NATIONAL SENIOR CERTIFICATE EXAMINATION
NOVEMBER 2017

LIFE SCIENCES: PAPER II

MARKING GUIDELINES

Time: 2 hours 100 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.

SECTION A

QUESTION 1

1.1

	Correct terms
1.1.1	Parental care – option 1
1.1.2	Allopatric speciation – option 2
1.1.3	Convergent evolution – option 2
1.1.4	Continental drift – option 2

1.2 1.2.1 500–600 (accept range)

1.2.2 2 050–2 250 (accept range)

1.3 morphological characteristics can evolve at an incredibly uneven pace sometimes completely out of step with genetic changes/speciation seems to occur in bouts and not steadily over time/speciation has been record breaking 1 550 species in relatively short time (10 million years).

1.4 1.4.1
- Cichlids possess two sets of jaws
- one in the mouth, (to suck, scrape or bite off bits of food)
- the second set of jaws are adapted in the throat
- to crush, slice or pierce the food
- greater feeding options
- the two sets of jaws are finely adapted to a type of food/very versatile/adaptable
- allows each species to occupy its own very specific ecological niche; (4 optional facts)
- hundreds of species can coexist without directly competing/if these cichlids had tried to exploit the same food resources, most would have been driven to extinction

1.4.2 **Summary of piscivorous cichlids and the types of food they eat**

Type/group of cichlids	Type of food	Type of food	Feeding specialisation
Piscivores	Whole fish	Consume whole fish	–
Scale Eaters	Scales	Eat scales from sides of other cichlids	Approach from behind and grab mouthful of scales
Paedophages	Eggs or young of mouth brooders	Dislodge young from mouth brooders and eat their eggs or young	Ram mouth of mouth brooder and dislodge eggs and young
Carnivorous cichlids	Insects and shrimp	Eating insects and shrimp	–
Crushers	Small and thin-shelled molluscs	Crush and process small and thin-shelled molluscs	Large molars to crush shells

Heading = column headings =
5 groups of piscivorous cichlids = linked to correct type of food
(sliding scale: 5 correct =; 4 correct =; 3 correct = ; 2 to 1 correct =)
Alt answer: Heading = column headings =
Max 3 correct =; 2 to 1 correct =) (4)

1.5 Cichlids in Lake Victoria are genetically very close to one another; evolutionary adaptations can and did evolve many times; independently of one another; example of convergent evolution; mtDNA indicates relatedness

1.6 **Survival of the fittest example:**
Bower builders (nest-builders) – many male African cichlid fish build a pit or sand castle on a lake bottom; to attract females; females pick the largest nest/bower; strongest males can move most stones; males compete with one another to fertilise the most eggs; carry on their genes in offspring.
Not survival of the fittest example:
Bright colouration of males; owing to preferences of the females; female cichlids are often a drab grey or brown; example of sexual selection; rather than pressure for physical survival/survival of the strongest; the different colours of otherwise identical fish serve as a barrier; separating distinct species; e.g. a female of a species that prefers yellow males will **not** mate with a red one.

1.7 1.7.1 inbreeding/selective breeding/artificial selection/cross breeding

1.7.2 decrease in gene pool/genetic diversity/decrease in homozygosity; increase in genetic abnormalities/less resistant to disease
(Relate to term given 1.7.1.)

QUESTION 2

2.1 State whether the following statements are True or False.

2.1.1 True

2.1.2 False

2.1.3 False

2.1.4 True

2.1.5 False

2.2 *H. naledi* braincases were tiny/560 cubic centimetres for the males/465 for the females far less than *H. erectus*'s average of 900 cubic centimetres bigger brain in *H. erectus* indicates closer to modern humans/more evolved species/greater cognitive/thinking ability
(2 facts for comparison + 1 for evolutionary implication)

2.3 Berger invited many scientists from different countries; many were young scientists; usually only scientists closest collaborators are given access to the bones; to help him analyse the bones of *H. naledi* quickly; could take years, even decades to investigate the findings; Berger's team spent 6 weeks; would let him be known in his field; give all scientists access to the newest discovery; mystery of human origins so important to unravel that all scientists need new information.
(How = + Why =)

2.4 *primitive above, modern below* = mixture of more advanced Homo features and more primitive Australopithecine features
Primitive above: *H. naledi*'s hand displays curved fingers, a clue that the species had retained an ability to climb in trees and on rocks; the shoulders were apish too; the widely flaring blades of the pelvis were as primitive as Lucy's; proportionately long arms; small braincase.
Modern below: the bottom of the pelvis looked like a modern human's; The feet are virtually indistinguishable from modern humans longer legs; ridges for strong muscle attachment.
(Accept other relevant structural differences (1 = explanation + 2 = primitive above + 2 = modern below))

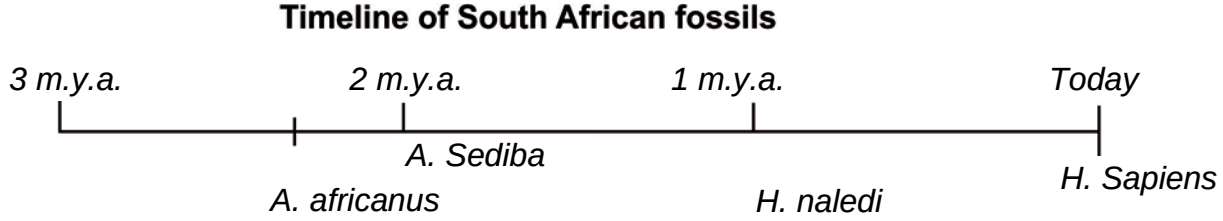
2.5 2.5.1 C A B (1)

2.5.2 Toes are all in line in *H.naledi* and human foot – no divergent big toe as in Little Foot (accept other relevant answers)

2.5.3 Enabled upright posture; freed hands; to manipulate objects/ environment/make tools; allowed walking/running gait/over long distances; less surface area exposed to sun therefore cooler.
(Other suitable advantages of bipedalism)

2.6

Australopithecus africanus	2,3-million-year-old fossil
Homo naledi	(unknown- closer to humans than *H. erectus*) (*H. erectus* + 2 mya – 100 000 years)
Australopithecus sediba	two million years ago
Homo sapiens	o mya



Heading
Timeline correct (*3 m.y.a* → today)
Placing of: *A. africanus*
A. sediba
H. naledi
H. sapiens

SECTION B

QUESTION 3 ESSAY

The rapid evolution of antibiotic resistance in bacteria will lead to the extinction of modern Homo sapiens (humans).

Summary of facts contained in sources to develop argument.

	Antibiotic resistance will lead to extinction of modern humans		**Antibiotic resistance will NOT lead to extinction of modern humans**
A Blog = not reliable/valid, etc.	• Bacteria continually evolve to adapt to new antibiotics.	**A**	
B	• Developing antibiotics to combat disease inadvertently leads to bacterial resistance. • Bacteria evolve very quickly. • Magic bullet (penicillin) analogy no longer holds; need magic shotgun = much more effective treatment.	**B**	• New antibiotics developed all the time. • Scientists understand how bacteria evolve.
C	• Not even on to human trials yet, only mice. • UN declared resistant bacteria threat to global health. • Hospital superbugs. • Gonorrhoea.	**C**	• Shu Lam, a 25-year-old PhD student, has developed a polymer that can kill six different superbug strains without antibiotics, simply by ripping apart their cell walls. • "A breakthrough that could change the face of modern medicine". • Antibiotics, which "poison" bacteria, can also affect healthy cells in the area. • The polymers that Lam has designed don't seem to affect healthy cells at all.

D Credible = BBC Medical correspondent	• Drug resistant infections will kill an extra 10 million people a year worldwide. • More than currently die from cancer. • Huge population decrease by 2050 unless action is taken. • Drug resistant infections are currently implicated in 700,000 deaths each year. • The costs would spiral to $100trillion. • Overuse of antibiotics causes resistance to spread through communities.	**D**	
E	• Sweden acknowledged urgent threat of antibiotic resistant bacteria. • Methods only successful in 0–4 yrs.	**E**	• Sweden has acknowledged the urgent threat to public health of antibiotic resistance and implemented effective programs. • For many years has worked hard to reduce the impact of antibiotic overuse. • Antibiotic use in Sweden has been reduced by 50% in children under the age of four. • Clear link between antibiotic resistance and consumption made Sweden draw up national treatment recommendations on how and when to use antibiotics.

F	• The development of new antibiotics by the pharmaceutical industry has essentially stalled due to economic obstacles. • Of the 18 largest pharmaceutical companies, 15 abandoned the antibiotic field. • Antibiotic research has been scaled back as a result of funding cuts due to the economic crisis. • Antibiotic development is no longer considered to be an economically wise investment for the pharmaceutical industry. • Because antibiotics are used for relatively short periods and are often curative, antibiotics are not as profitable as drugs that treat chronic conditions. • Decline in development and approval for antibiotic development in last 30 years.	**F**	• Six new drugs approved in 2014.
G	• Trials not yet started for resistant bacteria. • Clinical trials very recent.	**G**	• Bacteriophages control the number of bacteria and maintain ecological balances in nature. • Each bacteriophage infects only a few bacterial species or types, potentially making them real precision-guided "smart weapons" in the battle against bacterial infections. • They can be used against antibiotic-resistant bacteria. • First clinical trials with phage therapy have recently been carried out. • Bacteriophages were identified already in 1896 and were studied closely in the 1920s.

			• At that time, phage therapy was used to treat both animal and human infections – such as cholera and bubonic plague in India, often with good results so promising research.
H	• Only potential sources; will take years to develop.	**H**	• New antibiotic teixobactin. • Prevent some bacterial resistance up to 30 years. • Natural microbes in environment may provide new drugs.
Own Knowledge	• Colistinin example • XDR TB • Hospital superbug difficult to combat		• Nature of evolution – survival of the fittest humans will outpace evolving bacteria. • CRISPR-CAS 9 can destroy resistant bacteria or reprogram bacteria to not have resistance to antibiotics. • Natural population control mechanisms to reduce humans to carrying capacity, not all humans will die.

Total: 100 marks

Note: Essay should be 2½ to 3 pages in length.
Time allocation suggestion: Reading of sources 10 min.; Planning 10 min.; Writing essay 40 min.

	1 mark	2 marks	3 marks	4 marks	Possible mark (40)
Planning **× 2**	• Decision given • Key points present for and against the argument	• Decision given • Key points developed for and against the argument	• Decision given • Key points developed for and against the argument • Source references identified (e.g. Source A/own information)		6
Decision	• Vague • Changed position within essay	• Clear decision made			2
Use of knowledge from sources **× 2**	• Up to ¼ of potential detail in sources used to support argument	• Up to ½ of potential detail in sources used to support argument	• Up to ¾ of potential detail in sources used to support argument	• Source detail – very close to full potential used to support argument	8
Use of own knowledge	• Some facts given beyond the source to support argument	• Many facts given beyond the source to support argument	• Some facts given beyond the source to support argument • Facts integrated into the argument	• Many facts given beyond the source to support argument • Facts integrated into the argument	4
Content Relevance	• Repetition mostly avoided • Some minor digression • Supporting argument relevant	• Repetition mostly avoided • Some minor digression • Supporting argument relevant • Quality of source extracts acknowledged			2

Quality of argument supporting decision × 2	• Writing consists of facts with little linkage or reasoning • Reasoning incorrect	• **Maximum if no clear decision in support** • Reasoning correct, but hard to follow • Ordinary: some linkage evident	• Supports the position • Reasoning is clear • Minor errors in flow • Linkage sometimes missed	• Strongly supports a clear position • Reasoning is very clear and succinct • Flow is logical • Compelling with regular linkage • Well-integrated argument	8
	1 mark	**2 marks**	**3 marks**	**4 marks**	**Possible mark (40)**
Fairness – counter opinions to decision	• One to two counter opinions given from the sources	• Three to four counter opinions given from the sources	• Integration of one to two counter opinions from the sources into argument	• Integration of three to four counter opinions from the sources into argument	4
Presentation	• Writing is almost unintelligible • Tone, language, terminology unscientific and very weak • Introduction **and/or** conclusion **not** present	• Tone, language, terminology weak • Introduction **and** conclusion present	• Tone is consistent and suited to scientific language • Good and appropriate language and terminology • Mostly appropriate paragraphing • Introduction and conclusion have merit	• Tone is mature and suited to scientific language • Excellent and appropriate language and terminology • Correct paragraphing with good transitions • Interesting introduction, satisfying conclusion	4
Scientific merit	Essay shows academic rigour, accurate reasoning, insight and cohesiveness.				2