

MY SO STEM SHOWDOWN

CONTENT, RECOMMENDED MATERIALS & SCORING

STEM SHOWDOWN CONTENT

The STEM Showdown will consist of a series of online multiple-choice questions. Middle school (Grade 6-9) participant questions will center around the properties and evolution of stars and galaxies as well as their observation using different portions of the electromagnetic spectrum (e.g., Radio, Infrared, Visible, Ultraviolet, X-Ray, Gamma Ray). While high school (Grades 9-12) participants will focus on Star and Galaxy Formation and Evolution. A Showdown participant will have 55-minutes to answer as many questions as possible.

The middle school (Grades 6-9) content and skills covered by the Showdown this month is as follows:

1. Stellar and galactic evolution
2. Spectral classification of stars
3. Hubble classification of galaxies
4. Observation using multiple portions of the electromagnetic spectrum
5. The relationship between stellar temperature, radius, and luminosity
6. Magnitude and luminosity scales, distance modulus, inverse square law
7. Identification of the stars, constellations, and deep sky objects included in the list below as they appear on star charts, H-R diagrams, portable star labs, photos, or planetariums. Note: Constellations are underlined; Stars are boldface; Deep Sky Objects are italicized.
 - a. Andromeda: *M31 (Andromeda Galaxy)*
 - b. Aquila: **Altair**
 - c. Auriga: **Capella**
 - d. Bootes: **Arcturus**
 - e. **Cancer**: *DLA0817g*
 - f. Canis Major: **Sirius**
 - g. Canis Minor: **Procyon**
 - h. Centaurus: *NGC5128*
 - i. Coma Berenices: *NGC4676, NGC4555*
 - j. Corvus: *NGC4038/NGC4039*
 - k. Crux: *Dragonfish Nebula*
 - l. Cygnus: **Deneb**
 - m. Dorado: *30 Doradus, LMC*
 - n. Gemini: **Castor, Pollux**
 - o. Lyra: **Vega**
 - p. Ophiuchus: **Zeta Ophiuchi**, *Rho Ophiuchi cloud complex*
 - q. Orion: **Betelgeuse, Rigel** & *M42 (Orion Nebula)*
 - r. Perseus: **Algol**, *NGC1333*

- s. Sagittarius: *Sgr A**, *M8 (Lagoon Nebula)*
- t. Sextans: *Baby Boom Galaxy*
- u. Scorpius: **Antares**, *NGC6357*, *NGC6334*
- v. Taurus: **Aldebaran**, *T Tauri*
- w. Tucana: *SMC*
- x. Ursa Major: **Mizar**, **Alcor**, *GN-z11*, *M101*
- y. Ursa Minor: **Polaris**
- z. Virgo: **Spica**, *M60*, *M104*

8. Participants must also be knowledgeable about the evolutionary stages of all stars and deep sky objects on the list above

The high school (Grade 9-12) content and skills covered by the Showdown this month are as follows:

1. Use information from Hertzsprung-Russell diagrams, spectra, light curves, motions, cosmological distance equations and relationships, stellar magnitudes and classification, multi-wavelength images (gamma-ray, X-ray, UV, optical, IR, radio), charts, and graphs to answer questions related to:
 - a. Stellar and galactic evolution including:
 - i. Stellar classification
 - ii. Spectral features and chemical composition
 - iii. Luminosity
 - iv. Blackbody radiation
 - v. Color index and H-R diagram transitions
 - vi. Neutron stars
 - vii. Stellar mass and supermassive black holes
 - viii. Type 1a supernovas
 - ix. Galactic structure and interactions
 - x. Quasars
 - xi. Active galactic nuclei (AGNs)
 - xii. Galaxy clusters and groups of galaxies
 - xiii. Gravitational waves and gravitational lensing
 - xiv. Dark matter and energy
 - xv. Warm-hot intergalactic medium (WHIM)
 - xvi. The Cosmic Microwave Background (CMB)
2. Use Kepler's laws and rotation and circular motion to answer questions relating to the orbital motions of galaxies
3. Use the distance modulus, Type Ia supernovas, Hubble's law and redshift to answer questions about Hubble's constant and the recessional velocities of and distances to galaxies
4. Identify and answer questions relating to the content areas outlined above for the following objects:
 - a. SN UDS10Wil
 - b. NGC 2623
 - c. GRB 150101B
 - d. JKCS 041
 - e. PSS 0133+0400
 - f. PSS 0955+5940
 - g. GW151226
 - h. M87
 - i. MACS J0717.5+3745
 - j. MACS J1149.5+2223
 - k. Bullet Cluster (1E 0657-56)
 - l. H1821+643
 - m. GOODS-S 29323
 - n. H2356-309
 - o. 3C 273

- p. DLA0817g
- q. Chandra Isotropic Universe Survey
- r. Hubble CANDELS Survey

Recommended Materials

- Each Showdown participant will need a computer with internet access, scratch paper, something to write with, and a stand-alone, non-programmable, non-graphing calculator (e.g., a TI-83 or NSPIRE)
- Showdown participants may use resources available to help them answer the questions asked during the Showdown. These resources could be a collection of notes on the topics listed below, copies of magazine or journal articles, a textbook, or any combination of these items.

Scoring

- High score wins.
- Ties will be broken using:
 - a. The time it takes to complete the test; and
 - b. The number of test questions attempted.

Additional Resources

- NASA's Chandra X-Ray Observatory Site (<https://chandra.si.edu/edu/olympiad.html>)
- The Science Olympiad Store (store.soinc.org) carries the Astronomy Coaches CD, the Reach for the Stars CD, and the Bio/Earth Science CD
- Other resources can be found on the Reach for the Stars (middle school) and Astronomy (high school) Event Pages at soinc.org.