**1.** B

[1]

**2.** C

[1]

**3.** C

[1]

**4.** B

[1]

**5.** D

[1]

**6.** D

[1]

**7.** D

[1]

**8.** B

[1]

**9.** D

[1]

**10.** B

[1]

**11.** A

[1]

**12.** C

[1]

**13.** A

[1]

**14.** (a) arthropoda/arthropods;  
jointed legs/limbs/appendages/(hard) exoskeleton; 2  
*Use error carried forward if incorrect phylum but correct observation  
such as anelida because it is segmented/has bristles. This answer  
would earn one mark.*

(b) fossils show changes over time (in organisms);  
fossilized organisms are different from existing ones;  
(yet) share features with existing organisms / homologous structures;  
suggest common ancestry;  
show intermediate stages in evolution of groups / missing link fossils; 2 max

(c) natural selection;  
over time/generations;  
range/variation in size of eye (in the trilobite population);  
individuals with larger eyes are more likely to survive;  
example of selective advantage of large eyes *e.g.* can see predators /  
find food;  
surviving individuals reproduce and pass on their genes/large eyes  
to offspring; 2 max

[6]

**15.** (a) on Maui *T. stelarobusta* and *T. eurychasma* are closely related based  
on the cladogram (but they produce different webs);

distantly related spiders, *eg T. hawaiensis* and *T. stelarobusta*  
produce similar webs but are on different islands;

suggesting island is better indicator for relatedness than webs;

data inconclusive / more studies needed; 2 max

(b) (mt) DNA is isolated from organism / species;

(mt) DNA is sequenced / order of bases determined;

(mt) DNA sequence is compared between organisms / species;

more similarities between sequences signify more closely related /

recent divergence;

fewer similarities between sequences signify less relatedness / more

distant divergence;

cladograms are calculated by software that depicts the cladogram with the  
fewest number of branches;

for rooting the cladogram an outgroup / distantly related species is used; 3 max

(c) (i) *Award* ***[2]*** *max*

*Definition of convergent evolution:* independent evolution of  
similar traits in response to similar environments;

*Evidence* for: *T. stelarobusta* (Maui) and *T. hawaiensis* (Hawai’i)  
produce the same type of web;

*T. filiciphilia* (Maui) and “eurylike” (O’ahu) also produce similar webs;

(ii) *Definition of adaptive evolution:* rapid speciation to fill  
ecological niches;

*Evidence for:* on Maui, all three T. species present produce  
three different kinds of webs; 3 max

[8]

**16.** (a) self-replicating and catalytic activities of RNA;  
short sequences of RNA have been able to duplicate/copy other RNA  
molecules accurately;  
RNA enzyme/ribozyme (able to synthesize other molecules);  
3-dimensional structure of ribosome catalytic sites (for peptide formation)  
are composed of RNA;  
able to store information in sequence of (4) nucleotides (similar to DNA); 2 max

(b) all living organisms use DNA as genetic/hereditary material;  
genetic code is (almost) universal;  
idea that mutations accumulate gradually in DNA; 2 max

(c) A is most similar to B;  
A is equally similar to C and D;  
A is least similar to both C and D; 2 max

(d) methods used to prepare cladograms use a different approach from  
traditional classification/taxonomy;  
show ancestral relationships;  
reflect how recently two groups shared a common ancestry;  
cladograms are (objective/accurate because they are usually) based  
on molecular differences;  
they should be considered as a good complement to traditional  
classification; 2 max

[8]

**17.** DNA/genetic code is universal;  
  
always pairing of AT and GC;  
same structure of double helix of complementary strands;  
use the same 20 amino acids in their proteins;  
all left-handed;  
same/similar enzymes in processes of replication/transcription/translation;  
small differences in DNA/proteins show closer relationships;  
*e.g.* hemoglobin/cytochrome C/gene structures show relationships among  
organisms;  
humans have the same biochemistry as all organisms so part of same  
evolution/common ancestry;  
mitochondrial DNA used to determine maternal lines / y chromosome used  
to determine paternal lines;  
endosymbiotic theory/mitochondria/chloroplast structures indicate common  
lines of evolution; 6 max

[6]

**18.** (a)  × 100; = 39% (units required)  
*(Accept answers between 37–41% with the corresponding correct  
calculation.  
No marks if just difference (790–570) calculated.)* 2

(b) from earlier periods less fossil evidence available;  
because of more niches available at lower sea temperature / species  
spreading over greater depth / they evolved so more species/more  
time for adaptive radiation (speciation);  
modern classification methods recognize more species than previous  
methods;  
more research done at greater depths; 2 max

(c) valve length increases over time while average sea temperature decreases /  
there is an inverse/negative correlation between shell size and sea  
temperature;  
evolution of new species was slow up to approx. 5 million years ago  
when sea temperature was highest / evolution of new species was  
faster in last 5 million years when sea temperature was lower;  
depth of habitat not assessed for extinct species;  
conclusions unreliable because of lack of data from earlier time  
periods / conclusions unreliable because temperature relatively  
constant between 30 and 10 million years ago but the range of  
valves varies by about 100 µm; 3 max

[7]

**19.** (a) *At least one characteristic from each group is needed for maximum  
credit.*bryophyta have no roots / only have rhizoids;  
bryophyta have simple leaves/stems / only a thallus;  
bryophyta produce spores in capsule;  
byrophyta are nonvascular;  
bryophyte exhibit (pronounced) alternation of generations / a  
significant gametophyte generation;

filicinophyta have roots, stems and leaves;  
filicinophyta (often) have divided/pinnate leaves;  
filicinophyta produce spores in sporangia/spores on the undersides of leaves;  
filicinophyta exhibit alternation of generations;  
filicinophyta have primitive vascular tissue / no true xylem and phloem;

coniferophyta have woody stems;  
coniferophyta (often) have narrow leaves/needles/scales;  
coniferophyta produce seeds in cones/unenclosed seeds;

angiospermophyta have flowers;  
angiospermophyta have ovules in ovaries;  
angiospermophyta produce seeds (with hard coats) in fruits; 9 max

(b) starch is a large molecule;  
large molecules/starch cannot be absorbed by the intestine/villi/epithelial  
cells;  
glucose produced by digestion of starch can be absorbed;  
starch/glucose is a useful source of energy;  
starch is not used in humans;  
glucose is stored as glycogen not starch;  
starch is not soluble/could not be transported by blood; 4 max

(c) *In the table below, information from both boxes on same line is  
needed for 1 mark.  
Differences* ***[4 max]:***

|  |  |
| --- | --- |
| **Prokaryotic cells** | **Eukaryotic cells** |
| no nucleus | nucleus; |
| naked DNA | DNA associated with histone/protein; |
| loop of DNA | strands of DNA; |
| no mitochondria | mitochondria; |
| 70S/ smaller ribosomes | 80S/ larger ribosomes; |
| no/few internal membranes / no organelles | internal membranes/organelles/ Golgi/ER/lysosomes; |
| smaller in size (approx. 1-10µm) | larger in size (approx. 10-100µm); |
| cell wall (glycoprotein) present | sometimes present/not in animal cells; |

*Similarities: Award 1 mark for any combination of two different  
items* ***[2 max]****.*cytoplasm/plasma membrane/contains DNA/contains ribosomes 5 max

*(Plus up to* ***[2]*** *for quality)*

[20]