LIFE SCIENCES: PAPER II

MARKING GUIDELINES

QUESTION 1

1.1   1.1.1   How long ago did the first trilobites appear?
                550 million years ago. ✓   (1)

        1.1.2   Suggest one reason why trilobite fossils are abundant.
                They possessed an exoskeleton that helped them form fossils. ✓
                Accept other possible answers.   (1)

        1.1.3   Suggest one reason why all species of trilobites became extinct.
                The habitats they occupied changed/ disappeared. ✓
                Accept other possible answers.   (1)

> Trilobites are thought to be closely related to three other groups of fossil arthropods: helmetids, tegopeltids and naraoids. The tegopeltids and helmetids are the two most closely related groups. These two groups are more closely related to the trilobites than they are to the naraoids. The diagram below shows the evolutionary relationships between these four groups

        1.1.4   Using the information provided above, write the names of the trilobites, tegopeltids, helmetids and naraoids in the blocks at the top of the diagram, to show their evolutionary relationships.

| trilobites | helmetids/ (tegopeltids) | tegopeltids/ helmetids | naraoids ✓✓ |
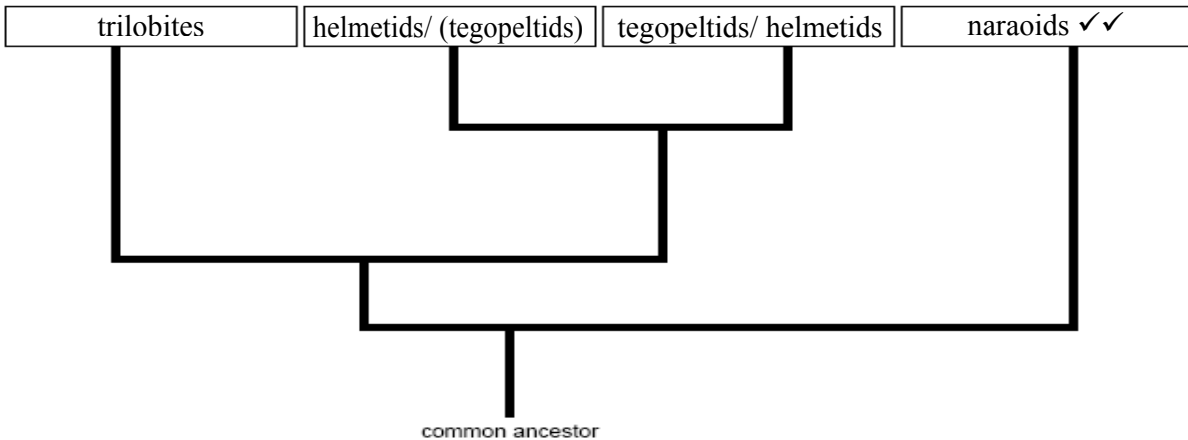
common ancestor

(2)

1.2   1.2.1   Identify two differences between the family trees shown on page 3.

Difference one
Tree 1: common ancestor evolved into different forms earlier than 30 million years ago and chimpanzees, humans, gorillas and orang-utans branched at the same time. ✓
Tree 2: common ancestor evolved into different forms later than 20 million years ago chimpanzees, humans, gorillas and orang-utans branched at different times. ✓

Difference two
Human, gorilla, chimpanzee and orang-utan are more closely related to each other than to gibbon.✓
Pygmy chimpanzees and chimpanzees are closely related; humans and the two types of chimpanzees are more closely related than they are to gorillas and orang-utans. ✓   (4)

1.2.2   Name two other types of evidence that scientists could use to construct family trees of this type.

Chromosome numbers could be compared ✓
Types of protein could be compared ✓
Structure of bones ✓   (2)

1.2.3   Which evidence should be used for deciding such family trees? Give your reasons.

Molecular evidence based on DNA ✓
plus 4 other reasons:
- It can be easily verified. ✓
- It is easy to store and retrieve. ✓
- Only one sample per population is needed, therefore causing little distress to animal. ✓
- Molecular sequencing can be done on a very small amount of DNA. ✓
- It is available to a scientist working anywhere in the world. ✓
- Family relationships can be established using mitochondrial sequencing. ✓   i.e. 1 + 4 = (5)

1.3   1.3.1   What type of radiation is shown in the diagram above? Give a reason for your answer.

Adaptive ✓, all fish evolved from one common ancestor. ✓   (2)

1.3.2   What advantages do the *Cichlid* species gain from being specialised feeders?

They fill a variety of niches without competition. ✓
Different species take advantage of different food sources. ✓
Different species can occupy one ecosystem. ✓   (3)

1.3.3   Name two events which would have to occur to allow the speciation of the *Cichlid* fish to take place.

Mutation ✓   Geographical isolation ✓ Accept other possibilities   (2)

1.4   1.4.1   Name the selection pressures that encourage wheat cultivation.

Fertile soil ✓
Non-stony soil ✓
Sufficient rainfall ✓
Lack of frost/ temperate climate ✓   (4)

1.4.2   A Land Bank programme proposes that people in rural villages plant communal (shared) cereal fields in an attempt to meet their own bread demands.
If you were a person living in a rural village in South Africa, which cereal would you plant plant? Explain your reasons.

- Many factors need consideration before deciding on which cereal to cultivate. ✓
- The quality of soil, the level of stoniness, amount of rainfall, the likelihood of frost will determine the appropriate cereal to be cultivated. ✓✓
- Another factor is what the village population are accustomed to eating. ✓

Other factors that are not mentioned will need to be considered:
- A series of test plantings should be done to see if the named cereal provides a good yield. ✓
- Further investigation will help one decide the best type of cereal to plant for the highest yield. ✓
- Cost of 'seed'/ availability of 'seed'. ✓   (6)

1.5   Seven multiple choice questions are given below. Choose the most correct option for each question and write the corresponding letter of that option in the space provided in the table below.

Question	1.5.1	1.5.2	1.5.3	1.5.4	1.5.5	1.5.6	1.5.7
Answer	C ✓	D ✓	A ✓	B ✓	B ✓	D ✓	C ✓

(7)

40 marks

QUESTION 2

2.1   2.1.1   Sulphur content is highest in lichens which receive pollution from the power station compared to those lichens that do not receive pollution from the power station. ✓✓✓   (3)

       2.1.2   Use the rubric given below for marking this question.

Yes:
- They tried to control variables by having the same type of lichens in each position on the map.
- Their experimental period of 1 month for all rocks was a controlled variable.
- Having the controlled variables allowed for fair testing.
- Selection of lichens was good, as they are sensitive to air pollution.
- Correct to have quantifiable data.
- Map given and report is informative on position.
- Data was collected from several positions of power station.
- Comparisons can be made.

Improvements they should make:
- Collect data for the whole year, not just one month.
- Have a control, i.e. sulphur content for area of no air pollution from power station.
- Test could be fairer: size of rocks need to be stipulated, amount of lichen tested – this is not given.
- Type of rock need to be examined in case acid rain leaches sulphur-containing minerals from the rocks and lichens absorb these.
- Lichens should have been tested for sulphur content before and after data was collected, to ascertain effects of air pollution.

Ethical considerations:
Chemical analyses should not happen at power station lab because of the possibility of results being skewed by management. Tests need to be done by an objective third party.

Criteria/ marks	0	1	2	3
Opinion about investigation	No opinion made 0 marks	Opinion made 1 mark		
Pupils' scientific method evaluated: Controlled variables identified	Controlled variables not mentioned	Controlled variables identified as such, 1 given	Controlled variables identified as such, 2 given	Controlled variables identified as such, 3 or more given
	0 marks	1 mark	2 marks	3 marks
Pupils' scientific method evaluated: Examples of good practice given	no examples given	1 example given	2 examples given	At least 3 examples given
	0 marks	1 mark	2 marks	3 marks
Suggestions for improvement: Data collection	No suggestions made	1 to 2 suggestions made	3 to 4 suggestions made	5 to 6 suggestions made
	0 marks	1/ 2 marks	3/ 4 marks	5/ 6 marks
Suggestions for improvement: Ethical considerations of where lichens are processed	No mention made of ethical issues	Mention made that there are ethical issues but none are identified	Ethical issues identified	Ethical issues identified, appropriate alternative suggestion/ s made
	0 marks	1 mark	2 marks	3 marks

(16)

2.3   Hypothesis needs to be given:
Statement predicting incidence of asthma for where people live in relation to the power station (e.g. referring to A –F). ✓✓✓
- Plan of data collection to include the following:
- Which groups of people will be approached to give information, age, gender, etc.? ✓
- How data will be collected? (e.g. questionnaires, surveys) ✓
- How responses will be recorded? (e.g. direct/ indirect questioning) ✓
- How data will be recorded? ✓
- How and what the control group will be? ✓
- Which areas will be surveyed? ✓
- Some indication of the questions asked? ✓
- How bias/ inaccurate information can be avoided? ✓
- Any other relevant to this type of plan   (3 + 8 = 11)

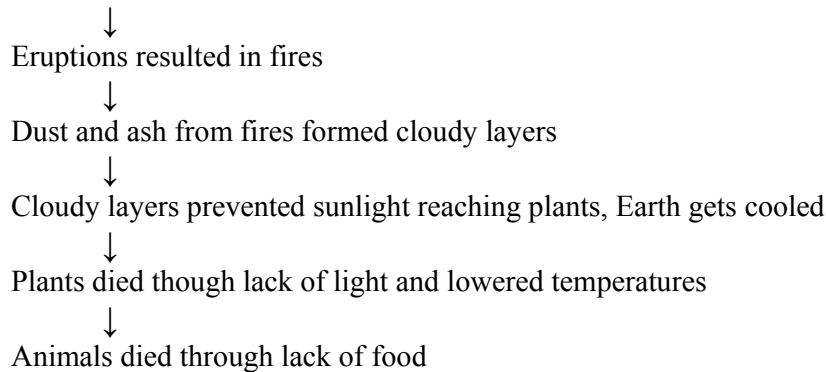| Criteria/ Marks	1/ 2	3/ 4	5/ 6	7/ 8
Number of appropriate and valid suggestions made that will test the hypothesis	1 or 2 suggestions made	3 or 4 suggestions made	5 or 6 suggestions made	7 or 8 or more suggestions made

30 marks

QUESTION 3

3.1   Hot water may denature enzymes which catalyse metabolic reactions. ✓
Hot water has a low oxygen content which affect rate of respiration of organisms. ✓   (2)

3.2   Study carried out on 2 populations. ✓
1 population living in hot water from power station, ✓ other population living in estuary water not receiving hot water from a power station. ✓
Head length of sand hoppers all measured ✓ and the mean (average) calculated. ✓
Study was done over 16 month period from June 1967 to September of 1968. ✓   (6)

3.3   At the beginning of January 1968, population that lived in estuary (unheated) water had average head length of 0.58mm ✓ while population living in hot water had average head length of almost 0.3mm longer. ✓ The warm water had probably increased the metabolic rate ✓ and therefore the growth of head length ✓ in hot water population.   (4)

3.4   Hot water from the power station increases metabolic rate and caused many more females to carry eggs ✓ than in the unaffected population where lower water temperatures did not increase metabolic rate. ✓ Hot water was available all the time. ✓ Breeding season started earlier and lasted longer. ✓   (4)

3.5   It appears to be an advantage in the increased number of females carrying eggs, ✓ i.e. based on the data available. If eggs are not all preyed on, this suggests that the population will increase: ✓ an advantageous situation for the population overall. However, it is not known if all the eggs reach the adult stage for population increase to happen. ✓ A disadvantage of a higher population is that there will be greater competition for resources. ✓   (4)

3.6   Offspring show variation ✓ but fallout radiation possibly causes mutations resulting in larger fish (monsters). ✓
Monster fish outcompete smaller 'siblings' and get more food, ✓ faster than rest of shoal because of the favourable variation of a larger body which allows them to swim faster when preying on sand hoppers. ✓
Monster fish survive better than normal sized fish, to breed and produce large offspring assuming mutation is inherited. ✓
Slowly fish size gets larger, forming monster population. ✓   (6)

3.7   Monster fish may be diseased. ✓
Monster fish may be radioactive. ✓
Until research shows that these fish are safe to eat, ✓ people should be discouraged from eating them. ✓   (4)

30 marks

QUESTION 4

4.1   4.1.1   Volcanic eruptions released ash and other compounds into the air

↓

Eruptions resulted in fires

↓

Dust and ash from fires formed cloudy layers

↓

Cloudy layers prevented sunlight reaching plants, Earth gets cooled

↓

Plants died though lack of light and lowered temperatures

↓

Animals died through lack of food

- 1 mark if no flow chart is shown
- 2 if order incorrect   (5)

4.1.2   Choice of theory ✓ (+ reasons)
Volcanic: comparisons can be made from present day eruptions where data collected. ✓
Data collected from different types of eruptions and their effects. ✓

OR   Asteroid theory:
Evidence is present in the form of soot and iridium ✓ in clay layer; craters off Mexico, and others such as in Siberia. ✓

For either theory: rate of photosynthesis is negatively affected by lower light intensity and lower temperatures ✓ and lack of food would have resulted in dinosaurs dying. ✓
Both theories are possible.   (1 + 2 + 2 = 5)

4.1.3   **Volcanic theory:**
Extinction happened millions of years ago. ✓
Cause was planetary upheaval. ✓

6th Extinction:
Present day. ✓
Caused by human impact on planet. ✓   (i.e. 4 marks for differences)

Both resulted in habitat loss, ✓ food loss ✓ and therefore disappearance of species. ✓   (i.e. 3 marks for similarities)   (7)

4.2 4.2.1 Layers of fossils and sediments are of different ages. ✓ Layer 1 the oldest, ✓ layer 5 the youngest. ✓ (3)

4.2.2 Carbon dating ✓ of fossils would give estimate of geological time when *Carnifex* was alive.

Skull and teeth (if present) would provide evidence for type of feeder: ✓ carnivore.

Comparison with bones and bones shapes and surfaces of present day animals, from Africa, would help identify the animal as a lion. ✓ With basic skeletal structure in place, ✓ modelling clay could be used to decide on musculature. (4)

4.2.2 Marking: using a rubric

Very careful management is needed to preserve the cave and its fossils, some suggestions are given:

- Numbers in a group would need to be controlled to reduce potential effects of increased human presence, and possibly the time they spend should not be too long.

- A one-way flow system of traffic could be a further measure of reducing potential effects of increased human presence, with paths or walk ways that are dust-free and reduce impact of weight of humans on cave floor/ fossil layers.

- With many visitors, the water vapour level and carbon dioxide level in the cave would be raised, leading to dissolution of the limestone. A ventilation system would need to be installed to reduce the effects of these two gases and to maintain an optimum cool temperature.

- The fossils, being so old, are very hard and may possibly not be affected by water vapour level and carbon dioxide level as much as the limestone itself. However, studies must be first done to assess the level of possible damage due to human presence.

- The fossils themselves would need to be protected against collection and mechanical damage, so should be screened off by glass or some other transparent screen. Alarms could be set up to alert the authorities should any one touch the fossils.

- The guides need to be well informed to cope with questions from people of different backgrounds, from school groups to academics.

- To allow people to have maximum benefit from the cave experience, there could be a pre-cave DVD to watch and post-cave display detailing all that visitors have seen in the cave.

Criteria/ Marks	1	2	3	4
Factors considered for management of cave system	Poor, not appropriate to context 1 suggestion	Satisfactory variety, some are appropriate to context 2 suggestions	Good variety, all are appropriate to context 3-4 suggestions	Very large variety; appropriate to context 5-6 suggestions
Suggestions	Explained reasonably well	Well explained, useful and valid		

(6)

30 marks

QUESTION 5

Criteria/ Marks	0	1	2	3	4
Making a decision	No decision made	Undecided	Clear decision made about effectiveness of measures in place to protect children from lead pollution		
Substantiation: Fairness (Acknowledgements of other view points)	No reference to alternate point of view	No/ little reference to alternate point of view being possible	Evidence that the alternate point of view exists but only shortcomings given	Evidence that the alternate point of view can be taken, with examples of ways in which lead pollution has been reduced	
Substantiation: Thoroughness (Extent of source material cited)	Response is entirely opinion with no supporting evidence from the sources given	Very little evidence from the sources is cited in support of opinion	Some source material quoted, about half	Several sources quoted	All sources are referred to depending on decision made. There is evidence of reasoning beyond the sources, that is integrated into the whole
Substantiation: Relevance (Selection of source material)	Source material is unprocessed	A lot of digression where question largely appears to be ignored	Some loss of relevance, approximately a paragraph	Slight loss of relevance, a sentence or two	Source material appropriate to decision is referred to in the answer, with no loss of relevance
Argument, depending on accuracy	Argument where given, is directly from the sources, and is unprocessed	Writing is mostly facts with little reasoning or linkage	Arguments and reasons are clear on average (50%)	Some unclear/ incorrect reasoning that detracts from the quality of the response	Arguments are logical, reasoning clear and generally persuasive
Ability to paragraph		No paragraph breaks apart from scene setting and wrap-up	Physical but inappropriate breaks	Paragraph divided clearly on unified theme rather than just physically	

20 marks

TOTAL FOR THIS PAPER: 150 MARKS