

2021 National Science Bowl®
Official Academic Competition Rules for
2021 Virtual Regional Competitions
Updated October 15, 2020

1. Eligibility Requirements

- 1-1. Each competing team consists of 4 or 5 student members. To be eligible to compete, a high school student must be enrolled for the current school year in grades 9, 10, 11, or 12 at the team's school, and be born on or after May 4, 2001. To be eligible to compete, a middle school student must be enrolled for the current school year in grades 6, 7, or 8 at the team's school, and be born between September 1, 2005 and April 29, 2011, inclusive. A student is limited to at most 3 years of middle school competition and at most 4 years of high school competition. A student may not compete in both the middle school and high school events in the same year.

The National Science Bowl® is a school-based competition. Teams of home-schooled students will be considered to belong to a school as long as each student can provide one of the following items:

- a) Dated copy of a letter of intent to homeschool from the parent to the state or county in which the student resides;
- b) Copy of the current membership ID to a homeschool association; or
- c) Dated proof of purchase of curriculum for the current academic school year.

All students on a home-schooled team must live within the geographic boundaries of the team's assigned regional event.

All team members must attend the same school. No club teams (community groups, non-school-based teams) will be approved.

- 1-2. No school may compete in more than one regional competition. No student may compete on more than one team. Coaches must be approved by the schools their teams represent and must be at least 18 years old. No student or coach may compete in or attend more than one regional competition, except that high school students or coaches may attend middle school competitions and vice versa. Each regional coordinator will determine if more than one team from a middle or high school will be allowed to participate in that regional. No more than 3 teams from one middle or high school may compete in a regional event. If a student attends two schools, such as a neighborhood school and a specialty school, that are both participating in regional Science Bowl competitions, then the student must compete on the neighborhood school's team.

Each school is assigned to a unique regional competition. To advance to the National Finals, a school must participate in its assigned regional event. A school may request to compete in a different regional event than the one to which it is assigned, but such a team will NOT qualify for the National Finals if it should win the competition. Instead, the highest placing team that is assigned to the geographic area of the regional event would qualify for the National Finals.

- 1-3. In order to participate, all students and coaches must have a signed and completed 2021 Media Release and Consent Form on file. Once a team is approved to participate, the coach will be able to upload their completed form and provide email addresses for parents to complete the forms electronically. The coach form can be downloaded here: <https://science.osti.gov/wdts/nsb/Regional-Competitions/Resources/>.
- 1-4. If a team registers, is approved, and cancels or withdraws from the competition more than 48 hours before the first round begins, the school will not be penalized. However, if a team cancels within 48 hours of the beginning of the first round of competition or provides no notice of cancellation, the Tournament Director may disqualify the students on the team and/or the school from competing in the 2022 National Science Bowl®.
- 1-5. The winning team from each qualifying regional competition is eligible to be invited to the National Science Bowl® Finals held in the Washington, DC area on April 29 – May 3, 2021*. In the case that 1) the school of the winning team is not assigned to the geographic area of the regional competition as detailed on the NSB webpage (<https://science.osti.gov/wdts/nsb/Regional-Competitions>) or 2) fewer than 4 players from the first-place team can attend and participate in all National Science Bowl® Finals activities, the invitation will be extended instead to the next highest place team from the geographic area and having at least 4 players who can attend. To be eligible for the National Science Bowl® Finals, a student must have competed at the regional competition on the team that attends the National Science Bowl® Finals. The “traditional” National Science Bowl rules will be in place for an in-person National Finals and will be posted [here](#) in early February 2021.

**Please note: Depending upon guidelines from the Centers for Disease Control and Prevention, the state of Maryland, and the District of Columbia, the National Finals may also be a virtual event. The virtual/in-person status will be determined by March 1, 2021.*

If the 2021 National Finals are virtual, middle and high school teams will compete in Preliminary Rounds throughout April 2021. Advancing middle school teams will compete for the National Championship on Saturday, May 8, 2021. Advancing high school teams will compete for the National Championship on Saturday, May 22, 2021.

- 1-6. **If the National Finals is held in-person:** By **March 15, 2021**, the winning team’s coach is required to inform the National Science Bowl® Coordinator of its availability to participate at the National Science Bowl® Finals. During this time of the school year, students are participating in a variety of activities and academic events that may conflict with their participation in the National Science Bowl® Finals (including, but not limited to, state or national athletic or academic tournaments, proms, International Baccalaureate, Advanced Placement, the USAMO, and SAT exams). In the interest of safety, continuity, and maximizing the educational value of the complete National

Science Bowl® Finals experience, the National Science Bowl® requires students and coaches to take part in ALL of its events and activities. Therefore, no waivers will be granted or special arrangements made for students to participate in any conflicting activities or exams. If team members are involved in these pursuits, the students will need to determine which activities or events are in their best interests and make their selections by **March 15, 2021**. All teams must arrive and depart on the designated dates and participate in all events as scheduled throughout the duration of the National Finals. If fewer than 4 students from the invited regional team are able to participate in all activities at all scheduled times, another team from their regional will be invited to replace them. All team members (students and coach) must travel together to and from the National Finals.

2. Competition Structure

- 2-1. Regional competitions will all be virtual events in 2021. Teams will not play head-to-head matches in the virtual regional competitions. Instead, teams are competing against all of the other teams in the competition. Each competition will have at least 2 preliminary rounds, in which each individual team will be read the same set of questions during each round. The teams with the highest combined point totals from all preliminary rounds will advance to the Elimination Tournament. The number of teams advancing to the Elimination Tournament will be decided by each Regional Coordinator, but will be no more than 32 and no fewer than 8 teams. (See Rules 8 – 10 below regarding the breaking of ties.)

The assumption is that each student and coach will be in their individual homes. However, if school, local, and state guidelines permit a team to gather together, it may do so at the school, with the school principal's permission, while following school guidelines. The coach of any team that wishes to gather together must send an email request to national.science.bowl@science.doe.gov, with a copy to the school principal, that details all requirements in place regarding COVID-19.

Due to these unusual circumstances, teams must agree to the following requirements:

- Each student must be available via computer with web camera or smartphone for a Zoom meeting (which will be password-protected with hidden meeting IDs)
- In addition, **another** device with a camera must also be on the Zoom call via the Zoom app, to show the student's workspace and surrounding area during the competition and to help the officials ensure the students and coaches are not breaking any rules. If multiple students are in one location, additional cameras for each student may be required to ensure the workspace of each student can be monitored.
- Each coach and co-coach may also be in the Zoom meeting. For each coach, **another** device with a camera must also be on the Zoom call via the Zoom app, to show the coach's entire person from the side. Any other adults in the same room with the students should also have a camera facing them.

- No one should be recording any part of the questions – via audio, video, writing, or other means. In mid-April 2021, regional questions will be shared online.
- After play of the tournament, players, coaches, and spectators must not communicate about the questions with anyone outside their team, other than National Science Bowl® officials, until the questions are shared on the NSB website.

During each round of the Elimination Tournament, each team will be read the same set of toss-up questions (15 for middle school, 18 for high school). The structure of the Elimination Tournament will be as follows for 32 teams (regional events advancing only 24, 16, or 8 teams from the Preliminary Tournament to the Elimination Tournament will skip to the appropriate Elimination Round):

- Round of 32: All 32 teams will answer the same set of questions.
- Round of 24: Will include the 24 teams with the most points in the Round of 32.
- Round of 16: Will include the 16 teams with the most points in the Round of 24.
- Round of 8: Will include the 8 teams with the most points in the Round of 16.
- Round of 4: Will include the 4 teams with the most points in the Round of 8.
- Round of 2 (Championship Round): Will include the 2 teams with the most points in the Round of 4. The winner of the Championship Round will be the Regional Champion.

3. The Questions

- 3-1. Two types of questions will be used: toss-up questions, worth 4 points, and bonus questions, worth 10 points. A toss-up question may be answered by any of the 4 or 5 members of the team by the student raising their hand so that the moderator can see. A team answering a toss-up question correctly will always get a chance to answer a bonus question. Communication among team members is allowed on both toss-up and bonus questions; this communication may be verbal, visual, or written in the Zoom chat box. The high school question categories are: Biology, Chemistry, Earth and Space Science, Energy, Mathematics, and Physics. The middle school question categories are: Life Science, Physical Science, Earth and Space Science, Energy, and Mathematics.
- 3-2. A team will have only one opportunity to answer a toss-up question. If it does not answer a toss-up question correctly, the moderator will proceed to the next toss-up question.
- 3-3. Questions are either multiple-choice or short-answer. A participant may answer a multiple-choice question with either the letter answer (W, X, Y or Z) or the verbal

answer; however, if the verbal answer is given, it must be exactly as indicated in the question or as read by the moderator. However, when mathematical expressions that would be conventionally written in symbols are the choices, common alternate expressions of the answer shall be accepted. For example, “square root of 2” and “square root 2” would both be accepted; “sine x ” and “sine of x ” would both be accepted. The determination of whether expressions are equivalent is a judgment call for the officials (see Rule #8). The only acceptable answer to a multiple-choice question will be the best of the 4 choices indicated in the question; in the event that more than one of the 4 choices is equally correct, then any of the correct choices will be acceptable. The official list of conventions used regarding questions and answers is contained in the appendix at the end of these Rules.

- 3-4. Once read in its entirety, a question will not be re-read.
- 3-5. For toss-up questions, the first player seen by the officials to raise their hand earns the right to answer the question. This player will be recognized before the answer is given, but there are no penalties for blurting. Answers will only be accepted from the student recognized by the official. Other players should remain quiet while an answer is being given.
- 3-6. On any toss-up or bonus question, the first response given, as determined by the officials, is the only one that counts. However, if a participant gives both a letter answer and a scientific answer to a multiple-choice question, both parts must be correct. Any prefacing remarks that do not directly answer the question, such as “my answer is” or repeating the question, will be considered delaying the game and counted as an incorrect answer. (Note: a very short “um”, “er”, or vocal stumble is acceptable, provided the officials do not consider it delaying the game.) The moderator may interrupt a player in the process of giving an incorrect answer at any time, so as to continue the flow of the game.
- 3-7. The answer to a bonus question may come from any of the team members. The player who will answer the question should raise their hand and wait for the moderator to recognize them. Answers will only be accepted from the student recognized by the moderator.

4. Timing

- 4-1. The match is played until all of the toss-up questions (and earned bonuses for correct toss-ups) have been read (15 toss-up questions for middle school and 18 toss-up questions for high school).
- 4-2. After reading a toss-up question, the moderator will allow 7 seconds for the team to respond. Timing begins after the moderator has completed reading the toss-up question, including all choices on a multiple-choice question. **Note:** The 7 seconds is based on the moderator’s timing, which begins upon completion of the question. One of the officials must see someone’s raised hand BEFORE 7 seconds has elapsed on the moderator’s timer. (Teams should be aware that they will most likely NOT have the

complete 7 seconds due to a variety of factors, including internet bandwidth.) If no player raises their hand before the 7 seconds elapses, the moderator will announce that time has expired, and proceed to the next toss-up question.

- 4-3. After a team member has answered a toss-up question correctly, the team is given the opportunity to answer a bonus question. The team will have 22 seconds for a team member to raise their hand to give an answer to the bonus question; timing begins by the moderator after the moderator has completed reading the bonus question, including all choices on a multiple-choice question. **Note:** the 22 seconds is based on the moderator's timing, which begins upon completion of the question. One of the officials must see someone's raised hand BEFORE 22 seconds has elapsed on the moderator's timer. (Teams should be aware that they will most likely NOT have the complete 22 seconds due to a variety of factors, including internet bandwidth.)
- 4-4. On a bonus question, the signal "5 SECONDS" will be given by the moderator after 17 of the allowed 22 seconds have elapsed. If no player raises their hand before the 22 seconds elapses, the moderator will announce that time has expired, and proceed to the next toss-up question.
- 4-5. A participant who raises their hand on a toss-up or bonus question must answer the question promptly after being verbally recognized by the moderator. After recognizing a participant, the moderator will allow for a natural pause (up to 2 seconds), but if the moderator determines that stalling has occurred, it will be treated as a wrong answer.

5. Scoring

- 5-1. Toss-up questions are worth 4 points, and bonus questions are worth 10 points.

6. Challenges

- 6-1. Challenges must be made before the moderator begins the next question, or, for the last question of a round, within 3 seconds of the end of that question. No challenges may be made during the play of a question. All challenges must come from the players. The coach may not become involved in challenges or their discussion.
- 6-2. Challenges may be made either to scientific content (i.e., whether an answer is scientifically correct or not) or to the administration of the rules (e.g., whether the rules are being correctly interpreted and applied). Challenges may NOT be made to judgment calls by the officials, including but not limited to whether 7 seconds have elapsed before a player raises their hand on a toss-up, whether 22 seconds have elapsed before a player raises their hand on a bonus, whether two verbalizations of a mathematical expression are equivalent, whether a stall or blurt has occurred, whether a player has given a first response, whether an answer has been pronounced correctly, or whether an answer to a multiple-choice question is exact.
- 6-3. Challenges to scientific content will be limited to 2 unsuccessful challenges per team per round. Successful challenges do not count against this limit. After the second unsuccessful challenge for a team during a round, that team will not be allowed any

further challenges to scientific content during that round. Challenges to rules may be made at any time a question is not in play.

7. Miscellaneous Rules

- 7-1. Cell phones used for audio connections during the competition must be placed on the competition table screen-side down. Cell phones may not be used as timing devices. No notes may be brought to the competition table. Students may have up to four sheets of 8.5 x 11 paper as scratch paper and a pen or pencil on the competition table. No other items are allowed. Nothing may be written before the match starts. Banner pens and scientific posters and charts (such as periodic tables or H-R diagrams) are not allowed.
- 7-2. Calculators and electronic devices are not permitted during play. The team of a player using such devices during play will be disqualified from the tournament.
- 7-3. Coaches will not write down the questions or answers the moderator reads or use any electronic recording or transmitting device, including digital cameras, cell phones, or computers during the match. Questions will be released after the competition.
- 7-4. Players may use the NSB Zoom chat box to communicate with their teammates, including note-taking as the question is read by the moderator. Verbal communication among the students within the NSB Zoom session and written communication within the NSB Zoom chat box are the only allowable methods of electronic communication during gameplay. Players may not communicate, in any way, with anyone else, including the team coach, during a game. Players who are at the same physical location may communicate with each other as long as all communication can be heard and/or observed by the officials.
- 7-5. At all times, players and coaches should conduct themselves with honor and good sportsmanship. The Tournament Director may disqualify any player, coach, or team engaging in conduct judged to be detrimental to the National Science Bowl®.

8. Rules for Breaking Ties to Determine the Top X Teams Advancing to the Elimination Tournament

- Middle school teams: In case of a tie, the first tie-breaker will be the combined score on questions 11 – 15 from all of the Preliminary Rounds. The second tie-breaker will be the score on question #15 (combined toss-up and bonus) from all of the Preliminary Rounds. The third tie-breaker will be the score on question #14 from all of the Preliminary Rounds, etc., with further tie-breakers using the questions in reverse order until the tie is broken.
- High school teams: In case of a tie, the first tie-breaker will be the combined score on questions 13 – 18 from all of the Preliminary Rounds. The second tie-breaker will be the score on question #18 (combined toss-up and bonus) from all of the Preliminary Rounds. The third tie-breaker will be the score on question #17 from all of the

Preliminary Rounds, etc., with further tie-breakers using the questions in reverse order until the tie is broken.

9. Rules for Breaking Ties to Determine the Top X Teams Advancing to the Next Round of the Elimination Tournament

- Middle school teams: In case of a tie, the first tie-breaker will be the combined score on questions 11 – 15. The second tie-breaker will be the score on question #15 (combined toss-up and bonus). The third tie-breaker will be the score on question #14, etc., with further tie-breakers using the questions in reverse order until the tie is broken.
- High school teams: In case of a tie, the first tie-breaker will be the combined score on questions 13 – 18. The second tie-breaker will be the score on question #18 (combined toss-up and bonus). The third tie-breaker will be the score on question #17, etc., with further tie-breakers using the questions in reverse order until the tie is broken.

10. Rules for Breaking Ties at the End of the Championship Round

- Middle school teams: To break any ties between two teams competing in the Championship Round, each team will be given the same series of five toss-up questions (no bonus questions will be used during this segment of the competition). The usual timing and scoring rules for the virtual competition are in effect.
- High school teams: To break any ties between two teams competing in the Championship Round, each team will be given the same series of six toss-up questions (no bonus questions will be used during this segment of the competition). The usual timing and scoring rules for the virtual competition are in effect.

APPENDIX – Question Conventions

A-1 The following conventions will be followed for all questions, unless the question specifies otherwise:

- a) Gravitational acceleration and factors related to motion – Gravitational acceleration on Earth should be assumed to be 9.8 m/sec^2 or 32 ft/sec^2 , dependent on whether the question is stated in terms of metric or English units, respectively. Questions involving gravitational acceleration will be assumed to have a setting near the surface of the Earth. Non-specified factors affecting motion such as wind resistance, friction, etc. should be ignored.
- b) Other physical constants – The speed of light c will be assumed to be 300,000,000 meters/second or 186,000 miles/sec, dependent on whether the question is stated in terms of metric or English units, respectively. The speed of sound on Earth will be assumed to be 340 meters/second or 1125 feet/second, dependent on whether the question is stated in terms of metric or English units, respectively. Absolute zero will be assumed to be -273 degrees Celsius or -460 degrees Fahrenheit.
- c) Mathematical systems – Numbers will be assumed to be in base 10. Geometry will be assumed to be Euclidean. Arguments of trigonometric functions will be assumed to be in radian units. Bases of logarithms will be specified, except possibly in cases where the base is irrelevant.
- d) Equally likely probabilities – In probability problems involving an object such as a coin or die, the object should be considered fair, i.e., each possible outcome is equally likely. Common objects used in probability problems will be assumed to be standard, such as coins (2-sided), dice (6-sided), and cards (52 in a deck with jacks, queens, and kings as face cards). Probability problems involving genders will assume that female/male outcomes each have probability $1/2$.
- e) Functions – Functions will be considered as functions of real numbers, with the domain considered to be the largest possible subset of the real numbers and the range considered to be the smallest possible subset of the real numbers for the corresponding domain.

A-2 The following conventions will be followed regarding the form of an answer to a short answer question, unless the question specifies otherwise:

- a) Numerical answers – All numerical answers must be given in exact and simplest form.
 - i) Answers that are integers must be expressed in integer form (e.g., 2^3 should be expressed as 8).
 - ii) Fractions and ratios that are part of answers must be in lowest terms. Fractions with absolute values greater than 1 may be expressed as either

- improper fractions or mixed fractions, and answers must not contain negative exponents (e.g., $\frac{12}{20}x^{-4}$ should be expressed as $\frac{3}{5x^4}$).
- iii) Answers that contain irrational numbers must be exact rather than approximate (e.g., the area of a circle of radius 3 should be expressed as 9π).
 - iv) Answers containing radicals must express the radical part in simplest rationalized radical form (e.g., $\frac{8}{\sqrt[3]{32}}$ must be expressed as $2\sqrt[3]{2}$).
 - v) Answers that involve a trigonometric angle θ must satisfy $0 \leq \theta < 2\pi$ in radians or $0 \leq \theta < 360$ in degrees.
 - vi) Answers that are non-real complex numbers must be expressed in $a + bi$ form; if either a or b is 0, stating the 0 term is optional. If trigonometric (polar) form is requested, the magnitude must be positive and the angle θ must satisfy $0 \leq \theta < 2\pi$ in radians or $0 \leq \theta < 360$ in degrees.
 - vii) Answers that are vectors must be expressed using the unit vectors i , j , and k (e.g., $4i + 3j - 2k$). If a coefficient is 0, that term may be omitted (e.g., $4i + 0j - 2k$ may be expressed as $4i - 2k$).
 - viii) Answers that are polynomials must be expressed in standard polynomial form, with terms in order of decreasing degree (e.g., $(x + 3)^2$ is expressed as $x^2 + 6x + 9$).
 - ix) If the factored form of a polynomial is requested, the polynomial must be factored completely over the integers (e.g., $x^3 + x^2 - 2x - 2$ is factored as $(x^2 - 2)(x + 1)$).
 - x) Equations must be solved over the real numbers (e.g., the solutions of $x^4 - 9 = 0$ are $\pm\sqrt{3}$).
 - xi) Numerals in bases other than 10 should be pronounced as individual digits (e.g., 234 base 6 should be pronounced as “two-three-four”). However, pronunciations such as “two hundred thirty-four” in the previous example will also be acceptable.
 - xii) Answers must not be expressed in scientific notation unless it is specifically requested. Answers must not be expressed as repeating decimals, but rather as fractions.
- b) Balancing chemical equations – The coefficients of a balanced chemical equation must be integers with no common integer factor greater than 1.
 - c) Biological classification – An answer that is the name of a biological taxonomic classification may be the scientific name or a synonymous common name (e.g., Arthropoda or arthropods).
 - d) Short answer questions with multiple answers – When a short answer question asks for multiple answers, the answers may be given simply in the respective order in which they were asked or by identifying which is which (e.g., “What are the smallest and largest prime numbers less than 10” could be answered as “2 and 7” or as “largest is 7 and smallest is 2”, but not as “7 and 2”).

- e) Answers to short-answer list questions – In questions that give a list of choices and ask for all choices that satisfy a certain property, the choices will be numbered. Either the verbal names or the numbers will be acceptable.
- f) Answers that are named conceptual entities – When the answer to a question is a law, principal, equation, constant, or other named conceptual entity, the answer must be the name of the conceptual entity rather than a description of it (e.g., “Newton’s Second Law” rather than “ $F = ma$ ”, and “speed of light” or “ c ” rather than “300 million meters per second”).
- g) Units - Units do not need to be stated in numerical answers; however, if they are stated, they must be correct and equivalent to the units requested. If a question asks for a physical quantity without specifying the units requested, the answer will be interpreted in the appropriate combination of SI base units or equivalent named SI derived units, such as meters, seconds, kilograms, joules, etc. Similarly, if a question does not specify the units of a provided quantity, they should be assumed to be in the appropriate combination of SI base units (e.g., “time $t = 2$ ” is in seconds).
- h) Numbers representing measurements – In a question, a phrase such as “to the nearest unit” means that the answer must be rounded to the nearest whole number of that unit (e.g., one meter to the nearest inch is 39, and one inch to the nearest tenth of a centimeter is 2.5). Numbers provided in a question should be assumed to be exact, and thus have no effect on the number of significant digits required in the answer.
- i) Significant digits – Answers that are required to be expressed to a certain number of significant digits (or significant figures) must be in integer or decimal form.