LIFE SCIENCES: PAPER I

MARKING GUIDELINES

Time: 2½ hours

150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

QUESTION 1

1.1   C   G   A   F   D   I   B   (7)

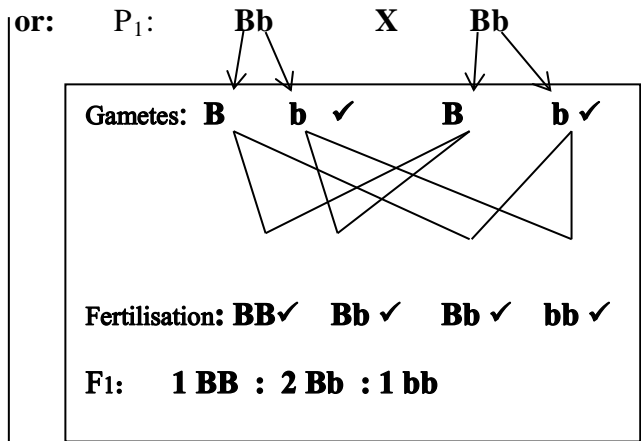1.2   1.2.1   A   (1)
       1.2.2   C   (1)
       1.2.3   C   (2)
       1.2.4   B   (2)

1.3   1.3.1

P_1: **Bb** x **Bb**   or: P_1:   **Bb**   **X**   **Bb**

Punnet diagram;

♂ \ ♀	B	b
B	**BB**	**Bb**
b	**Bb**	**bb**

Gametes: **B**   **b** ✓   **B**   **b** ✓

Fertilisation: **BB**✓   **Bb** ✓   **Bb** ✓   **bb** ✓

F_1:   **1 BB : 2 Bb : 1 bb**

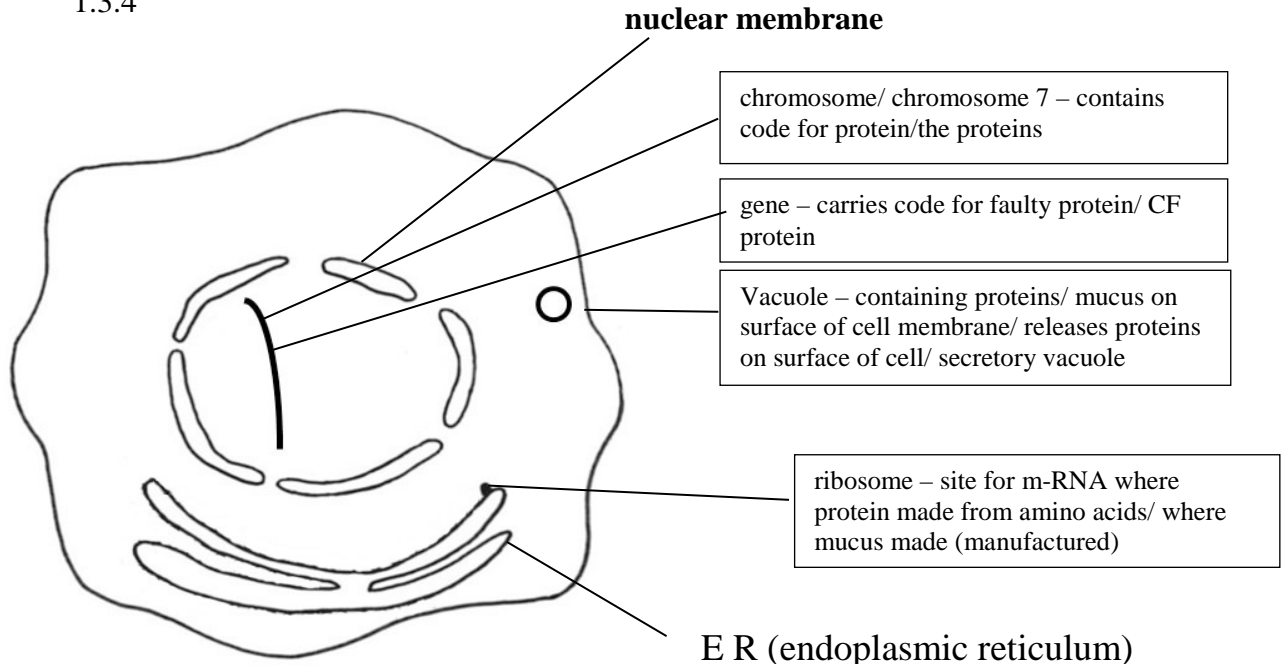   (6)

Probability: 1 in 4; or 25%   (1)

1.3.2   carried on autosome/ found on chromosome 7/ not on X or Y gonosomes/
         Chromosome 7 not a gonosome   **any 1**   (1)

1.3.3   (a)   25
         (b)   50   (2)

1.3.4

nuclear membrane

chromosome/ chromosome 7 – contains code for protein/the proteins

gene – carries code for faulty protein/ CF protein

Vacuole – containing proteins/ mucus on surface of cell membrane/ releases proteins on surface of cell/ secretory vacuole

ribosome – site for m-RNA where protein made from amino acids/ where mucus made (manufactured)

E R (endoplasmic reticulum)

2 annotated functions   (6)

1.3.5   dehydration   increased stickiness of mucous secretions
excrete sweat that is more salty than normal

any 2   (2)

1.3.6   m-RNA   copied from DNA/chromosome ; moves out through pores   in
nuclear membrane   **3 facts**   (3)

1.4

|	Statement	L, D, or D and L
1.	All the members of a species display varying characteristics and over time their appearances change.	*D and L*
2.	Only the fittest individuals with the most advantageous characteristics survive in a changing environment.	*D*
3.	Species acquire better and more efficient body structures by their increased use and pass on their acquired characteristics to their offspring.	*L*
4.	An example of a species becoming more diverse in when certain bacteria become resistant to antibiotics, are able to survive and pass on their resistance to their offspring.	*D*

(4)

1.5   *Homo sapiens* flattest face/largest brain capacity
Homo sapiens has smallest lower jaw
Australopithecus africanus has most pronounced mandible/lower jaw; smallest brain
capacity (Or any other reasonable answer referring to timescale and brain capacity)
                                                                    any two   (2)
                                                                    [40]

QUESTION 2

2.1   2.1.1   (a)   meiosis/gametogenesis/spermatogenesis   (1)

               (b)   testes   (1)

       2.1.2   (a)   female chromosome number = 47   (2)

               (b)   one chromosome pair did not separate during meiosis I/gamete
                      formation /unequal distribution of chromosomes ; whole
                      homologous pair moved to pole ; non-disjunction   **2 clear facts** (2)

       2.1.3   (a)   Down syndrome / trisomy 21   (1)

               (b)   upward slanting eyes/ cognitive difficulties
                      crease, fold of skin in corner of eye
                      deep creases in sole foot / palm of hand
                      short stature
                      abnormally large tongue
                      shortened fingers
                      heart abnormalities   **1 feature**
                      cognitive difficulties   (1)

               (c)   1   2   4   (3)

2.2   2.2.1 $\left(\dfrac{33}{1119} \times \dfrac{100}{1} \right)$ ✓ = 2,9 / 3%   (2)

       2.2.2   Number of Down syndrome babies born to mothers between 20 to 45 years of age

                                                                                         (4)
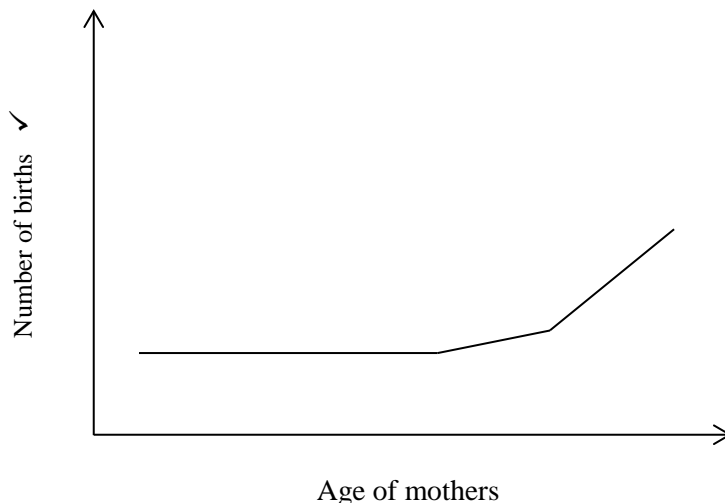
2.2.3 **Yes** amniocentesis; informed if has trisomy , can make plans; abort; prepare to take care of incidence of trisomy increases very rapidly after 40 years Risk after amnio very low/ 1% to 2%

No amniocentesis; religious reasons , cannot take a life / Overall numbers not too high prepared to take a chance / Too many risks with amniocentesis infection leaking amniotic fluid / increased chance of miscarriage not prepared to lose baby **two reasons explained** (4)

2.3   2.3.1 cancer causing: radiation/ chemicals/ HPV/ any virus **any one** (1)

2.3.2 **Yes** (family should benefit)
1. HeLa cells have been used in NB research and given glory to scientists/aid to ill, therefore great financial gain which is not possible without these cells; family should get monetary reward. OR:
2. Prestige and recognition to scientists not possible without HeLa cells; family should also receive awards/recognition for her contribution of cells.
3. Other people have got rich from this research; family entitled to a share.

No
1. This research for good of whole humankind many have benefitted / altruistic reasons
2. Companies have spent money/time to develop; so they entitled to all rewards
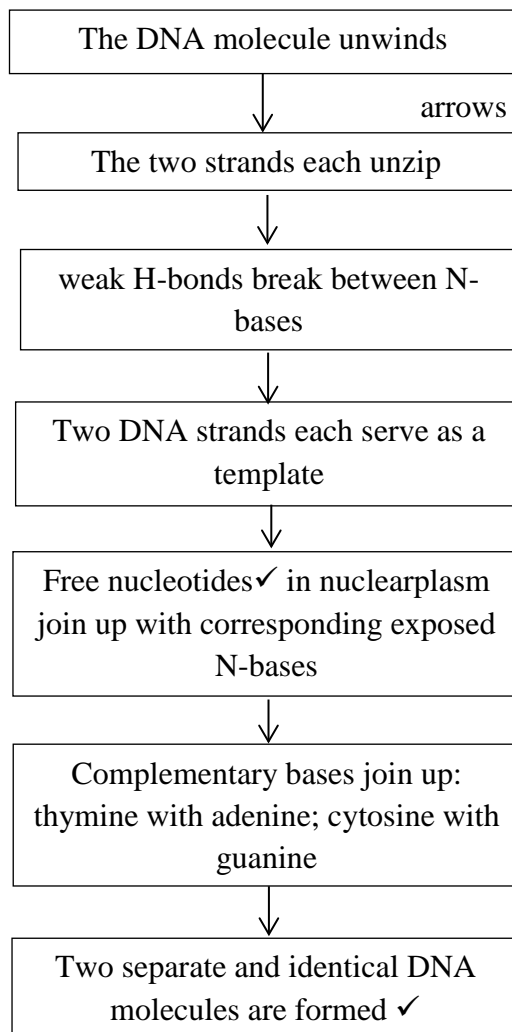
State explain two reasons (4)

2.3.3
1. Used without her knowledge all patients should be informed immediately/asked permission/sign legal documents/determine what they are used for, etc.
2. Named them after her should be kept anonymous if permission not asked for
3. Continued growing them should be destroyed to preserve her dignity
4. Still not informed family received their permission immediately
5. Did not acknowledge her contribution she should be named in all research

list explain two reasons (4)

[30]

QUESTION 3

3.1   3.1.1 (a) polyploid/y (1)

(b) Cannot produce fertile seeds/cannot reproduce (1)

3.1.2 (a) 2 sets more (1)

(b) larger and more numerous (kernels/seeds/grains)/longer stalk with more seeds. **any 2** (2)

3.1.3 **Sympatric:** species in same place/area/grow close enough so that pollination could occur OR

Not allopatric: geographic barriers / too far apart for pollination (2)

3.1.4   name animal   explain why crossed   describe outcome of enhanced feature   (3)

3.2   3.2.1   cuts non-coding DNA into different lengths   (1)

    3.2.2   **white** – have nuclei/have chromosomes DNA   OR
           red – no nuclei no DNA/chromosomes   (1)

    3.2.3   *non-coding DNA* – does not provide/not involved with direct code for protein synthesis/has other purpose such as ending metabolic process
           coding DNA – provides code for protein synthesis.   (2)

    3.2.4   Compare lines in gel   with DNA fingerprint of suspect. /or other more generalised answer.   (2)

    3.2.5   Small amount of DNA segments reproduced/increased (amplified) by adding sections of nucleotides to each DNA strand making more DNA catalysed by enzyme/DNA polymerase   **3 facts**   (3)

3.3   3.3.1   **Flow chart of process of DNA replication**

The DNA molecule unwinds

↓   arrows

The two strands each unzip

↓

weak H-bonds break between N-bases

↓

Two DNA strands each serve as a template

↓

Free nucleotides✓ in nuclearplasm join up with corresponding exposed N-bases

↓

Complementary bases join up: thymine with adenine; cytosine with guanine

↓

Two separate and identical DNA molecules are formed ✓

Arrows + 8 facts + 1 logical sequence = (10)

    3.3.2   maternal lineage/sibling relatedness/relationships between spp   (1)

[30]

QUESTION 4

4.1   4.1.1   protection from predators / protection/ competitive edge over other herbivores

(1)

4.1.2 $\dfrac{2000\,\text{kg}}{80\,\text{kg}}$ =   25X   (2)

4.1.3   evolution   (1)

4.1.4   1.   Live in similar place adapted to same environment
        2.   Same bony armour, etc. have same body plan , unlikely to have originated independently
        3.   Similar bony scales same type of structural material

any 2 well explained facts   (4)

4.1.5   ice age/asteroid/change in climate remove food source starvation/outcompeted by smaller more well adapted individuals too large/ heavy feet too small slow in finding food/ escaping predators

any reasonable explained answer   (2)

4.2   1.   **Random assortment:**
        During meiosis maternal and paternal chromosomes randomly line up on equator Maternal and paternal chromatids move in unequal numbers to opposite poles gametes contain varying numbers of maternal and paternal chromatids /always different number of maternal and paternal chromatids
        OR
    2.   **Crossing over:**
        During meiosis maternal and paternal chromatids of homologous pairs cross over at chiasmata swop sections of DNA new combinations of genes on chromosomes /results in gametes with new combinations of maternal and paternal characteristics **OR**
    3.   **Gene mutations:**
        Change in order of N-bases/ DNA permanent/ heritable changes in genes /new characteristics that confer advantage to individuals type of mutation

5 good facts to explain source of variaton   (5)

4.3   4.3.1   Frogs that call the loudest are the largest size. statement
            The larger frogs have louder mating calls statement
            Increased noise causes frogs to grow larger and have louder mating calls statement   (3)

4.3.2   Only record frogs that they can catch inconclusive data skews results Mark frogs that have been recorded so not repeating data Estimated mass of some frogs /incorrect data ensure that they catch frogs which are recorded

4.3.3   noise pollution   (1)

4.3.4   mates not attracted no breeding /extinction/ die out in the area important part of food chain cannot hear mates   (3)

4.3.5   put up barriers next to road/ redirect road/relocate frogs to reduce effect of noise (2)

4.3.6   Yes   –   is an overall increase in size continue to see if this trend becomes established not enough time to establish if a trend is developing in growth/loudness

No   –   no real increases in sound or size not supporting hypothesis

any other reasonable answers (2)

[30]

QUESTION 5

This research of transferring genes to other organisms is important:	This research of transferring genes to other organisms is NOT important:
1. Treat disorders 2. Prevent disease – HIV resistant gene 3. Improve quality of crops – drought, pest, disease resistant 4. Helps the environment – less pollutants into oceans; clean up pollutants with microbes 5. Solve world hunger – produce crops more quickly, crops more nutritious 6. Find cures for life threatening diseases, e.g. cancer HIV, etc. 7. Many countries are planting mainly GM crops 8. Can reprogram cells to produce required proteins	1. Not long enough to know side effects 2. Upset food chain, harm desirable, unintended organisms 3. Cause allergies 4. Vectors can cause cancer, toxicity, disease 5. Short-lived, must be replaced into every diseased cell's genes 6. Open to abuse – animals suffer as just bred for meat, milk, etc. 7. Targeting issues 8. Research still in infancy, more trials

In covering SAGs candidates would have much extra information to add to the essay.

Total: 150 marks

QUESTION 5   RUBRIC

	1	2	3	4
Content: Thoroughness	• Up to of ⅓ potential detail cited	• About half of potential detail cited	• All main topics covered • About ¾ of potential detail cited • One instance of significant information beyond the sources.	• All main topics covered • Source detail very close to full potential • At least (x) significant instances of information beyond the sources
Content: Relevance	• Mostly digression and/or repetition	• Around half is digression and/or repetition	• Repetition mostly avoided • Some minor digression	• Isolated incidences of minor repetition • No digression
Supporting Argument i.e. for	• Writing consists of facts with little linkage or reasoning • Reasoning incorrect	• Max if no decision to support • Reasoning correct hard to follow and lengthy • One paragraph placed illogically • Ordinary; some linkage is evident	• Supports the position • Reasoning is clear but bit lengthy • Minor errors in flow • Solid but not compelling; linkage sometimes missed • No new info in conclusion	• Strongly supports a clear position • Reasoning is very clear and succinct • Flow is logical, showing evidence of clear planning (no after-thoughts) • Compelling with regular use of linking language • No new info in conclusion • Refer to at least one incidence of bias, anecdote, false argument, emotive language, etc. where relevant
Fairness i.e. Argument against	• Few counter opinions given • Merit to counter opinion not given	• Counter opinions often given (x) • One instance of merit to counter opinion in order to get a 4.	• Counter opinions regularly given (x) • A few instances (x) of merit to counter opinions	
Position	• Clear decision made			
Presentation	• Writing is almost unintelligible • Language exceptionally weak • Inappropriate language	• Tone is inconsistent and/or in places inappropriate • Language is weak but appropriate • No terminology • Intro and conc present, no matter how weak	• Tone is consistent and suited to scientific argument • Good and appropriate language • Some good use of terminology • Intro and conc have merit • Some generalisation but not exaggerated	• Tone highly mature and suited to scientific argument • Excellent and appropriate language • Good use of terminology • Correct paragraphing with good transitions • Interesting intro, satisfying conc • No sweeping generalisation

[20]