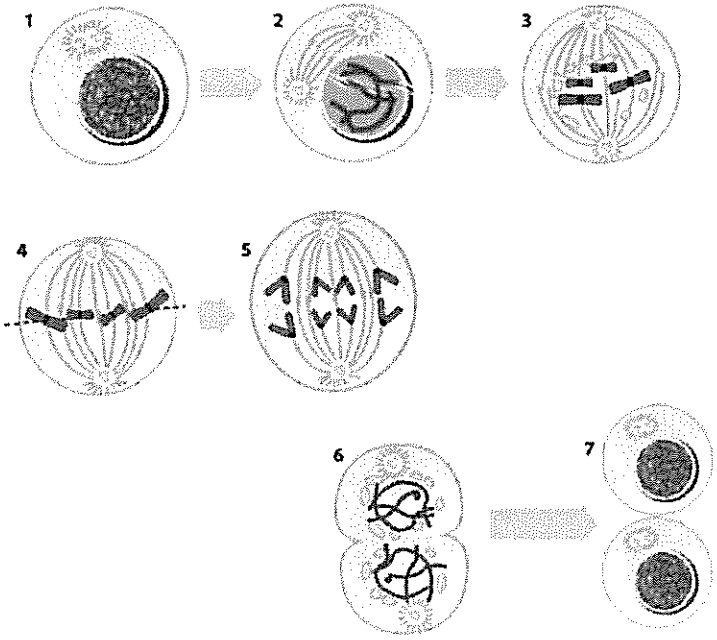
O It happens in the reproductive organs

O It is necessary for the growth of an organism

O It produces new cells to replace dead or dying cells

● It enables each parent to contribute genetic information to the offspring

36. The following figure represents the stages of mitosis, but they are not in the order in which they occur.



Which of the options below shows the correct order for mitosis?

O 1, 6, 7, 3, 4, 2, 5

O 2, 5, 1, 3, 7, 6, 4

O 5, 1, 6, 7, 3, 4, 2

O 5, 1, 7, 6, 3, 4, 2

Date: _____

37. By which process do most bacteria divide?
O Mitosis
O Meiosis
O Budding
● Binary fission

38. Which of the following is not true about binary fission and mitosis?
O Binary fission occurs more rapidly than mitosis
O The nuclear membrane breaks down and reforms during mitosis, but not during binary fission
O Spindle fibres are present during mitosis, but not during binary fission
● Binary fission occurs in eukaryotes, and mitosis occurs in prokaryotes

39. Which one of the following statements about the cells resulting from mitosis is correct?
● They are identical in shape, size and content to the original cell
O They are each half the size of the original cell and have identical nuclear content
O They are daughter and son cells
O They are each one quarter of the size of the original cell

40. A cell with a diploid number of 12 chromosomes undergoes mitosis. What will the product at the end of mitosis be?
● 2 cells each with 12 chromosomes
O 4 cells each with 6 chromosomes
O 2 cells each with 6 chromosomes
O 4 cells each with 12 chromosomes

41. Which of the following is not an example of asexual reproduction?
O Reproduction via budding in baker's yeast
O Formation of spores during sporogenesis without meiosis in red algae
O Formation of plantlets on specialised leaves of kalanchoe
● Fertilisation of orchids resulting in formation of a fruit

42. Which of the following factors can contribute to a person developing cancer?
i genetic factors
ii oncogenes
iii exposure to a carcinogen
iv infection by human papillomavirus

O i only
O i and iii only
O ii and iv only
● i, ii, iii and iv

Date: _____

43. The use of embryonic stem cells has attracted a great deal of attention in the scientific world and in the media. Pluripotent stem cells are taken from embryos. They can be stimulated to become any type of cell in the body. This technology has given rise to many ethical questions because:

O Differentiated stem cells have no practical use outside the laboratory

O Stem cells must be taken from two-week-old embryos that have been removed from the uterus

O There is no source of embryonic stem cells other than from aborted foetuses

● Stem cells are taken from excess embryos produced through the IVF process that would otherwise be discarded

44. Which of the following is a feature of cancer cells that makes them different from normal cells?

O Cancer cells are unable to synthesise DNA

O Cancer cells are arrested at the S phase of the cell cycle

● Cancer cells continue to divide even when they are tightly packed together

O Cancer cells are always in the M phase of the cell cycle

45. Which of the following statements about asexual reproduction is correct?

O Asexual reproduction only involves one parent.

O Offspring of asexual reproduction are identical to the parent.

O There are no gametes produced in asexual reproduction.

● All of the above statements are correct.

46. Which of the following correctly matches the type of organism with the method of asexual reproduction?

	Type of organism	**Type of reproduction**
A	Euglena	Vegetative propagation
B	Ginger	Budding
C	Hydra	Fission
D	*Penicillium* fungus	Spore formation

47. A bacteria cell divides using binary fission and produces 64 cells after 150 minutes. What is the time between each division?

O 25 min

● 30 min

O 64 min

O 150 min

48. A cell during metaphase I in meiosis has 4 chromosomes. How many chromosomes would each daughter cell have at the end of meiosis?

O 1

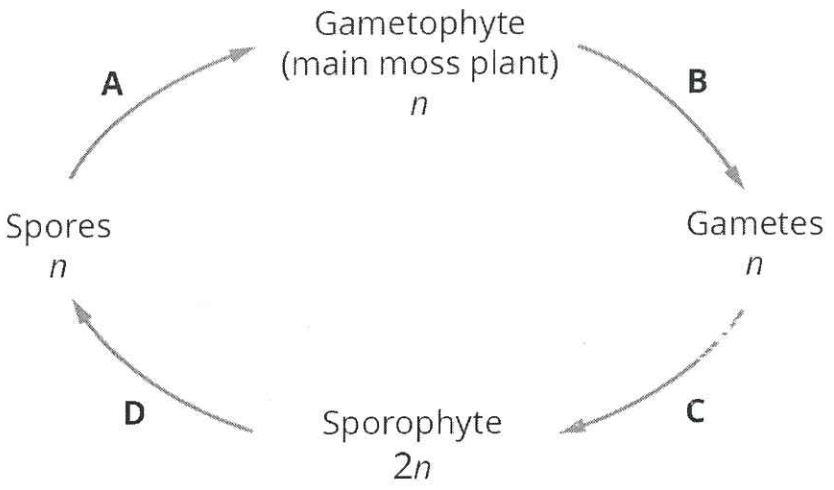
● 2

O 4

O 8

Date: _____

49. The diagram below shows the life cycle of a moss. The number of unique chromosomes is shown as *n*. At which stage in the life cycle does meiosis take place?



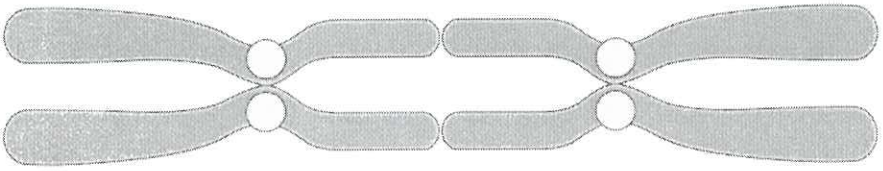
Where does meiosis occur?

- ● in the sex organs
- ○ in testes and ovaries
- ○ in all body cells
- ○ in growing cells

50. A cell during metaphase I in meiosis has 4 chromosomes. How many chromosomes would each daughter cell have at the end of meiosis? Repeat

- ○ 1
- ● 2
- ○ 4
- ○ 8

Use the diagram below to answer *Questions 51 and 52*. The diagram shows chromosomes during a stage of meiosis.



51. How many chromosomes and chiasmata are visible?

	Number of chromosomes	Number of chiasmata
A	2	2
B	4	2
C	2	4
D	4	4

Date: _____

52. At what stage of meiosis would the chromosomes be?
● prophase I
O prophase II
O metaphase I
O metaphase II

53. What is the usual cause of Down syndrome?
O 21 pairs of chromosomes
● duplication of a segment of chromosome 21
O non-disjunction of sex chromosomes
O fertilisation of the egg by two sperm

54. Normal human body cells contain how many chromosomes?
O 22
O 23
● 46
O 44

55. At the end of meiosis I, the resulting two cells are:
O Identical in all ways
O genetically identical
● genetically different
O prepared to enter interphase so the chromosomes can be replicated

56. At the end of metaphase I, _____ separate.
● homologues
O sister chromatids
O centrioles
O only autosomes

57. If you view a cell in which the genetic material is beginning to be visible as separate bodies, and the nuclei have disappeared from view, you may assume the cell is in:
O telophase
O metaphase
O interphase
● prophase

58. Fertilisation results in:
● a zygote
O a diploid cell
O a cell with a new genetic combination
● all of these are correct

Date: _____

59. A farmer grows a range of plants. The table below outlines the reproductive strategies of the plants.

Plant	Type of reproduction
Tulip	Asexual
Poppy	Sexual
Lily	Asexual
Strawberry	Asexual and sexual

If a virus infects all of the plants, which plants are most likely to survive?

● poppy and strawberry

O tulip and lily

O tulip, lily and strawberry

O poppy only

60. During which stage of meiosis does crossing over occur?

● prophase I

O anaphase I

O prophase II

O telophase II