CERP
Centre for Economic Research in Pakistan

NSB Pakistan
Learn. Compete. Inspire.

# National Science Bowl Pakistan

# Starter Pack

**Version 1.0**

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This is a starter pack to introduce schools to the National Science Bowl Pakistan (NSB-P) competition and to help them set up their own science bowl teams and practices.

The list of relevant documents are list below:

1. What is the National Science Bowl Pakistan?
   *This document provides a brief overview of NSB-P*

2. Science Bowl Competition - How it's Played & Rules
   *This document explains how the NSB-P rounds are played and goes through the basic rules. It also highlights videos of sample rounds.*

3. Setting up a Science Bowl Club
   *This document goes through a step-by-step process through which schools can set up their own science bowl teams and how to help run practices, mock tournaments, and practice for the competition.*

4. Sample Questions
   *We provide some sample questions from past actual science bowl tournaments.*

5. Guide on how to study *V1.0 [Updated 5th Oct 2021]*
   *This document provides tips on how to prepare for the NSB-P including how to practice by creating your own questions.*

# What is the National Science Bowl?

The National Science Bowl Pakistan (NSB-P) is a science knowledge competition modeled on the successful quiz bowl format of the US National Science Bowl.

The goal of NSB-P is to inspire children with the love of science. Students are quizzed in Biology, Chemistry, Earth & Space, Mathematics and Physics using an exciting and fast-paced team competition format. In each round of competition, two teams compete head to head in a time-bound "buzzer-based" round.

NSB-P started in the summer of 2019 through the efforts of US High school students (Lexington, MA), and has since then become a joint initiative of the Center for Economic Research Pakistan (CERP), the Pakistan Innovation Fund (PIF), and the Society for Better Educational Engagement at LUMS (BEE).

2020-21 saw the first full round of NSB-P competitions in Pakistan that started with regional tournaments in Islamabad, Karachi, and Lahore featuring some of the leading schools in Pakistan and culminated in the Finals held virtually on February 6-7 2021. The team from the Karachi Grammar School won the overall competition.

Our hope is to build on the positive momentum from the first year and expand the program to include schools from all over Pakistan. Talent is not confined by race, religion, or income and we seek to inshAllah celebrate talent wherever it is.

We invite you to join us by having the best and brightest students from Pakistan participate in the upcoming NSB-P. Please refer to the NSB-P Starter Pak as well as download the NSB-P App to get going!

Our regular cycle will consist of qualifying rounds in late October/November, followed by regionals in Late November/December and national Finals in February.

To enter teams into this year's competition please register by Oct 1st using the link here. If you would like to find out more or are interested in helping please email us at join@sciencebowl.pk.

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# NSB-P
# How it's Played & Rules

# MATCH & TEAMS

The Match:

- Two teams compete in a match head-to-head
- The march lasts a fixed amount of time
- The team with the highest total score wins

The Teams:

- Each team consists of 4 main players and an optional substitute player (who can be subbed in between matches)
- The team is lead by team captain (C)

# MATCH OVERVIEW

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- Each match begins with a TOSS-UP question
- A student has 5 seconds to buzz in and answer - if the time elapses and no one answers the moderator will move to the next TOSS-UP question
- The student who buzzes fastest within the allotted time gets to answer after his/her name has been called out by the moderator. No consultation is allowed in a TOSS-UP question
- If a student answers the TOSS-UP question:
  - Correctly: their team earns 4 points and gets to work together to answer a BONUS question (worth 10 points)
  - Incorrectly: the opposing team gets to buzz-in. If they answer correctly they gets to work together to answer a BONUS question
- The above process continues till the allotted time for the match ends
- sample videos

# The BONUS Question

- Recall a team can ONLY answer a Bonus question if they get a TOSS-UP correct
- A Bonus Qs. is worth 10 points
- The team has 20 seconds to consult with each other and answer. The answer is provided by the team captain
- Note: The opposing team DOES NOT participate in a bonus question.

# PENALTIES

1. **Blurt:**
   - After buzzing in, a student must wait to be verbally recognized (called out) by the moderator, before giving the answer
   - If the student answers before they are recognized(called out) by the moderator a blurt penalty of 4 points is awarded to the other team

1. **Interrupt:**
   - Students can buzz in before the question has been fully read by the moderator
   - But if the answer is incorrect there is a 4 point penalty awarded to the other team and the opposing team gets to answer the question (it is reread from the beginning)
   - A Double interrupt happens if the opposing team also interrupts and also face a 4 point penalty

# Short Answer /MCQ

Both Toss-up and Bonus questions are either

Short Answer or Multiple Choice

A participant can answer a multiple choice question with either the letter answer (W, X, Y, or Z) or the verbal answer.

W) Answer 1

X) Answer 2

Y) Answer 3

Z) Answer 4

If verbal answer is given, it must be exactly as indicated in the question or as read by the moderator  (with the exception of mathematical expressions)

The first response, as determined by officials, is the only one that counts. But if a participant gives both the letter answer and the verbal answer, both parts must be correct.

Prefacing remarks such as “my answer is” or repeating the question, as determined by officials, may be considered as delaying the game and will be counted as an incorrect answer.

# CHALLENGE

- Challenges CAN be made to the scientific content of the question (whether a question is scientifically correct or not)
- Challenges CANNOT be made to the judgment calls by the officials
- Challenges must be made before the moderator begins the next question
- If answer on a toss-up is incorrect, and the team wishes to challenge the scientific content of the question, the first team must hold the challenge until after the opposing team has completed its toss-up opportunity
- Challenges to scientific content are limited to 2 unsuccessful challenges per team per round
- Successful challenges do not count within this limit

# SCORING

## Correct answers

- Toss-up : +4 points, a bonus question
- Bonus : +10 points

## Incorrect answers

- Toss-up : 0 points, opportunity for opposing team to answer
- Bonus: 0 points

## Penalty for a blurt

+4 points to opposing team

## Penalty for an interrupt followed by an incorrect answer

+4 points to opposing team

## Consultation among team members on a toss-up question

+0 points, answer does not count even if correct

# SCORING FOR ROUND ROBIN

Every team will always get the points equal to their score for the match

A WIN will add 100 points to that score

A TIE will add 50 points to that score

A LOSS will add {50 points minus number of points by which the team lost}.

Examples:

Lose by 1 point —add 49 points(50 -1)

Lose by 40 points —add 10 points(50-40)

Lose by 50 points —add 0 points (50-50)

Lose by more than 50 points—add 0 points( a minimum of 0 points will be added)

*This document outlines how a school and/or set of students can set up their own science bowl team and subsequently be able to participate in the National Science Bowl - Pakistan.*

## I. Forming a Pakistan Science Bowl Team

The most successful teams at Science Bowl events (and academic competitions in general) typically have an after-school club dedicated to the activity. Thus in order to succeed in Pakistan Science Bowl it is imperative that you first form a club, this club can initially start out as you and a few friends competing with a teacher as your course and slowly grow over time to the point where there may be excess of 50 students trying out for the school's Science Bowl teams. Once you have formed a science bowl team in your school you should contact the competition organizers and begin preparing to compete in the Pakistan Science Bowl competition.

### Hold weekly practice sessions to attract enthusiastic students

Many of the most successful schools hold weekly open practice sessions in the start of the year to give anyone who is interested a chance to play – while many 9th and 10th grade students may not yet be well-equipped to be on a competing team, engendering a passion for Science Bowl early on ensures that your team will have talented players for years to come. A good strategy for open practice sessions may be to read easier questions from our question database.

For these open practices early on, it is fine to alter the competition format to maximize the amount of practice that the students receive (one important exception: make sure to enforce the blurt rule. Students should be well-trained to not blurt before they compete). For instance, if the buzzer system you are using supports more than 8 players, it is better to allow more students to participate. All players should be encouraged to solve bonus questions, and an alternative way to practice before teams are picked is to simply treat bonus questions as 20-second toss-ups open to everyone. This way, every bonus question gets read, regardless of if the toss-up was answered correctly. If there are more students interested than available buzzers, make sure to rotate frequently so everyone has an opportunity to play.

For those unacquainted with the rules of the competition and how rounds are run refer to the guide linked here.

### Pick competing team(s) early to afford time for focused practice and specialization

It is important to start organizing the team(s) as early as possible – the start of the school year typically precedes the regional Science Bowl competitions by only a few months. This may seem like a lot of time, but it can quickly disappear due to other student obligations. We suggest that coaches narrow down their competing team(s) by early October so that students will know whether or not they should be dedicating more time to science bowl in order to succeed.

Selecting your team can be a 2 step process if you have enough students trying out, if you have more students trying out than there are team slots available it is best to have a few initial practices followed by tests given to the students in 2 subjects of their choosing(these will be the subjects the

students will specialize on later on). Based on these results a school can then form it's teams (dividing them into teams numbered A B C and so on depending on how many students they select). Once this is done practices will continue to be held and teams should still remain fluid as if someone turns out to be far better than initially. thought or if someone is performing poorly teams can be adjusted as needed.

Once teams are picked, students should begin to focus far more on practice. Wlth the club holding practice sessions at least once a week (though more is better). This time period should really be focused on improving your top teams in order to prepare them for the regional competition and ensure that they perform well.

**Dividing Subjects**

In order to maximize their chances, a team must be willing to maximize the efficiency of their studying. The advice in this section is mostly directed towards team captains and coaches, but anyone who has an interest in the strategic aspects of Science Bowl will find useful information here.

At the time of writing this guide, there are six categories of questions in the National Science Bowl, all of which have varying amounts of synergy with each other. As a coach, you are responsible not only for picking the best players, but for picking a team that will overlap minimally. The reason that most mid-upper tier teams cannot break into the highest tier of competition is because their players have far too much overlap in their knowledge.

Ideally, a coach would like to see four strong players during tryouts with good breadth of knowledge, but they are slightly stronger than each other in different areas. Unfortunately, this situation is incredibly unlikely. This guide will discuss a realistic "best case" and "worst case" scenario that coaches will commonly see during the Science Bowl preseason and the best ways to transition out of these situations.

Most commonly, a good year will produce one generalist and two or three weaker subject-specific players. With some gentle urging, this combination of players is easily capable of placing within the top teams at Nationals. The challenge lies within getting the players to maximize their practice efficiency.

As an example, the following table is the subject splits of a recent top tier team.

| Player: | Captain | A1 | A2 | A3 |
|---|---|---|---|---|
| Main Subject: | Biology | Earth and Space | Mathematics | Chemistry |
| Secondary Subjects: | Physics, Earth and Space, Energy | Physics, Math, Energy, Chemistry | Physics, Energy, Biology | Physics, Energy |
| Weak Subjects: | Math | Biology | Chemistry | Earth and Space |

As you can see, this team shores up its weaknesses in physics and energy by having everyone study the two subjects on the side. At the same time, they have no overlap in their weaknesses or main subjects, resulting in a very strong team overall. The strongest players (Captain and A1) have the most responsibility in terms of knowledge breadth, while the other two players are focused more on depth of knowledge.

Every coach should aim to pick the four strongest members who all focus in different subject categories. If the team is going to have an alternate, the alternate MUST overlap completely with one of the other team members. Far too many teams delegate their least favorite subject to the alternate, only to never play their alternate during a round and give away free points. An ideal team should split their subjects in the following way:

| Player: | Captain | A1 | A2 | A3 |
|---|---|---|---|---|
| Main Subject: | Biology | Mathematics | Earth and Space | Chemistry |
| Secondary Subjects: | Chemistry, Earth and Space, Energy | Physics, Chemistry, Energy | Physics, Energy | Biology, Physics |
| Weak Subjects: | Math | Biology | Chemistry | Earth and Space |

Essentially, any balanced team should never have any overlap in strongest subjects or weakest subjects. Ideally, the strongest, fastest players should be focusing on the main three of the Science Bowl subjects, biology, chemistry, and physics. Because most, if not all, competitors have been exposed to those three subjects, the only way to guarantee points from those questions is to designate your strongest team members to learn those subjects. The "peripheral" subjects of energy and the earth and space sciences are better designated to the slower players simply because more of the tossups in those subjects will be uncontested by the other team during buzzer races.

**Choose motivated students who have an intrinsic desire to compete in Science Bowl**

In terms of team selection, students often demonstrate variance in both interest in Science Bowl and prior preparation, so it's important to select a team that not only has good *a priori* science knowledge but is also composed of students that are passionate about Science Bowl and will be able keep each other motivated through practice matches and study sessions.

Pakistan Science Bowl, much like the other academic competitions your students compete in, requires time and effort to excel at and it is difficult to achieve excellence if your students have their attention split between too many activities. Moreover, the actual day of the competition should be thought of as the culmination of a team's preparation and practice rather than the focal point of the Science Bowl experience. It is, therefore, a priority to pick students who have the interest and time

to prepare effectively for the competition, so that the effort they put forth will grow their knowledge and ability far beyond any initial differences between students.

We also find that exposure to the competition is one of the best indicators for future Science Bowl success, so building teams with highly-prepared older students and promising younger students ensures that your team will have a good team not only this year, but also in future years. Remember that every team must have either four or five competitors and that teams may not be shuffled around between the Regional and National competition should your team qualify. Also, it is recommended that coaches place 5 students on each team: if one student cannot attend the National Finals, the other four students will still be eligible to attend. Teams of three students are NOT eligible to attend the National Finals.

## II. Preparing for the National Science Bowl-Pakistan

There are several vectors along which you can focus your efforts toward improving your Science Bowl team, each of which is important. Broadly speaking, we recommend spending in-person sessions running practice competitions and allowing the students to study on their own time.

### In-person meetings should be practice sessions with their own questions

In practice it is necessary for there to be high quality questions in order to best prepare for the Science Bowl Competition, while initially it may be fine to draw from one of our question databases initially and for less experienced students for those with experience getting good rounds is the key to success. This can be accomplished by having them write rounds for each other, and by trading these rounds with other teams thus allowing all teams to maximize the amount of practice they get thus improving the overall quality of the competition. Meetings should at the very least be held weekly ensuring students get in a regular amount of practice.

### Students should take note of questions they missed so they can research those topics

During practice sessions, it is likely that your students will hear several questions that they do not know the answer to. Because Science Bowl questions tend to revisit the same major topics year after year, it is a good practice for your students to make note of the questions that they missed so that they can look up those topics in their textbooks on their own time. It is no coincidence that the strongest Science Bowl teams have read thousands of practice questions during their practices – this serves to familiarize the students with both the nature of the competition and the spread of topics that we feature in our questions. A good practice is for students to write their own practice questions about topics they are researching to help crystallize the knowledge – as we will discuss below.

### Students should be studying on their own time

In person meetings primarily serve just to get in practice for the competition itself, as a result science bowl is mostly self motivated when it comes to studying so students need to be willing to take time out of their day in order to study the topics that science bowl covers. When it comes to studying,

students should refer to the study guide linked here that outlines the basics of studying for the science bowl competition.

**Students should write questions using their study materials**

One of the main study strategies that perennial Science Bowl powerhouses use is to write Science Bowl questions from their study materials. Just as teaching some material is one of the best ways to crystallize knowledge of that material, writing practice questions as you study is one of the best ways to think about what types of questions could be asked about the material you have just learned. Not only is this a good technique for studying, but it also ensures that the Science Bowl club will have a backlog of additional practice questions for years to come. Furthermore, students should try to "get in the heads" of the question writers by mimicking the style and construction of Science Bowl questions in order to ensure that their questions are both useful for their own learning and as practice tools for their teammates. For more information on the details of question writing Refer to the guide linked here.

**Remember that Science Bowl is a journey, not just a destination**

We believe that academic competitions and Science Bowl, especially, are best thought of as a journey. Every after-school meeting, practice round, and study session is an important part of what makes Science Bowl a valuable experience and regardless of whether your team wins or loses, your students will have learned a lot about science, discipline, and the benefits of deliberate practice. As such, it is important to set realistic goals about how much time you and your team can devote to Science Bowl and what results can be achieved given that much practice and study. While we have had instances of newly-formed Science Bowl teams winning their regional competition and, in one case, placing in the top three at the Pakistan Science Bowl, in most instances newly-formed teams find that Science Bowl is a difficult but rewarding activity that requires deliberate preparation. By setting challenging goals that will push your students and celebrating when they succeed, we believe that the Pakistan Science Bowl will be a deeply valuable experience for you and your students!

*We provide some sample questions from past actual science bowl tournaments.*

# *Sample Round : 10x2 Questions*

***Answer Key at end***

***TOSS-UP***

*1)BIOLOGY Multiple Choice The common cold is an infection caused by which of the following?*

*W) Virus*

*X) Bacteria*

*Y) Fungi*

*Z) Protist*

***BONUS***

*1) BIOLOGY Short Answer A mammalian cell is enucleated, what is the most likely identity of this cell?*

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***TOSS-UP***

*2) BIOLOGY Multiple Choice Which of the following descriptions best describes Huntington's disease?*

*W) Autosomal recessive*

*X) Autosomal dominant*

*Y) Sex-linked recessive*

*Z) Sex-linked dominant*

***BONUS***

*2) BIOLOGY Short Answer Tay-Sachs disease is caused by the defect of what organelle, resulting in lipid build up in the brain?*

**TOSS-UP**

*3)MATH Short Answer Anka is creating an outfit out of hats and scarves. If she has 4 different hats and 5 different scarves, how many outfits can she make if she must choose one hat and one scarf?*

**BONUS**

*3)MATH Short Answer What is the sum of all odd integers between 1 and 11, inclusive?*

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**TOSS-UP**

*4)MATH Short Answer The variance of a set of temperature measurements taken in degrees Celsius has a numerical value of 5. If they are converted to degrees Fahrenheit by multiplying each reading by 1.8 and then adding 32, what is the new numerical value of the variance?*

**BONUS**

*4)MATH Short Answer Four circles of radius 1 are centered at the corners of a square with side length 2. A fifth circle with radius r and center coinciding with the center of the square is tangent to the other four circles. Find r.*

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**TOSS-UP**

*5)PHYSICS Multiple Choice What force perpendicular to a surface is responsible for keeping objects on the surface?*

*W) Friction*

*X) Normal Force*

*Y) Gravity*

*Z) Buoyancy*

**BONUS**

*5)PHYSICS Short Answer A 10 kilogram ball is rolled along a frictionless surface at a constant velocity of 6 meters per second. What is the linear momentum of the ball?*

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**TOSS-UP**

*6)PHYSICS Multiple Choice At what angle does polarization by reflection occur at the intersection of two media?*

*W) Critical angle*

*X) Brewster's angle*

*Y) Snell's angle*

*Z) Maxwell's angle*

**BONUS**

*6)PHYSICS Short Answer Light must pass through two polarizers to reach a target. The angle between the transmission axes of the polarizers is $30^{o}$ . In terms of the initial intensity of light I, what is the transmitted intensity at the back of the two polarizers?*

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**TOSS-UP**

*7)CHEMISTRY Short Answer What is the atomic number of oxygen?*

**BONUS**

*7)CHEMISTRY Multiple Choice Which of the following particles is not found in a carbon atom?*

*W) Photon*

*X) Neutron*

*Y) Proton*

*Z) Electron*

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**TOSS-UP**

*8)CHEMISTRY Short Answer Identify all of the following 3 statements about sigma and pi bonds that are true:*

*1. Pi bonds are higher in energy than sigma bonds*

*2. Pi bonds display cylindrical symmetry*

*3. Triple bonds contain 1 sigma bond and 2 pi bonds*

***BONUS***

*8) CHEMISTRY Short Answer Order the following three compounds in order of least to most positive oxidation state of oxygen:*

*1. CO 2*

*2. OF 2*

*3. Na 2 O 2*

***TOSS-UP***

*9)EARTH AND SPACE Multiple Choice Plate tectonics is driven by which of the following?*

*W) Convection under the Earth's surface*

*X) Conduction under the Earth's surface*

*Y) Radiation under the Earth's surface*

*Z) Advection under the Earth's surface*

***BONUS***

*9)EARTH AND SPACE Multiple Choice What type of rock is sandstone?*

*W) Igneous*

*X) Sedimentary*

*Y) Metamorphic*

*Z) Mineral*

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***TOSS-UP***

*10) EARTH AND SPACE Multiple Choice Pointing a spectrometer at a source of electromagnetic radiation passing through a medium, what type of spectrum would occur?*

*W) Continuous*

*X) Emission*

*Y) Absorption*

*Z) Paschen*

***BONUS***

*10)EARTH AND SPACE Multiple Choice Which of the following would not increase the resolution power of a telescope?*

*W) Utilizing interferometry*

*X) Increasing lens diameter*

*Y) Increasing seeing*

*Z) Increasing the telescope's altitude*

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*Answer key:*

1.
   a. *TOSS-UP ANSWER: W) Virus*
   b. *BONUS ANSWER: Erythrocyte*
2.
   a. *TOSS-UP ANSWER: X) Autosomal dominant*
   b. *BONUS ANSWER: Lysosome*
3.
   a. *TOSS-UP ANSWER: 20*
   b. *BONUS ANSWER: 36*
4.
   a. *TOSS-UP ANSWER: 16.2*
   b. *BONUS ANSWER: $\sqrt{2}$ -1*
5.
   a. *TOSS-UP ANSWER: X) Normal force*
   b. *BONUS ANSWER: 60 kilograms meters per second*
6.
   a. *TOSS-UP ANSWER: X) Brewster's angle*
   b. *BONUS ANSWER: 3I/8*
7.
   a. *TOSS-UP ANSWER: 8*
   b. *BONUS ANSWER: W) Photon*
8.
   a. *TOSS-UP ANSWER: 1 and 3*
   b. *BONUS ANSWER: 1, 3, 2*
9.
   a. *TOSS-UP ANSWER: W) Convection under the Earth's surface*
   b. *BONUS ANSWER: X) Sedimentary*
10.
   a. *TOSS-UP ANSWER: Y) Absorption*
   b. *BONUS ANSWER: Y) Increasing seeing*

*This document provides tips on how to prepare for the NSB-P including how to practice by creating your own questions*

*V1.0 [Updated 5th Oct 2021]*

# Guide on How to Study



## Studying

Please find an introduction to answering and writing questions **directly** from experienced science bowl participants and coaches. To study, use the textbooks that you have first and then move on to

supplementary texts. Supplement texts will be added to this document in later versions. You'll find subject specific tips at the **end of this document**.

## Helpful Tips

Studying habits are a truly important thing to develop if you want to do well. Since you are all going to be starting out, none of you are expected to know how to study, however, there are some things you should know.

- Do not let studying impede your school work
- Study, **A LOT**. Go through a wide variety of sources, however, if you just want to get good at your subjects fast, just read the textbooks, and take a lot of good notes!
- Taking notes is really good for memory retention and it also helps you quickly reference important information without having to look through the textbooks
- Many newer students seem to disregard note taking when studying, but it vastly improves retention rate while simplifying future review. At the very least, every keyword should be written down, but by far the most effective method of studying is to write down every fact that you do not already know. Frequent review of your notes will force this knowledge into your quickly accessed long term memory.
- Get confident in your subjects. The more you think you know the answer, the more likely you are to know the answer. **TRUST IN YOUR INSTINCTS**.
- If no one is buzzing, and you're not interrupting, please buzz. Literally there are **no** consequences for buzzing and getting it wrong. In-fact, if you don't guess at all, you will not make the cut.

## Misconceptions

Most students are limited not only in their knowledge, but they also tend to possess misconceptions about how to properly acquire knowledge. The following is a list of a few of the most crippling of these beliefs. 1. Science Bowl Questions are Trivia. One of the biggest assumptions that newer students glean after watching a round of Science Bowl is that the questions are trivia questions. This assumption seems to arise from the fact that most freshmen have never learned science in a structured, methodical way, so the few

answers that they do know came from a myriad of sources. THIS IS WRONG, please properly study the textbooks.

**The trap that newer students tend to fall into is thinking that they'll never be able to efficiently improve their knowledge pool through studying.** Fortunately, this error is easily corrected, but the recent history of Science Bowl is littered with teams that fail to instill proper training methods in their younger members. The only reason that this misconception gets perpetuated is the general lack of good study habits exhibited by lower to mid tier teams, even by their more experienced students. Because they never take the opportunity to correct the misconceptions of the previous students, this misconception is perpetuated endlessly. If you want to become good at the Science Bowl, you must learn from the **strongest students** who have come before you. The biggest questions are: what sources do you learn from,and how do you learn it? The very best students who know what they are doing are always the students you should be putting blind faith in, while you should think carefully about the advice that you get from less skilled students. By ingraining the study and practice habits of top students, any weaker parts of your play can easily be shored up. The major advantage of learning from many strong students is that there is not just one way to improve at Science Bowl. While many students can reach the middle tier of play with merely a rigorous course load, making the push to the mid-upper tier requires a minimum of 60 hours of studying.

**Oftentimes, newer students blame their inability to answer questions in a round on their reflexes. The most common excuse tends to be, "I knew the answer to sixty more questions, but his brain was faster than me!"** However, there is a distinct difference between having a general idea of what the answer is and having the confidence to buzz in early. After the answer has been read, it is easy for students to convince themselves that their inkling of the answer meant that they actually knew the answer, but the ability to buzz in early in high pressure situations is something that only results from true, comprehensive knowledge of the question. **The most important myth in regards to speed that newer students must dispel from their minds is the idea that reaction time has any effect on your play.** On the other hand, any lack of confidence in a player's knowledge can cause up to several seconds of hesitation, which is where the misconception of "my reaction time wasn't fast enough" arises.

# Question Writing Guide

There is a lot more to success in science bowl than simply learning from textbooks. It is crucial to understand how questions are written in order to be able to buzz as fast as possible on them. The best way to accomplish this is by writing questions on the material you learn. This has two major benefits: Firstly it greatly improve your retention as you remember what you are writing and can quiz yourself using those questions later, secondly IT allows for you to understand how a question for a certain answer would be worded so when you hear a question on the same topic again you will be able to buzz on it more quickly.

## Introduction

Writing a packet of Science Bowl questions may seem like a daunting task. Indeed, it is a lot of work, and it is enticing to take shortcuts. However, it is well worth your time - and your teammates' time - to be thorough and complete with your question sets. First, we'll discuss the idea behind Science Bowl packets, and what they entail, and then move on to the various question types. Finally, we'll go over what to do when writing your questions, and some other helpful tips to facilitate the writing process.

## Question Sets

A Science Bowl question set, depending on the context, has any number of questions in any number of subjects. The subjects considered canon by the Department of Energy include biology, chemistry, earth and space science, energy, mathematics, and physics. There are two main kinds of question sets: lightning rounds and team rounds.

### Lightning Rounds

Simply put, a lightning round is a round where every participant can buzz in on any question at any time. There are two main types of lightning rounds: subject-specific lightning rounds and varied lightning rounds. Additionally, a round may be "half" a round (that is, 12 or 13 questions), or a "full" round (that is, 24 or 25 questions). Since there are six subjects, some people like to write two or four questions per subject in a round. Others like to write two or four questions per subject in a round, except for one subject, for which that person will write three or five questions. There is a certain amount of lenience; as long as you write an evenly-distributed round, then you have completed your task.

Subject-specific rounds will have any number of questions on one of the six main subjects - most commonly, 25. There are variations to this rule - indeed, more so than for varied lightning rounds. If statistical data is being collected, rounds can be collections of 100 or more questions on a single subject.

### Team Rounds

In a team round, two teams of four to five people each compete for a toss-up, worth four points. The team that gets the toss-up will hear a bonus question, worth ten points. No conferring is allowed when competing for a toss-up question, but the team that gets the toss-up correct will be able to talk about the bonus questions for twenty full seconds after the question is read before the answer must be given by the captain. In general, bonus questions are considerably harder than toss-up questions, not only because there is more time to think, but also because they are often more of a collaborative effort. Rarely do students write subject-specific team rounds - instead, nearly all questions in team rounds are distributed equally among the six subjects.
As with lightning rounds, team rounds are either half rounds or full rounds. Half rounds most commonly consist of 12 toss-ups and 12 corresponding bonuses, and full rounds most commonly consist of 25 toss-ups and 25 corresponding bonuses (again you can see the 24+1 arrangement). Team rounds require a great deal of work to write, as a full team round is twice as long as a lightning round, and writing bonuses is an added challenge.

## Questions

In a standard Science Bowl round, there are exactly two types of questions: Short Answer questions and Multiple Choice questions. There are, in reality, many different types of questions. However, each one boils down to one of those two types.
I'll begin by talking about Multiple Choice questions, as they tend to be very similar among the subjects, and then we'll go into the vast complexity that is writing a Short Answer question.

### Multiple Choice Questions

Multiple choice questions consist of a preceding statement (usually a question), and four choices (labeled W, X, Y, and Z to eliminate vocal confusion like there would be with A, B, C, and D). There is a 1/4 chance that you will get a multiple choice question correct if you guess randomly (though this is obvious, it's important to note chances like this). In order to get the question right, you

must either say the correct letter that corresponds with your answer, or you must say **exactly** what the answer line says. Exactly means letter-for-letter if you say "Gastropod" and the answer is "Gastropoda", then you will lose the points.

There are usually two main motivations for writing a multiple choice question. Either:

1. Each of the four answers is a statement, and one of the statements is not like the other (either only one is false or only one is true), or
2. Each of the four answers is a **guessable** term, and therefore strategic interrupts are encouraged.

There is one more motivation that does not fall under these two - basically, a miscellaneous category. we'll go over that as well.

## Statement-Style Multiple Choice Questions

These questions are one of two types of questions that includes choices revolving around statements (the other being pseudo-multiple-choice questions, which we'll discuss later). These questions tend to encourage in-depth knowledge surrounding one subject, such as stereochemistry within the subject of chemistry itself. (You wouldn't see a statement-style multiple choice question that includes statements about diversity, genetics, anatomy, and cytology, for instance.) There are basically two types of these statement-style multiple choice questions - either every answer is true, except for one, or every answer is false, except for one. I'd estimate that there are more questions where all are true, but one is false, but truthfully either one could happen.

Here is an example of a difficult statement-style multiple choice question:

**Earth and Space Science** *Multiple Choice* Kirchhoff's three laws dictate the three types of line spectra. Which of the following is not one of Kirchhoff's three laws?

W) If light comprising a continuous spectrum passes through low-density gas, an absorption spectrum will result.
X) A hot, low-density gas will produce light with a continuous spectrum.
Y) A low-density gas excited to emit light will do so at specific wavelengths,producing an emission spectrum.

Z) An excited, hot solid object produces light through blackbody radiation.

ANSWER: X) (high-density gas produces continuous spectra, while low-density gases produce emission spectra)

Let's analyze this question a bit. It's very obvious from the end of the preceding statement that you will not be able to guess exactly the answer. This question centers around one specific facet of astronomy: line spectra. The answer X is wrong for two reasons: first, continuous spectra only result from high-density things, like solids, liquids, and high-density gases. Second, low-density gases will produce emission spectra, as shown by the answer Y (which is correct). Even if you do not know line spectra or Kirchhoff's three laws, you might be able to get this question correct if you analyze the wording, noticing that X and Y contradict each other.

Let's briefly discuss buzzing strategy. There are two good buzzes here. First, if you know the subject well, you should prepare to interrupt after the question itself is read - that is, during the choices. The second you hear the word "continuous", if you know the subject well enough, you should buzz in. If you aren't confident, it is better to wait until the end of answer Z to buzz in. There is minimal strategy; either you are confident, and you interrupt, or you are not, and you do not.

There is one bit of strategy that does not apply to this question, but applies to many statement-style multiple choice questions. Due to paralellism, you can predict what W, X, Y, and Z will be in relation to each other. For example, if W is "thermodynamically stable and labile" and X is "thermodynamically stable and non-labile", you can safely predict that Y will be "thermodynamically unstable and labile" and Z will be "thermodynamically unstable and non-labile". Therefore, if you know the answer is Z, in that case, you can actually buzz in after X to say Z. Otherwise, you could say "thermodynamically unstable and non-labile", but you have to be careful; it's sometimes very easy to mix up a word or two and then it's all over for you.

One small thing I'd like to point out: the reason X is wrong is written in the answer line. This is done so if someone asks "why" at a practice, we'll have an answer for them. This is, in my opinion, **very important**. Too often, practices become sidetracked with needless discussion over why a question's answer is right, largely because the question-writer was autopiloting while writing the question. It's a really good thing to learn from writing questions, and you can't learn if you don't know why an answer is right! Do it for the team, and do it for yourself.

Writing questions like this isn't as hard as it looks. More often than not, you can look in paragraph or a section of a textbook, judge which statements are important for students to know, and select

four statements to include in the question. Then, make one wrong in a way that educated students will be rewarded (bad etiquette is to change simply one word, like from "less" to "more", unless it is very important that the quantity is "less" rather than "more"). Overall, this is a preferable question style. It rewards those who know the subject and rewards those who can logic out the correct answer with only minimal knowledge on the subject. However, the chance of guessing it right is still only 1/4, making it preferable for toss-ups and only good for bonuses if it is pretty difficult.

## Term-Based Multiple Choice Questions

This is one of the most common types of questions in a typical Science Bowl packet, and is one of the most difficult to master despite its apparent simplicity. A question is posed, and four terms are presented. There are some very good buzzing strategies with these types of questions, especially compared to statement-style questions. First, we'll offer an example, then analyze the buzzing and writing strategies.

**Biology** *Multiple Choice* What is the name for the final chamber of the stomach of many ruminants, in which cud is digested by the animal's own enzymes, rather than those of microorganisms?
W) Reticulum
X)Rumen
Y)Abomasum
Z)Omasum

ANSWER: Y) ABOMASUM

First, let's go over buzzing strategy. The **best possible buzz** would be after the word "ruminants." The important thing to note with such a buzz is that there is **no other possible word** for "Abomasum". However, if the question were different, it would be in your best interest to wait. we'll go over a question like that later. Beyond the word "ruminants", the next-best possible buzz would be after "own enzymes". However, let's say you're not confident enough to say the answer, and instead want to say one of the letters. That's fine; let's do that. You hear W, and know it's wrong. Same thing for X. As the moderator says "Y", you must prepare yourself: the first syllable of

Y will give the answer away. If the first syllable is ”Ab”, the answer is Y; if it is anything else, the answer is Z. The syllable ”Ab” is said, and the answer is Y.

But what if there were other words for ”Abomasum” - would it still be good to interrupt? Unless you want to try your luck, the answer is **no**. A good example is where the answer is a person’s name. The initial clue indicates to you that the answer is ”Turing”, and you know this. However, you recall that the moderator said ”Multiple Choice” before reading the question, and so you must choose to wait. (A good way to do this is to write SA or MC on some paper as the question is read so you do not forget.) You know the answer is probably ”Alan Turing” or “Turing”. You hear the first choice - it’s ”Paul Erdos”. Since you know that multiple choice questions have parallelism, you can buzz in and say “Alan Turing”, since each answer is both the first and the last name of the person.

Question-writing strategy is usually very easy for these types of questions. You look through a textbook, find a group of three to five terms, choose one to define, and then put them as multiple-choice answers. The only important thing to remember every time is that **when writing multiple choice questions, the answers must be parallel.** Said another way, if one answer is ”transmission electron microscopy”, the next one better not be ”light microscope” it has to be ”light microscopy”. Otherwise, writing these questions is a matter of choosing a group of important terms to know and defining just one of them in a uniquely identifying way.

## Miscellaneous Multiple Choice Questions

Most commonly, math multiple choice questions fall under this category. It’s important to know that for mathematics questions, commonly **the multiple choices are simply put there to extend the amount of time students have to work on the problem.** We don’t think we need to explain an example here. If you think a math short-answer problem will take too much time (more than 3 seconds), then put some plausible-sounding choices in order to extend the time.

The second major question type that falls under ”miscellaneous” is magnitude questions. These are common in Earth and Space Science questions, Energy questions, and rarely Physics questions. These questions have answers that range widely in scale. For instance, the answers may be W) 20 percent, X) 40 percent, Y) 60 percent, and Z) 80 percent. Real examples may vary; they could be W) 1000 years, X) 10000 years, Y) 100000 years, and Z) 1000000 years. There are two important things to know when writing these questions: the answers must be **ascending or descending**, and the answers must be **significantly far apart.** Clearly, 21 percent and 24 percent are not acceptable answers. (Who would memorize the percentage down to the ones place?) Just be reasonable when writing these.

### Brief Conclusion

Multiple Choice questions are great for toss-ups, because there is lots of strategy involved in buzzing in on them, and there is a 1/4 chance you will get it right even if you guess randomly. This is low enough to discourage crazy guessing before the question is even read, but high enough to encourage educated guessing when no one knows the answer for sure. As for bonuses, it is best if the question is short answer, but I've seen many multiple-choice bonuses that are statementstyle (and even some difficult term-style questions). Multiple Choice questions are easy to write straight from textbooks, and usually require the least effort. Overall, they're really a great way to test knowledge, though they do have their shortcomings.

## Short Answer Questions

Short answer questions are generally much more difficult than multiple choice questions in nearly every regard. They either cannot be guessed or the likelihood of guessing right is much lower. They can be longer and more difficult to interpret in a short amount of time. They are also difficult to write. Despite all this, they are very accurate judges of knowledge, and should be used often within a round. For lightning rounds, we usually do half multiple-choice and half short-answer, and in team rounds, it's usually more like one-third multiple choice and two-thirds short-answer. As with multiple choice questions, there are two main types of short answer questions:

1. Pseudo-multiple-choice questions, where each answer is preceded by a number, and the student must give some combination of numbers as an answer, or
2. Term-based questions, where the student must give one or more terms.

### Pseudo-multiple-choice

Pseudo-multiple-choice questions work just like multiple-choice questions, but are often even more diverse in their writing styles. As with multiple-choice questions, there are statement-style pseudo-multiple-choice questions and term based pseudo-multiple-choice questions.

#### Statement-style Pseudo-multiple-choice

These questions are often the hardest questions you will encounter in Science Bowl, despite being guessable. These questions always either have 3 statements or 4 statements. Additionally, they all begin with **"By name or number, indicate..."**. This means that if you were to say the full statements

instead of their corresponding number, just with multiple-choice questions, you could still be right. Generally, there are two types of these questions (yes, this is just like taxonomy...). Either that phrase continues with **"all of the following *n* choices that is or are true/correct regarding..."** or it continues with **"the *x* of the following *n* questions that are true regarding..."**. Generally, it's frowned upon to write questions that revolve around identifying false statements, since it is hard to comprehend in a few seconds. Be wary of the probability with which you can guess these questions right. If there are 3 statements, there are 8 possible answers, ranging from "none of them" to "all of them". With 4 choices, the number of possible answers increases to 16. If the question asks for 2 of 3, then there's actually a 1/3 shot - better than multiple choice, and therefore frowned upon. If it's 2 of 4, the most common of this form, then you have a 1/6 shot of guessing correctly. Here's an example of one of these questions:

**Earth and Space Science** *Short Answer* By name or number, indicate all of the following three statements that is or are true regarding ocean life.

1: Plankton include all organisms that drift with ocean currents.

2: Benthos describes the community of organisms that reside at or in the ocean floor.

3: Nekton are animals that reside close to the ocean surface at all times.

ANSWER: '1 and 2' OR 'All but 3' (nekton are the opposite of plankton)

To write these questions, the same method as statement-style multiple-choice questions can be employed. Find something in a textbook that seems important, change some of the statements (sometimes, all of them; sometimes, none of them) to falsehoods, and then represent them with numbers.

There are some pretty interesting buzzing strategies when you must identify 2 of 4. If the first two are true, you can interrupt after 2 is read to say '1 and 2'. If the first two are false, you can interrupt to say '3 and 4'. Finally, and most importantly, with perfect knowledge, **you can always buzz in after 3 has been read.** Most often, since these questions are hard, you won't interrupt anyway. If the question is easy, though, then you should.

At the 2014 National Science Bowl, statement-style pseudo-multiple-choice questions were extremely abundant, and almost without exception listed three statements. Very rarely there were "two of the following four" questions, but they were used for difficult bonuses.

## Term-based Pseudo-multiple-choice

These questions are also very important to Science Bowl, and are used frequently both at Nationals and at Regionals. They begin the same way as any other pseudo-multiple-choice question: "By name or number, indicate all of the following $n$ choices that satisfy $x$," where $n$ is the number of choices and $x$ is some descriptor by which the choices will be selected. As with statement-style questions, the question might ask for you to identify two of four choices. Questions will sometimes use $n = 3$ and sometimes use $n = 4$; unlike with statement-style questions, both are equally common. Here is an example:

**Physics** *Short Answer* By name or number, indicate all of the following three quantities of which capacitors in parallel must have equal values.

1: charge

2: voltage

3: stored energy

ANSWER: '2 only'

These questions are very straightforward. They tend to be easy to write, especially for subjects whose textbooks contain tables, like biology, earth and space, and less frequently, chemistry and physics. Even math questions can be written in this way, using adjectives like 'surjective' or 'transcendental' as choices. Anything goes with pseudo-multiple-choice; you just have to be careful not to go overboard with the difficulty.

## Miscellaneous Pseudo-multiple-choice

The two types of pseudo multiple-choice questions we have seen so far tend to be much easier to write for biology and earth and space science, but there are many other ways to integrate the other subjects. One way is to ask students to order a set of three or four items in increasing or decreasing order. For instance, behold the following chemistry question:

**Chemistry** *Short Answer* By name or number, rank the following four bonds in order of increasing ionic character.

1: N-O

2: Ca-O

3: C-F

4: K-F

ANSWER: '1, 3, 2, 4' OR 'N-O, C-F, Ca-O, K-F'

Though more suitable as a bonus, this question is a good example of the diversity of pseudo-multiple-choice questions; any task you can think of can be done using a short answer question, as long as you don't go overboard with difficulty!

## Classic Short Answer Questions

So far, all we've discussed are pseudo-multiple-choice questions. Let us now discuss the two other purposes short answer questions could hold. There are questions where:

1. The answer is a term, *e.g.* "cumulus," "cyclohexane," "cardiac muscle," "cardioid," *etc.*
2. The answer is some value that satisfies a math, physics, or chemistry equation.

These questions tend to be so basic that we feel little need to cover how they are normally written. Nevertheless, we'll briefly explain each type.

Term-based short answer questions are usually 1-3 sentences long, with more difficult clues towards the beginning of the question (a so-called pyramid-style question, because the difficulty is like a pyramid). Official National Science Bowl questions rarely use clues longer than 2 sentences; instead, they leave such tasks to Quiz Bowl, which features exclusively pyramid-style toss-ups. For Science Bowl toss-ups, longer pyramid-style questions are okay. But for bonuses, any term-style short answer question should be shorter and more difficult, since buzzing strategy is no longer important. For more info on how to write pyramidstyle questions, there are tons of guides online to writing quiz bowl questions, but for Science Bowl, you could find it as easy as copying a definition from a textbook.

Value-based short answer questions are also very simple. A math problem will have you evaluate some answer, or a physics problem will ask you to give a quantity, or some other variant. When too easy for a multiple-choice question, value-based questions are often converted into short-answer questions where speed, and not knowledge, is rewarded. One important note: **never require a student to give units as part of a short answer.** Instead, phrase the question in such a way that all you need to give is the number; for example, ask "how many meters" instead of asking "how long". Otherwise, make sure the question is doable in 3 seconds, and you will be good.

# Writing

Now that you've learned about all the different kinds of questions that Science Bowl has to offer, there are just a few small things we have to discuss. What follows is a generalized step-by-step guide on writing a question.

1. Begin by selecting what kind of packet you're going to be writing. If writing a subject-specific packet, make sure you have the textbook(s) recommended for that subject.

2. For subjects like earth science, astronomy, and biology, where small details are easy to grasp even without knowledge of the surrounding material, flip to a random page in a textbook and come up with a vague question idea. For subjects that require some more in-depth knowledge, like chemistry, physics, and mathematics, don't be afraid to use the textbooks' question banks for **inspiration**. It's important not to plagiarize questions straight from textbooks for three reasons: first, you won't learn anything by doing this, and learning is important; second, the difficulty might be inappropriate for a Science Bowl question; and third, and perhaps most importantly, it's not ethical! Anyway, get your general idea fleshed out.

3. Next, you should evaluate what would be too much or too little to ask. Would this question be more suitable as a toss-up, or as a bonus? We've found that oftentimes when students write the bonus before the toss-up since their initial idea was too hard to fit into a toss-up. There's more information in the rest of this packet on what is and isn't suitable in terms of question difficulty. This is probably the most difficult step, and until you have considerable question-writing experience, you might write a question here and there that is way too easy or way too difficult; this problem is even more considerable for subjects with which you are unfamiliar. Just do your best.

4. Concisely type out your question, using a proper formatting scheme. Formatting of questions is no exact science, as long as the questions themselves are easy to read. A question that is too wordy can be hard to keep in mind for contestants, and this is something you need to consider as you write it out.

5. Do a final proofread of your question. First, check whether it's too easy or too hard. Next, check to make sure you haven't pulled any "cute tricks," like changing one word in a multiple choice answer to make it wrong, or changing the number of a law to make it wrong. You're testing **holistic understanding** with questions, not trying to trip up experienced players. When in doubt, a slightly-too-easy question is preferable to a way-

too-hard question. Try to clean up the question as much as possible, getting the idea out so that it's concise yet easy to understand. If it is multiple choice, make sure the choices exhibit parallelism. If pseudo-multiple-choice, make sure to mention how many choices there are in the question.

6. Come up with a related toss-up or bonus to pair with your question. Tossups and bonuses don't have to be related at all - at the National Science Bowl, they rarely are - but it's considered good form to come up with a pair of related questions. This is because not only will you learn the answer to more questions in an unfamiliar area, but you will be testing your comrades' knowledge on a more in-depth scale. But always remember that it's your packet of questions, and as such, you can do whatever you want. Be creative! Have fun!

# Subject Specific Study Tips

In this section science bowl veterans (expert students) that compiled this guide give advice on studying for some of the subjects in the science bowl.

- **Biology:** "Studying biology is no small task. The sheer amount of information and massive time commitment can be overwhelming to many, but don't be intimidated! Your brain can do amazing things and it is more than capable of learning challenging material. Take it step by step and study strategically, and you'll be fine. Biology is NOT a random collection of factoids to memorize, so don't treat it as trivia. Take the time to understand the mechanism and logic behind natural processes; not only does this make the information easier to recall, but it also makes the subject much more interesting to learn. TAKE NOTES. Not necessarily detailed ones--just enough to remember what you read. Pay special attention to diagrams, as they are immensely useful for clarifying multi step processes and help solidify your understanding of difficult concepts. Be resourceful. Use Wikipedia, course websites, online powerpoints, and friendly captains to supplement textbook readings. Take the Biology Olympiad. There is a tremendous amount of overlap between Scibowl and Bio Oly, so preparing for one ultimately prepares you for the other. Practice tests for the US Biology Olympiad can be found online."
- **Chemistry:** "Chemistry is a unique subject among the 5 major categories. It is not a subject in which one can learn by working through derivations and problems such as Physics or Math, but it is not memorization of details and content such as Earth and Space Science, or Biology. It incorporates aspects of both the memorization side and the problem-solving

side, and in order to do well, one must do both. In reading a chemistry textbook, one must take extensive notes. Taking notes will help internalize the content as well as leaving a source that can be used for quick review. One important part of chemistry in scibowl is what is known as "trivial chemistry", which tests seemingly random knowledge, such as colors of gases or reactions used in industrial processes. It is easy to skip points in the textbook in which concepts are not presented, but remember that these points are important, and notes should be taken on them. An important aspect of learning chemistry is to solve the problems presented in the textbook. It is very obvious in Math and Physics that solving problems is a must for learning concepts, but it is just as important in Chemistry. You cannot learn the material without solving problems, so it is imperative that you do so."

- **Earth and Space Science:** "Studying for the earth and science category can be daunting. Consider the following resources to help you on our journey:
    - Earth System Science 1: Intro to ESS. Lecture 1. Introduction and the Scientific Method college lecture course on ess, good resource for learning (Downside is they are rather long so I recommend watching at a higher speed).
    - Introduction to Astronomy: Crash Course Astronomy #1
    - Nova Documentaries are also good resources if you can find them
    - hugefloods Good Geology youtuber and gives real life examples of geologic process very interesting(Ideal if you want something fun and informative to watch).
    - https://uctv.tv/search-moreresults.aspx?catSubID=39&subject=sci Large number of science shows you can watch, so it is another good resource(I think it mainly has documentaries, but they are very good such as this one on swells: https://uctv.tv/shows/Where-the-Swell-Begins-24248 ).
    - https://geology.com/ Very good source, covers a broad base of information, definitely worth a try.
    - https://www.nasa.gov/audience/foreducators/5-8/classroom-combo + https://soho.nascom.nasa.gov/classroom/ (second one is better imo) Nasa Classroom is a good source of scientific knowledge as well, however it is mainly on astro.
    - https://www.geol.umd.edu/~jmerck/geol100/ College course covering the physical geology book, with notes for each chapter, it is a very good resource for ess and 100% worth a try. It also has links to other websites at the bottom of the page so check those out too.

- Britannica and Wikipedia are good for info, but not so much for learning so I wouldn't really recommend them for studying.
- https://pubs.usgs.gov/of/2004/1216/text.html Guide of glacial terms, rather specific but still worth a look.
- https://www.open.edu/openlearn/science-maths-technology/science/geology Wide variety of geology courses (mit also has a lot of good classes for this)"

- **Math:** "Most questions are either standard examples or short problems, and the best way to improve your speed on them, even more so than usual, is to get a lot of practice in rounds and devise various shortcuts. Other tools include the Arithmetic Game (http://arithmetic.zetamac.com) for raw calculation and AoPS FTW for speed solving. If you are doing math as a science bowl category, you should also consider joining your school's Math Team."