[01] Although Chytridiomycota is now grouped with the major fungal groups (Zygomycota, Ascomycota and Basidiomycota), it has many traits which are different from any of the other groups, but, which of the following trait(s) does it share with the other major groups?

A. dikaryotic vegetative colonies B. asexual spore production from conidiophores
C. coenocytic D. chitinous cell walls
E. glycogen stores F. A, B and D G. C, D and E H. C and D

*Shared traits include multi-nucleate cell units (coenocytic), chitin, and glycogen stores. The answer is **G**.*

[02] Glomus is an example of a genus (member of the glomermycete) of extraordinary importance for which of the following reasons?

A. It forms a Hartig net, especially on the roots of conifers and other trees.
B. It is the cause of the Glomus blight, affecting cereal crops such as wheat, barley and corn.
C. Many members of the Glomus genus (and other genera) form an intimate symbiotic relation with the roots of plants (commonly vesicular and/or arbuscular mycorrhizae).
D. Glomus (a member of the Entomophthorales) is often a pathogen of insects, used for biocontrol of common insect pests
E. Glomus is the major fungal group forming an intimate symbiotic relation with algae (usually Chlorophytes, but rarely the prokaryotic cyanobacteria) to create the remarkable lichens.
F. Glomus is a common spoilage mold (growing on bread and cheese, for example, making them inedible).
G. Glomus is a common smut pathogen, a member of the Basidiomycota.
H. None of the above.

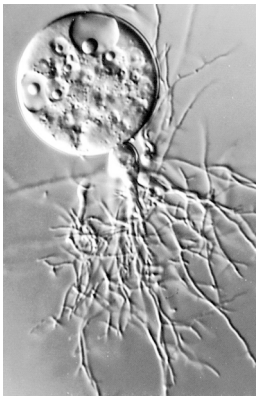
*It's possible that the invasion of land depended on remarkable symbioses, including the crucial role of Glomus as a common mycobiont in mycorrhizae. The answer is **C**.*

[03] Identify the most appropriate group on the basis of the reproductive structures diagrammed in the figure (choose the best answer)?

A. Ascomycete
B. Chytridiomycete
C. Hymenomycete
D. Gasteromycete
E. Basidiomycete
F. Zygomycete
G. Lichens
H. Teliomycete

*Directly from figure 14-15 in your textbook, it is Rhizopus, a Zygomycota (**F**).*

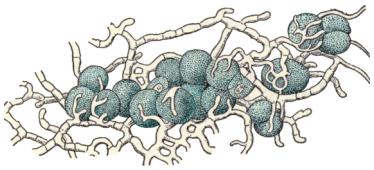
[04] Which of the following is/are correct for the photograph (choose the best answer(s))?



A. The image shows an example of the germinating teliospore (Basidiomycota).
B. This is an example of a germinating conidia of one of the Entomopthorales, in which the haurtoria are breaking through the chitin wall of the insect host (not shown).
C. It appears to be a basidium (Basidiomycota), arising from the mycelium.
D. The image shows a puffball (Basidiomycota) from which basidiospores are ejected/released.
E. It appears to be a Chytrid, with rhizoids used to extend into the substrate.
F. It is the spore-bearing structure of a truffle *Tuber melanosporum* (Ascomycota).
G. C and D
H. None of the above

*Directly from figure 14-13 in your textbook, it is a chytrid with rhizoids (**E**).*

[05] Identify the most appropriate group(s) on the basis of the structures in the figure (choose the best answer)?



A. Ascomycete B. Basidiomycete
C. Zygomycete D. Chlorophyta
E. A and D F. B and D
G. C and D H. all of the above

*From your lab manual it is a lichen. The most common mycobiont of lichens is Ascomycota; chlorophytes are the usual photobiont (**E**).*

Match the following heterotrophic divisions of the Fungal Kingdom with the one most distinguishing characteristic for each division. Choose the best answer (you may choose an answer only once).

[06] Zygomycota	A. none of the below	B. karyogamy	C. conidia
[07] Ascomycota	D. septate	E. dolipore	F. aseptate
[08] Basidomycota	G. zygomata	H. dikaryotic	

*Zygomyota is aseptate (except in the zygosporangiphore) (**F**); nothing is a specific characteristic of the ascomycete (**A**); dolipore is a good diagnostic when working with dikaryotic vegetative forms of the Basidiomycota (**E**).*

Match the following definitions with the most appropriate term.

[09] Specialized hyphae that penetrate photobiont cells by means of pegs	A. ascogenous hyphae B. cleistothecium C. conidiophore D. isidia E. mycorrhizae F. trichogyne G. haustorium H. none of the above
[10] Small outgrowths that contain both fungal hyphae and algae or cyanobacteria that act as dispersal units.	
[11] A receptive protuberance of the 'female' gametangium for the conveyance of spermatia.	

*The pegs are haustorium (**G**), Isidia are small outgrowths (**D**), and a trichogyne is the 'female' gametangium (**F**).*

[12] Which of the following groups are known for the production of aflatoxins?

A. Cordyceps B. Entomophthorales C. Aspergillus D. Saccharomyces
E. Neurospora F. Stachybotrys G. Penicillium H. none of the above

Students tell me the answer is C.

[13] Which of the following groups is used to produce beer and bread?

A. Cordyceps B. Entomophthorales C. Aspergillus D. Saccharomyces
E. Neurospora F. Stachybotrys G. Penicillium H. none of the above

Students tell me the answer is D.

[14] Ectomycorrhizae are an example of a fungal/plant symbiotic relationship in which the mycobiont does not penetrate *into* the plant cells (but may grow *between* the root cells in a Hartig net), it forms a mantle surrounding the root. Which of the following are characteristic(s) of such a mycorrhizal symbiotic relationship?

A. In addition to carbohydrate produced by the photobiont, the mycobiont may receive essential vitamins from the plant.
B. Mycorrhizae are often essential for growth of plant seedlings, in the absence of the fungal symbiont, the seedlings lack vigor and may die.
C. The mycelial network of the mycobiont increases the volume of soil from which nutrients (most especially sodium and small molecular weight organic acids) are provided to the plant symbiont.
D. If the fungal hyphae do not penetrate *into* the plant root cells, it is not a mycorrhizae relationship.

E. A, B and D F. A and B G. B and D H. none of the above

*Mycorrhizae, whether endo- or ecto-, provide water, phosphorus and micronutrients to the photobiont, but **not** sodium and organic acids. They do receive carbohydrate and vitamins, and are essential for growth of many seedlings. The answer is F.*

[15] Place the following groups in order of increasing complexity of their adaptations to survival on land, or appearance in the fossil record?

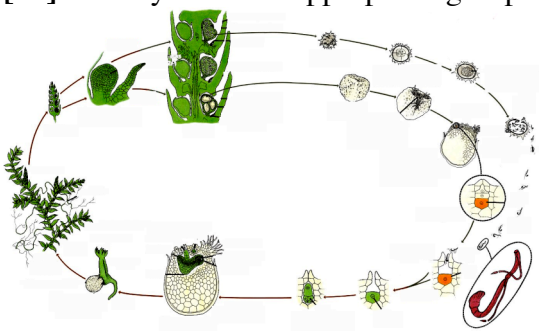
1. Cycadales 2. Liverworts 3. Hornworts 4. Bryidae 5. Coniferales

A. 2,3,4,1,5 B. 2,1,4,3,5 C. 3,2,5,4,1 D. 3,4,2,5,1

E. 1,4,3,2,5 F. 4,1,3,2,5 G. 3,4,2,1,5 H. none of the above

The correct order is liverworts, hornworts, Bryidae, cycads, and conifers (2,3,4,1,5) so the answer is A.

[16] Identify the most appropriate group on the basis of the life cycles shown below



A. Ginkgoales
B. Bryidae
C. Lycopodium
D. Cycadales
E. Selaginella
F. Marchantia (liverwort)
G. Anthoceros (hornwort)
H. Isoetes

*It is the life cycle of Selaginella, from your textbook: **E***

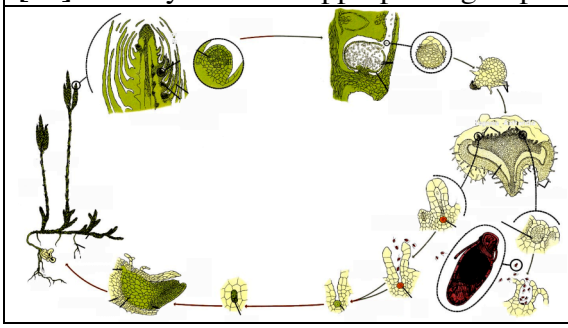
[17] What specialized cell(s) or trait(s), functioning as a component of adaptation to terrestrial environments, is/are usually lacking in Anthocerophyta (hornworts) but present in the Bryidae (mosses)?

A. phloem B. xylem C. hydroids D. operculum

E. embryogenesis F. rhizoids G. A and B H. C and E

Hydroids are an example of a 'primitive' water-conducting cell, found in Bryophytes (mosses), an adaptation to life on land. The answer is C.

[18] Identify the most appropriate group on the basis of the life cycles shown below



A. Ginkgoales
B. Bryidae
C. Lycopodium
D. Cycadales
E. Selaginella
F. Marchantia (liverwort)
G. Anthoceros (hornwort)
H. Isoetes

*It is the life cycle of Lycopodium, from your textbook: **C***

[19] The life cycle of a bryidae (mosses) can be functionally divided into three distinct 'phases. Which of these allows the organism to ramify through the substrate to optimize access to necessary nutrients, and especially water, soon after spore germination?

A. protonemata B. rhizoid C. operculum D. gametophyte 'buds'

E. peristome F. arhegonial head G. strobilus H. caulonema

Protonemata is one of the distinct phases. The answer is A.

[20] Leptosporangia and eusporangia refer to which of the following characteristic(s) of Pteridophyta (ferns) (Choose the best answer)?

A. In leptosporangial ferns, a single apical cell is the progenitor of the sporangia, including the haploid spores.
B. Leptosporangial ferns have a tapetum (nutritive tissue in the sporangium), which is absent in eusporangial ferns.
C. Eusporangial ferns have a tapetum; leptosporangial ferns do not have a tapetum.
D. In euosporangial ferns, multiple cells cooperate in creating the sporangia, including the haploid spores.
E. A and B F. A and C G. A and D H. B and D

In both fern types, there is a tapetum: ***G****.*

Match the following characteristics with the most appropriate division. Choose the best answer (you may choose an answer more than once).

[21] Siphonostele
[22] Heterosporic

A. Polypodium B. Psilotophyta C. Lycopodiaceae
D. Selaginellaceae E. Sphenophyta (Equisetum) F. A and C
G. C and D H. D and E

*Siphonostele is found in Equisetum (E), heterospory is found in Selaginallaceae (****D****)*

[23] In the period of time from about 350 to 150 million years ago, which of the following groups were very abundant (as either a component of the vegetation and/or the number of species) on the basis of the fossil record?

A. Lycophyta B. Sphenophyta (Equisetum) C. Anthocerophyta (Hornworts)
D. Bryophyta (mosses) E. Angiosperms (Flowering Plants)
F. A, B, C and D G. B, C, D and E H. All were abundant

Lycophyta, Sphenophyta, Anthocerophyta and Bryophyte were all abundant (either as a component of the vegetation or species numbers) prior to the appearance of angiosperms (more recent than the 150 million year cut-off). The answer is F.

[24] Which of the following characteristics are key <u>adaptive</u> component(s) of the successful invasion of land by plants (Choose the best answer)?

1. phycoplastic cell division
2. chlorophylls a and b
3. vascular tissue
4. embryophyta
5. determinate growth of the gametophyte
6. indeterminate growth of the gametophyte
7. heterospory
8. stomata
9. archegonium and antheridium

A. 1, 2, 3, 4 and 5 B. 1, 3, 4, 7 and 8
C. 2, 3, 4, 5 and 6 D. 3, 4, 6, 8 and 9
E. 1, 3, 4, 6 and 9 F. 1, 2, 4, 5 and 7
G. 1, 3, 5, 6 and 9 H. 3, 4, 6, 7 and 8

Stomata to regulate water loss (and carbon dioxide uptake), vascular tissue to transport water and photosynthate, protection of the diploid embryo in the parent, aggressive vegetative growth (mosses), and protection of gametes in the archegonium and antheridium: ***D****.*

[25] Which of the following are potential mechanisms by which a vascular plant can transport water to distances as high as 30-100 meters (against the opposing force of gravity)?

A. Capillary action pulls the water up the narrow xylem conduit ('pipe') because of the surface tension of water.
B. The water is pushed up the xylem conduit by osmotic pressures generated in the roots by lowering the osmolarity of the root cell sap, causing water to flow into the root and up the stem.
C. The water is pushed up the xylem conduit by osmotic pressures generated in the roots by increasing the osmolarity of the root cell sap, causing water to flow into the root and up the stem.
D. The water is pulled up the xylem conduit by evapo-transpiration from the leaves, creating a negative pressure that 'sucks' the water up the stem from the roots (and soil).
E. A and B

F. B and D
G. C and D
H. None of the above
*As explained in lecture, evapotranspiration (for tall heights) is the well-established mechanism for water transport: (**D**). Root pressure (for short heights, created by the higher osmolarity within the root) can play a role, but it is limited to short heights and cannot be sustained due to accumulation of osmolytes at evaporative surfaces.*

[26] Among the extant groups of gymnosperms, which of the following group(s) retain the characteristic of motile sperm?

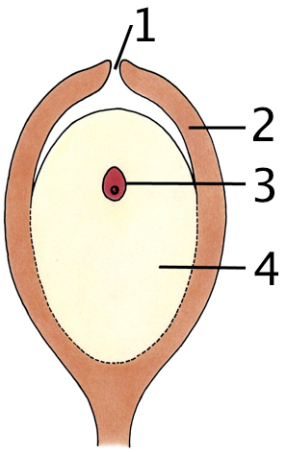
A. Ginkgoales	B. Taxodiaceae	C. Cycadales	D. Gnetales (Gnetophyta)
E. Araucariaceae	F. A and B	G. A and C	H. A, B and E

Ginkgos and cycads have motile sperm, the other groups do not (G).

Match the following definitions with the appropriate term.

[27] In heterosporous plants, the female gametophyte, located within the ovule of seed plants	A. megaspore B. microspore C. megasporocyte D. microsporocyte E. microgametophyte F. megagametophyte G. microsporangium H. megasporangium
[28] In heterosporous plants, a haploid (1n) spore that develops into a male gametophyte	

The definitions come from the glossary of your textbook: 27 is the megagametophyte and 28 the microspore.



For the gymnosperm ovule shown in the diagram, identify the four regions.

[29] 1	A. nucellus	B. microspore
[30] 2	C. megasporocyte	D. megaspore
[31] 3	E. integument	F. micropyle
[32] 4	G. megapyle	H. none of the above

Per diagrams in lecture and in the textbook: in order, micropyle, integument, megaspore and nucellus (F, E, D, A).