

Chapter 1

Testing Tactics

Getting the correct answer, even when you know nothing, is one of the defining skills of the academic champion. The rest of this book is about developing your knowledge. This chapter is about what to do when things go wrong.

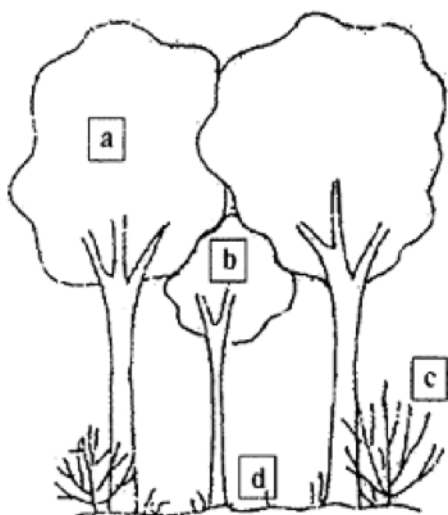
You'll encounter questions you can't answer throughout the rest of the book. Treat them as practice. While *knowing* the answer is preferable, you can learn to bluster your way through almost anything - with surprising accuracy.

If you're reading an Olympiad prep book, I will assume that your test-taking instincts are already quite good. You don't need a lecture about pacing yourself, sleeping the night before, etc. (though you should do these things). Rather, this chapter is about the quirks of biology, and IBO-style exams in particular, which can be exploited by a savvy student.

For example, take this question from the first IBO:

1. TESTING TACTICS

Example 1. Outgoing from the ecological regularity, complement the Figure into squares with the denominations of such plant's species, which can constitute, as a result, fragment of defoliated forest with natural species composition. Order of designation of species in a separate several horizons are not important. The codes of the answers:



1. durmast oak (*Quercus petraea*)
2. small-leaved lime (*Tilia cordata*)
3. European hazel (*Corytus avellana*)
4. weymouth pine (*Pinus strobus*)
5. golden osier (*Salix alba*)
6. European hornbeam (*Carpinus betulus*)
7. loranth (*Loranthus europaeus*)
8. juniper common (*Juniperus communis*)

9. frail (*Phragmites australis*)
10. daphne february (*Daphne mezereum*)
11. annual meadow grass (*Poa annua*)
12. fescue (*Festuca rubra*)
13. nightshade black (*Solanum nigrum*)
14. chickling (*Lathyrus vernus*)
15. mustard dish (*Thlaspi arvense*)
16. wood bluegrass (*Poa nemoralis*)
17. *Symphoricarpos alba*
18. *Nardus strica*

This is a *terrible* question. I would smack anyone who submitted this for a USABO today. However, it's a perfect test of tactics - you can get most of the credit from very little knowledge. Really. First, you have to...

1.1 Keep Calm and Carry On

At first glance, this question is impenetrable. How do you “complement the Figure into squares”? And a “fragment of defoliated forest” - did they spray it with Agent Orange? And I don't know any of these random species names either. Crap. Now what?

Just keep calm and carry on. Use your wits.

To answer a question, you have to know what the question actually says. Sometimes this is the hardest part. (At IBO 2003, the English speakers had a three-hour argument over what one of the practical questions meant. It was bad.)

1. TESTING TACTICS

Questions get written by non-native English speakers, translated by non-scientists, mangled by questionable edits, or all of the above. You may have to play detective to find the original intent of the question writer.

In this case, there's a clear English issue. They ask about a "defoliated" forest, which can't be right. Fortunately there's a diagram showing...a deciduous forest. That's probably what they meant. From there, the rest is pretty straightforward. An improved version might look like this:

Example 2. The diagram shows a mature temperate deciduous forest. For each layer of this forest marked by a letter, indicate which of the numbered species would be part of the natural species composition in that layer. The order of species within each layer is not important.

Now that we understand the question, we can apply basic logic to get a fair percentage of the points.

1. **durmast oak** - oaks provide large timbers for traditional wood-frame houses, ship's masts, and furniture. These are big trees, and they are "hardwoods" - they have the durable wood characteristic of a deciduous tree. Probably (a).

2. **small-leaved lime** - this is not a *Citrus* tree. It is some other small-leaved plant. Plants in the forest understory have large leaves to gather more light, so this would be (a) or nothing. Moreover, this plant must have relatives with larger leaves, since "small-leaved" is distinctive enough to be its common name. This strongly suggests that this plant is a deciduous tree. It's a dicot for sure; grasses, pines, et al aren't known for their leaf size variation. It could be a herbaceous dicot,

1.2. Know Your Dead Languages

perhaps an alpine flower with smaller leaves than its lowland cousins, but I assume they'd use a more descriptive epithet in that case. I would go with (a).

4. weymouth pine - pine trees are not deciduous. Pass.

10. daphne february - from the "february" in its name, we know this plant is active very early in the growing season. This activity must be possible in its environment, but rare enough to deserve mention in its common name. Growing in February is expected in the tropics, and impossible in the tundra - but for a temperate woodland, it's just possible. Early season growth is a common strategy of small woodland plants. If it grows in literal February, though, this plant is probably a small perennial. Such plants can blossom and sprout leaves from established stems as soon as the ground begins to thaw, yet are short enough that the extra light from leafing out early is worth the risk of frost damage. (c).

11. annual meadow grass - meadows are not forests. Pass.

16. wood bluegrass - lives in the woods, and is a grass. (d). (It's also "blue", which could refer to the chlorophyll-rich leaves needed to live at the forest floor.)

1.2 Know Your Dead Languages

As a USABO lecturer, I used to tell students that biology was 80% knowing the logic of evolved things and 20% knowing dead languages. Many scientific terms come from either Latin or Greek, and can be parsed through analogy with other science terms or modern words with the same origins. This

1. TESTING TACTICS

will save you an absurd number of points. It's not necessary to know either Latin or Greek, or even to be able to tell them apart. However, you should be analyzing scientific terms you don't know for root words that you do.

1. durmast oak (*Quercus petraea*) - *petraea* means "of the rocks". It's the same root word as "petrify" and "petroleum". It's still an oak tree, but this oak tree lives in rocky terrain, not the deep soil of a mature forest. Pass.

2. small-leaved lime (*Tilia cordata*) - *cordata* means "heart shaped". You might recognize it from "core", or if you're into old-school choral music, *misericordiam* or "merciful heart". Heart-shaped leaves are adapted for shedding rainwater from their pointed tip. This plant lives where it rains enough to support a forest. Sticking with (a).

5. golden osier (*Salix alba*) - salicylic acid, aka aspirin, was famously the active ingredient of willow-bark tea. A *Salix*, or willow, is a moderately-sized deciduous tree. (b).

7. loranth (*Loranthus europaeus*) - It's from Europe. There are lots of forests in Europe. I would pick a letter.

9. frail (*Phragmites australis*) - *australis* is easy. It means "southern"; think Australia. The southern hemisphere is not known for its temperate deciduous forests. *Phragmites* is harder, but you might make the connection to phragmoplast, which is the scaffold that forms in plant cells during late cytokinesis to serve as the basis for the cell plate. The word *phragma* means "fence". So we have a fence-like plant from the global South. Not definite, but I would pass.

12. fescue (*Festuca rubra*) - *rubra* means "red". This doesn't

1.2. Know Your Dead Languages

help much. But if you're a dead language ninja, you might know that *festuca* means "straw". No, I didn't know that either (thanks, Google!) but a straw-like plant with red leaves most likely does not belong in a forest. Pass.

13. nightshade black (*Solanum nigrum*) - unfortunately, the Latin here means the same as the English, and neither is helpful. Fortunately, the Latin tells you this plant is in *Solanaceae*, and is therefore probably a small herb. (d)?

14. chickling (*Lathyrus vernus*) - *vernus* means "spring". If a plant is so strongly associated with spring, perhaps it does the bulk of its growing early in the year, before the leaf cover grows in and blocks too much sunlight. As mentioned before, this is common behavior in woodland plants. Also, this plant is probably quite small; the English suffix *-ling* marks a small or child-like thing. (d).

15. mustard dish (*Thlaspi arvense*) - hopefully you recognize mustard as a member of *Brassicaceae*. But if you know some Spanish, you might also know that *arvenses* means "weeds". Weedy plants do not generally grow in the forest. Pass.

17. *Sym-phori-carpos alba* - "together bearing berries white". It has clusters of white berries. White berries stand out on the forest floor. This is probably not a grass or herb, but a small shrub which can hold the weight of berry clusters. (c).

18. *Nardus stricta* - there's no such thing as a *stricta*. It's *stricta*, darn it. As in "strict" and "restricted". Plants described as *stricta* have an upright, bunchy growth habit. This does not work well in the forest. Pass.

1.3 Use Hints from Other Questions

One great thing about long, content-rich exams like the IBO is the sheer amount of information they contain. There may be a hundred or more questions and answer sets, all packed with true statements about biology. These statements were written by many different people and combined towards the end of the test-writing process. As a result, it's not unusual to find the answer to one question given to you as part of another question, or to find sets of questions that have only one mutually consistent set of answers.

For example, let's see what else we can learn about temperate deciduous forests from the 1990 IBO:

Question 1990.10

The dominant of the herbal layer of an oak and hornbeam wood may be:

- A) deadly nightshade (*Atropa belladonna*)
- B) rejuvenating woodland beech (*Fagus sylvatica*)
- C) purple orchis (*Orchis macidata*)
- D) starwort (*Stellaria holostea*)

Question 1990.13

The silver birch (*Betula pendula*) belong to the trees which are:

- A) strongly light loving
- B) shade loving
- C) indifferent to light
- D) light and shade loving

In the previous question, we were asked to determine what sort of plant the European hornbeam (*Carpinus betulus*) was.

1.3. Use Hints from Other Questions

Simply by paying attention to the rest of the questions, we have a good guess. From Question 10, we know that “an oak and hornbeam wood” is a thing. These plants naturally occur together. Most people know what an oak tree is; it’s a big tree. The hornbeam is probably not fighting with the oak tree for canopy space, due to competitive exclusion. It also can’t be part of the “herbal layer”, since this niche is specified to be open in an ecosystem with oaks and hornbeams. Thus, the hornbeam is almost certainly a small tree which lives in the understory of this forest.

We may also be able to relate what we’ve learned about *Carpinus betulus* to its presumed relative, *Betula pendula*. (In my day, *Betulaceae* was in the IBO syllabus...get off my lawn, etc.) Both are members of the birch family, and birches are moderately-sized deciduous trees.

If you know “birch tree” but not *Betulaceae*, Question 13 may help you identify the hornbeam as a birch-type tree. If birch doesn’t help you, but you have followed the logic that makes the hornbeam a small tree, you may reasonably hope this other *betula* is a small tree also.

Question 1990.46

Not among the flowering plants is the:

- A) hazel (*Corylus*)
- B) poplar (*Populus*)
- C) larch (*Larix*)
- D) walnut (*Juglans*)

Question 1990.47

An angular stem, symmetrical flowers in tight inflorescences, two

1. TESTING TACTICS

longer and two shorter stamens characterise the family of:

- A) mustard (*Brassicaceae*)
- B) poppies (*Papaveraceae*)
- C) dead-nettles (*Lamiaceae*)
- D) figworts (*Scrophulariaceae*)

Question 1990.48

Willows (*Salix*) are pollinated by...and their seeds are spread by...

- A) the wind - the wind
- B) the wind - animals
- C) insects - water or animals
- D) insects - the wind

We also learn something about hazel (*Corylus*). It has a 75% chance of being a flowering plant. If you recognize larch as a pine, that chance hits 100%. You likely knew this if you've eaten hazelnuts, but still. Moreover, if you recognize the other answer choices as trees, you can assume that hazel is a tree also. (We'll get to that strategy later.) This doesn't reveal how big a tree it is, but it does reduce the set of possible answers.

Next, we are reminded that mustard is a *Brassicaceae*. You should know that *Brassicaceae* includes a variety of weedy, short-lived plants. There are a lot of great vegetables in this family, but they grow in fields, not in the woods.

Finally, we learn that *Salix* means "willow". The golden osier (*Salix alba*) is therefore a willow. If you don't know what a willow is, you do know that it's a large enough plant that wind could plausibly pollinate or distribute its seeds, since wind appears in all but one answer choice for **1990.48**.

A small shrub or herb would be too close to the ground for wind to be effective. This seems too easy to be the point of a question, so a willow is probably a tree of some kind. You may also know the word “willowy”, meaning tall, slender, and graceful, so this is probably a smaller tree rather than an oak-sized tree.

1.3.1 Answers for example questions

In the end, we have extracted perhaps 15 of 18 answers from the original question, based on super-basic knowledge (oak trees are big) and a smattering of facts that should never have been relevant (phragmoplasts are “fence-makers”). That’s pretty good. It’s 15 more points than people who looked at that question and ran away screaming got.

For the record, the full answers are:

Example 1-2. a: 2; b: 5, 6; c: 3, 7, 10, 17; d: 13, 14, 16.

10. d. **13.** a. **46.** c. **47.** d. **48.** d.

1.4 Know When to Give Up

Sometimes a question is just not answerable, and sometimes this isn’t your fault. To be blunt about it, the quality control on these exams isn’t always of the highest order. The people who are doing the final edits on these things are overworked, sleep deprived, and working on a deadline. Things get missed. For example, take this question from the 2013 semis:

Example 3. The gene for whether an individual has bending ability has multiple alleles. Assume that water bending is domi-

1. TESTING TACTICS

nant to air bending, and both are dominant to nonbending. An air bender male who comes from a true-breeding lineage marries a water bender female whose parents are both benders, but whose brother is not a bender. What is the conditional probability that these two benders will have an air bending child?

Yes, that question is unanswerable. Multiple people edited it, the edits got merged, and somehow an important piece of information went missing. (The female's parents should be *water* benders.) This was pointed out by cranky students, and the question got thrown out. If you spent half your exam trying in vain to solve this one...sorry.

If you don't know how to solve a question, you know what to do. Sometimes you have to cut your losses and move on. Make a note of it; perhaps there's a piece of information elsewhere in the test that can help you, or perhaps spending more time on it at the end will help. Don't throw away ten easy points for the chance at one hard point.

If you think the question is broken, though, you have options. At the USABO Opens and Semis level, make a note, ask your friends after the test, and if you still think it's broken, tell us. We can and have removed questions after the fact. You can talk to the USABO coordinator, or complain on the forums. (Yes, we read those.) A polite and reasoned query will generally at least get your issue looked at.

At the Finals or IBO level, you can say something in real time. This is especially true at Finals, where many of the question-writers will be in the room proctoring the exams, and on practicals, where the exam-runners are similarly right there. These people want things to go smoothly and will

listen to you if you tell them something's wrong. You might get more help than you were really supposed to; it's human nature, and you won't know unless you ask.

We've gotten better about this, at both IBO and USABO levels. Still, you shouldn't assume that the tests are infallible. If you think a question is broken, don't ignore the thought; fix it if you can, move on if you can't.

1.5 If You Must Guess

Sometimes you've got nothing. Not even a hint. It happens. Most people know the strategy of "when in doubt pick C". This actually works. It works wonders in Science Bowl, incidentally, but even in Olympiads it's a thing.

But hopefully we can do better than this. There are more advanced strategies available for picking the right multiple choice option.

1.5.1 Right answers look like the wrong ones

When people write multiple choice questions, they often write the correct answer first and then come up with 3-4 plausible alternatives. These "distractors" are based on the correct answer. You can exploit this tendency by picking the answer which most resembles the others.

For example:

Question 1990.65

The respiratory muscles of a man are:

A) the internal crosswise stomach muscle and diaphragm

1. TESTING TACTICS

- B) the external and internal intercostal muscles and direct stomach muscle
- C) the external and internal intercostal muscles and diaphragm
- D) the large and small chest muscle and diaphragm

The diaphragm is mentioned in three of the four choices. If this were incorrect, and you knew what the diaphragm really did, you'd have the answer regardless of your knowledge of respiratory physiology. This seems too easy to be the point of a question, so the correct response must include the diaphragm. (This argument was also used for **1990.48** previously.) The only other choice mentioned more than once is the intercostals. There's only one choice which includes both of these - and it's C, the correct answer.

This approach is especially powerful when applied to questions which ask you to choose a set of correct responses. Such questions have been de-emphasized, partly for this reason. But you'll still see them, and you'll still get free points.

Question 1994.64

(The actual question is irrelevant.)

- A) only 2
- B) 1 and 4
- C) 2, 4, and 6
- D) 2, 4, and 5
- E) 3, 4, and 5

There's only one answer choice which excludes 4, so that's in. There's also only one answer choice that includes 1, 3 or 6, so those are out. The only choice left is C - which happens to be the correct answer.

1.5.2 Listen for the dog whistles

This question may seem similar to the last one:

Question 1994.63

(The question is still irrelevant.)

- A) 1, 2, 3, and 4
- B) 3, 4, and 6
- C) 1, 2, 4, and 6
- D) 1, 2, 5, and 6
- E) no correct answer

Choices 1, 2, 4, and 6 all appear three times. It would be logical to pick C once more. But your instincts might instead point you to E. This is the only “none of the above” choice of the entire exam - it’s unusual. They’re up to something. And indeed, 6 happens to be false, and E is correct.

As you take more exams, you will develop a sense for the “dog whistles” that appear. These are words, phrases, or constructions that sail over the head of most readers, but if you notice them, they indicate that the question writer is up to something. For a basic example:

Question 1990.43

Photorespiration is a process typical for:

- A) all plants without exception in roughly the same intensity
- B) mainly C4-plants
- C) mainly C3-plants
- D) this process is not typical for plants

If you see the words “all” or “none”, this often signals a false statement. There’s a counter-example that you are

1. TESTING TACTICS

expected to know about. By contrast, if you see “mainly” (or similar), this often signals a true statement. There may be an exception or two that’s beyond IBO level, but they’re after the general principle.

At a lower level of question writing, false statements may be signaled by awkward constructions. (They wouldn’t have written **1990.43** this way if D were true.) At a somewhat higher level, you may see differences in wordiness or uses of qualifiers. (Look at how much **1990.43** choice A stands out in relation to the others.) These quirks are rarely definitive, but they can alert you to what the writers had in mind.

1.5.3 The right number may surprise you

One common pattern in “choose the number” questions is to make the correct answer the biggest or smallest number. This is especially true if the numbers are within a narrow range. In this setup, you don’t have to know the exact number, only that the other choices aren’t extreme enough.

For example:

Question 1990.38

Colorado beetle (*Leptinotarsa decemlineata*) was brought to Europe from North America in:

- A) 1925
- B) 1938
- C) 1947
- D) 1914

The question is irrelevant here too, but it’s perhaps the worst IBO question I have ever seen, so I left it intact for sheer

entertainment value. Unless you were a European potato farmer in the first half of the 20th century (and I rather doubt that) then you're heading straight for tactics.

If you know a little history, you can apply some logic to determine when large shipments of materials from North America to Europe were most likely to occur. 1914 was the start of World War I, and Europe would have scrambled to import food and supplies. It's a decent guess.

But you know tactics, and you're encouraged to see that 1914 is the earliest year given. It's a bit unreasonable to ask whether the beetle appeared during 1925 or 1938; it's a bit more reasonable to ask whether the beetle had *already* appeared by 1914. This is surprisingly early.

Moreover, there's something of a moral element to that surprise. It would be impressive if humans had managed to keep a common pest from hopping continents until 1947, despite the enormous (and careless) transfer of agricultural materials during and after both world wars. But putting that event in 1914 shows just how easy transferring an invasive species really is. *Surprisingly* so. A responsible biologist should know this, which is likely why this question exists.

Finally, there's a gigantic dog whistle here. All the dates are in ascending order except for 1914, which is tacked on at the end. There's no real reason to do that unless 1914 is the right answer. Perhaps the ordered list of dates made it too obvious that you're supposed to choose the earliest. Perhaps there were too many questions in a row where the answer was A. (Test writers like to make answers "look random". This is an excellent tie-breaker if you're stuck.) Regardless, your instincts should be screaming at you to pick D.

1. TESTING TACTICS

Question 1994.103

Approximately what percentage of existing animal species are invertebrates:

- A) 20%
- B) 50%
- C) 70%
- D) 95%

Again, you should head straight for the most surprising number. We tend to focus on charismatic megafauna, which makes it surprising that 95% of species diversity is among the more humble invertebrates. This is surprising more in the “science is cool” sense, but the point remains.

1.5.4 “There is no shame, there is only points”

This is an old quiz bowl saying. Did you power-buzz five words into a Justin Bieber question? Did you know every single answer in that Pokémon bonus? Hold your head high. The scoreboard does not know of shame.

Likewise, there is no shame in getting an answer because you recognized a Latin term, or remembered a tidbit of information from twenty questions ago, or parsed the answer choices to find the most likely one. It’s all part of the game. The score sheet won’t know the difference.

This does not mean you can rely on tactics alone; *knowing* the answer is always more accurate, and less time-consuming, than having to pull an answer out of your hat. However, you will never know everything, and sometimes tactics are your only option. Use them wisely.