

HandBook



**4TH
NATIONAL
ASTRONOMY
OLYMPIAD
2017**

February 2017

Introduction

The National Astronomy Olympiad Program is an educational program designed by Nepal Astronomical Society (NASO) to encourage Nepalese students who pursue further studies in physics, mathematics, astronomy, astrophysics and space Science.

Vision: *School students will be empowered to recognize and comprehend the celestial objects inhabiting our universe and their association with the evolution and preservation of our lives on earth thereby dispelling superstitious beliefs of their influences prevailing in our society.*

Mission: *School students will be trained to be abundantly versed with astronomy for logically convincing and communicating with any member of local or international society on the importance and indispensability of cosmic entities dwelling in our universe.*

Goal: *Our goal is to impart school students with sufficient knowledge on basic astronomy to recognize and understand the heavenly entities for enabling them to participate in annual international astronomy Olympiad successfully.*

Objective: *School Students will be selected, prepared, facilitated and qualified for their successful participation in annual regional and international astronomy Olympiads.*

The 4th National Astronomy Olympiad 2017 (NAO2017) will be held in Nepal during March-June, 2017. Students can visit our office in Kathmandu or meet our representatives (nearest) to submit their application forms.

Below are the details on exam centers, contact persons and eligibility criteria for NAO2017:

Exam Center	Contact Person	Contact No.	Eligibility Criteria
Biratnagar	Devraj Sapkota	9841521281	<ul style="list-style-type: none">• Student who is currently studying at high school (upto class 12). High school graduate can apply if s/he has not joined university program.• S/he must be less than twenty years on 30th June of the year of the competition.
Kathmandu	Suresh Bhattarai	01-4110344	
Chitwan	Rudra Pd. Poudel	9855061782	
Pokhara	Suman Gautam	9846142632	
Butwal	Alok Bhattarai	9857038351	

How to apply for NAO2017?

- Collect **Application Form** from one of the places mentioned above or download from www.nepalastronomicalsociety.org/olympiad
- Deposit the application fee: **NRs 1,000/-** at **Mega Bank Nepal Limited** nearest to you with the details: **A/C Name: Nepal Astronomical Society, A/C No.: 0010010279643 NPR** (while making deposit, please make sure you write your full name instead of your signature)
- Submit the duly filled **application form**, photocopies of **SLC marksheet & character certificate** and **deposit slip** at one of the centers
- Attend entrance exam. Details of the exam centers will be available prior to the selection exam.

Stages of the NAO2017

Stage I (Entrance Exam)

Entrance exam will be objective type carrying **90 marks**; remaining 10 marks will be calculated on the basis of the marks of **School Leaving Certificate (SLC)** or equivalent (5 marks) and **motivation** (5 marks) section of your application form. Total duration of the exam will be **2 hours**. Programmable/scientific calculator is not allowed inside the examination hall.

Please note that the entrance exam will be held on **Saturday, March 4, 2017** during **during 12:00 PM- 2:00PM**.

Selected students will go to Stage II (Pre-Closed Camp).

Stage II (Pre-Closed Camp)

Selected students from the Stage I (*Entrance Exam*) will be assigned different tasks as a part of Pre-Closed Camp and evaluated. This section will require your input via online with few in person activities. Successful students will go to Stage III (*Closed Camp*).

Stage III (Closed Camp)

Selected students from the Stage II (*Pre-Closed Camp*) will go through this stage during May-June 2017. The closed camp will be at least of 3 days residential participation in Kathmandu. Details of the closed camp will be emailed to the selected students.

The camp includes several theoretical and experimental classes and tests based on the IOAA syllabus. Orientation is provided to students especially in experiments. Resource persons include the well trained Olympiad Teachers, experts from Tribhuvan University, Nepal Physical Society, Research Group of Astronomy & Astrophysics Nepal, Nepal Astronomical Society and other institutions in Nepal and abroad. The camp will conclude with a valedictory function where distinguished scientists are invited to speak to the students.

The top 5 students from closed camp will be announced as the winners of 4th National Astronomy Olympiad 2017 (NAO2017). Also, the highest scorer will be announced as the absolute winner of the year.

Stage IV (Pre-departure Training)

National Delegations^{1,2} for the regional and international competitions will be formed based on merit list. The selected students for the delegations will undergo a rigorous training program in Kathmandu in theory, data analysis and observational astronomy during July-August 2017.

¹ International participations will be subjected to the availability of funds. Details will be available prior to the international events.

² Each country can have two types of teams: regular and guest teams. Guest teams and observers are facilitated for their participations provided that they will take care of their expenses themselves.

Stage V (International Participation)

National Delegations will be formed as requested in order to provide meritis students an opportunity to participate in upcoming 13th Asian Pacific Astronomy Olympiad (13th APAO) 22nd International Astronomy Olympiad (22nd IAO) and 11th International Olympiad on Astronomy and Astrophysics (11th IOAA). Details of these programs will be circulated among the participants when available.

Guest team and observers can participate to the Olympiad. For more details, please contact us at 4110344 during our office hours.

Syllabus (Entrance exam)

The syllabus for Entrance exam of **National Astronomy Olympiad (NAO)** is broadly equivalent to the senior secondary level (up to Class XII) of National Examination Board (NEB) of Nepal.

- **Mechanics:** Newton's Laws of Motion; Gravitation; Circular Motion; Rotational Motion; Simple Harmonic Motion
- **Heat and Thermodynamics:** Thermodynamic Equilibrium; Ideal Gas; Energy Transfer; Black Body Radiation
- **Nuclear Physics:** Atom; Hydrogen Spectrum; Nucleus and Radioactivity; X-Rays
- **Wave and Optics:** Light; Interference, Diffraction, Polarization; Microwave, Infrared, Ultraviolet, Gamma Rays, Visible Wavelength Bands; Optical Instruments; Doppler's Effect
- **Electricity and Magnetism:** Electromagnetic Theory; Magnetic Properties and Behavior
- **The Sun:** Solar Structure; Sun-Earth Relation; Solar Wind and Radiation; Eclipse
- **The Earth:** Atmosphere; Longitude and Latitude; Tides; Seasons; Meteor Shower; Aurorae
- **The Solar System:** Earth-Moon System; Planets introduction
- **The Stars:** Life Cycle; Neutron Star; Black Hole; Supernova; Constellation
- **Universe:** Galaxy; Dark Matter; Hubble's law
- **Space Exploration:** Satellites; Human exploration and missions
- **Mathematics:** 3-D figures (Sphere, Cone, Prism, Cylinder, Cuboid, Cube); 2-D figures (Triangle, Quadrilateral, Circle)

Note: Above mentioned sections are as per the syllabus of NEB, students are encouraged to explore reference materials. If you have any queries, feel free to contact us during office hours.

Sample Objective Questions

(Please encircle correct answer/s among the given options)

FM: 90

Time: 2 Hours

Each question carries 2 marks

1) The moment of linear momentum is called

- a) torque
- b) force
- c) linear momentum
- d) centripetal momentum.

2) A transverse wave of amplitude 0.5 m, wavelength 1m and frequency $2c/s$ is propagating in a string along negative X-direction. The equation for the wave is

- a) $y = 0.5\cos 2\pi(x+t)$
- b) $y = 0.5\cos 2\pi(x+2t)$
- c) $y = 0.5\sin 2\pi(x-t)$
- d) $y = 0.5\cos 2\pi(x-2t)$

3) A machine Gun is mounted on a 2000kg car on a horizontal frictionless surface. At some instant the gun fires bullet of mass 10g with a velocity of 500m/s with respect to the car. The number of bullets fired per second is 10. The average thrust due to ejected bullet on the system is

- a) 2.5×10^{-3} N
- b) 50 N
- c) 250 N
- d) 550 N

4) At what height from the earth's surface the value of g will become one-fourth of its value at earth's surface? (R_e =Radius of earth)?

- a) R_e
- b) $R_e/2$
- c) $R_e/4$
- d) $2R_e$

5) A car sometimes overturns while taking a turn. When it overturns

- a) its inner wheel leaves the ground first
- b) its outer wheel leaves the ground first
- c) Both wheels leave the ground simultaneously
- d) Either wheel leaves the ground first

6) In an isothermal process

- a) Pressure remains constant
- b) Thermal energy remains constant
- c) Volume remains constant
- d) Temperature remains constant

7) 110 J of heat is added to a gaseous system whose energy increases by 40 J, then the amount of external work done is

- a) 40J
- b) 70J

c) 110J

d) 150J

8) The rate of radiation of a black body at 0°C is E Joules/sec. The rate of radiation of the blackbody at 273°C will be

a) E

b) $4E$

c) $8E$

d) $16E$

9) What is the ratio of the orbital electron in 4^{th} and 5^{th} orbit of the hydrogen atom?

a) 4:5

b) 5:4

c) 16:25

d) 25:16

10) The ionization power is the maximum for

a) X-rays

b) Beta Rays

c) An alpha rays

d) Gamma rays

11) What is the diameter of Sun in terms of radius of Earth (R_e)?

a) $50 R_e$

c) $118 R_e$

b) $218 R_e$

d) $318 R_e$

12) The LAST manned moon flight was made in what year?

a) 1971

b) 1972

c) 1973

d) 1974

13) According to Kepler's Laws, all orbits of the planets are:

a) Ellipses

c) parabolas

b) Hyperbolas

d) square

14) A conic section is the locus of the point in a plane which moves in such a way that the ratio of its distance from a fixed point (called a focus) to its perpendicular distance from a fixed straight line (called a directrix) is a constant e (called eccentricity). The conic section is an ellipse if

a) $e=1$

b) $e>1$

c) $e<1$

d) $e>0$

15) The largest moon in our solar system has an atmosphere that is denser than the atmosphere of Mars. The name of this moon is:

a) Titan

b) Ganymede

c) Triton

d) Io

16) Where are most asteroids located? Is it between

- a) Jupiter and Saturn
- b) Mars and Venus
- c) Earth and Mars
- d) Mars and Jupiter

17) Data from Voyager II indicate that previous estimates of Triton's size were in error. It is now known that Neptune's largest moon is

- a) nearly the size of Mars
- b) half the size of Mercury
- c) twice the size of the Earth's moon
- d) even larger than previously thought

18) A monoatomic gas at atmospheric pressure has a volume V . Now the gas is expanded adiabatically to the volume $8V$; if $\gamma = 5/3$, the new pressure is

- a) 1 atm
- b) $1/32$ atm
- c) 32 atm
- d) $1/8$ atm

19) 0.93 Watt hour energy is supplied to a block of ice weighting 10g. It is found that

- a) Half of the block melts
- b) The entire block melts
- c) The entire blocks melt and the water attains a temperature of 4°C
- d) The block remains unmelted

20) The relative emissive power of a black body is

- a) 0
- b) 0.5
- c) 1.0
- d) Infinity

21) The ionization energy of the hydrogen atom from ground state is equal to

- a) 13.6eV
- b) 13.6 joule
- c) 13.6erg
- d) 13.6×10^{-19} joule

22) What percentage of mass accounts by Sun alone in solar system?

- a) 50 %
- b) 70%
- c) 90%
- d) 99%

23) The VISUAL aurora consists of luminous arcs, rays or bands in the night sky, usually confined to high latitudes and located in the:

- a) troposphere
- b) stratosphere
- b) ozonosphere
- b) ionosphere

24) If you were watching a star collapsing to form a black hole, the light would disappear because it:

- a) is strongly redshifted
b) is strongly blueshifted
c) its color suddenly becomes black
d) none of the above

25) The equation for parabola is

- a) $x^2+y^2=r^2$
b) $y=ax^2$
c) $y=mx+c$
d) $y=ax^3+bx^2+cx+d$

26) Which of the following men wrote the book "On the Revolutions of the Heavenly Spheres"?

- a) Kepler
b) Euclid
c) Copernicus
d) Newton

27) On one of the moon landings astronauts left an object on the moon. Scientists periodically bounce a laser beam off of this object to measure the distance between the earth and the moon. What is this object?

- a) Lens
b) Compass
c) Mirror
d) Watch

28) What is the most distant object in the sky that the human eye can see without optical instruments?

- a) The Horsehead Nebula
b) The Sagittarius Constellation
c) The Andromeda Galaxy
d) The Aurora Borealis

29) A star like object with a very large redshift is a

- a) neutron star
b) nova.
c) quasar
d) supernova.

30) When two sound waves of same frequency and constant initial phase travelling in the same direction in the same line at the same instant, superpose to give maxima and minima. The phenomena is called

- a) Refraction
b) Interference
c) diffraction
d) beats

31) With increase in stretching force of the wire its frequency

- a) increases
b) decreases
c) remains unchanged
d) may increase or decrease

32) An observer is approaching a stationary source. The observer will hear sound of frequency

- a) lower than actual frequency
- b) higher than actual frequency
- c) same as actual frequency
- d) lower or higher frequency depending on the speed of observer

33) The image of an object formed by device is always virtual and small. The device may be

- a) concave lens
- b) concave mirror
- c) a glass plate
- d) convex lens

34) The focal length of concave mirror is

- a) maximum for red color
- b) maximum for yellow color
- c) maximum for violet color
- d) same for all colors mirror

35) The speed of light in vacuum depends on

- a) wavelength
- b) frequency
- c) intensity
- d) none

36) At what angle does a diver see the setting sun

- a) at 49 degree to the horizon
- b) at 90 degree to the horizon
- c) at 41 degree to the horizon
- d) at 60 degree to the horizon

37) If monochromatic red light is used instead of blue light then focal length of a lens

- a) Increases
- b) decreases
- c) remains same
- d) may decrease or increase depending on material lens

38) Chromatic and spherical aberration are absent in

- a) Reflecting telescope
- b) refracting telescope
- c) Galilean telescope
- d) any astronomical telescope

39) The light is falling normally on the surface. If the surface is tilted, then the illuminance on the surface would

- a) increased
- b) decreased
- c) remains unchanged
- d) none of above

- 40) The electric field intensity at the surface of a charged conductor is
- a) Zero
 - b) directed normally to the surface
 - c) directed tangent to the surface
 - d) directed along 45degree to the surface
- 41) Electric potential of the Earth is taken to be zero because Earth is good
- a) insulator
 - b) conductor
 - c) dielectric
 - d) semiconductor
- 42) When a difference of temperature is maintained across the same conductor and the current is absorbed. The effect is said
- a) Joule's effect
 - b) Seebeck effect
 - c) Peltier effect
 - d) Thomson effect
- 43) Two parallel wires carrying current in a opposite direction
- a) attract each other
 - b) repeal each other
 - c) cancel each other
 - d) none of above
- 44) What is the mean distance between the Sun and Earth?
- a) 93 million km
 - b) 150 million miles
 - c) 150 million km
 - d) 150 AU
- 45) About how many light years across is the Milky Way? Is it:
- a) 1,000
 - b) 10,000
 - c) 100,000
 - d) 1,000,000

National Astronomy Olympiad Organizing Committee-Nepal

Prof. Dr. Binil Aryal, Advisor

Prof. Dr. Binil Aryal, Head of Department at the Central Department of Physics, Tribhuvan University, Kathmandu, Nepal, is pioneer introducing Astrophysics in Nepal and working in the field of galaxy orientation and Evolution. His field of research includes evolution of galaxy in cluster, clusters of galaxy, interaction in the ISM (Interstellar Medium), dust structures around PNe, white dwarfs and pulsars, chirality of the large scale structure and dark energy.



Er. Rishi Shah, Chair

Rishi Shah, academician at Nepal Academy of Science and Technology (NAST), has been advocating for astronomy, astrophysics and space science outreach and education in Nepal since 1980s. He has been actively promoting astronomy outreach working with youths for more than three decades.



Mr. Suresh Bhattarai, Academic Coordinator

Suresh Bhattarai is executive chairman at Nepal Astronomical Society (NASO). He has extensive experience on outreach and educational activities on science. He is also a Regional Coordinator for Asia Pacific at Space Generation Advisory Council in Support of United Nations Program on Space Applications (SGAC). He is a board member of International Olympiad on Astronomy and Astrophysics (IOAA).



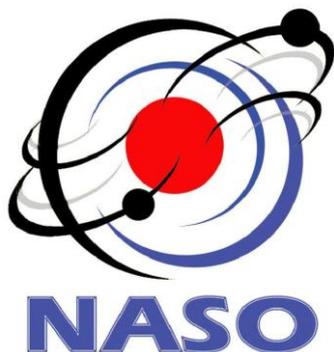
Ms. Manisha Dwa, Logistic Coordinator

Manisha Dwa is working as Project Coordinator at Nepal Astronomical Society (NASO). She is coordinating Women in Astronomy-Nepal (WIAN) and UNAWA-Nepal. Her expertise lies on outreach activities with children and high school students. She enjoys photography and promoting landscape astrophotography in Nepal. She is a board member of International Olympiad on Astronomy and Astrophysics (IOAA).



Congratulations!

Bijaya Chandra Luitel awarded Honorable Mention at 10th International Olympiad on Astronomy and Astrophysics



For more details:

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