

---

# EXPLORING CREATION WITH ASTRONOMY



## Table of Contents

<b>INTRODUCTION</b> .....	13
<b>Module 1</b> .....	<b>17</b>
MYSTERIES OF THE UNIVERSE	
Space.....	17
Interstellar Space.....	18
The Universe.....	19
Normal Matter.....	19
Antimatter.....	21
Cosmic Rays.....	21
Dark Matter.....	22
Dark Energy.....	23
Black Holes.....	24
Wormholes.....	25
Temperature of the Universe.....	25
Where Do We Go From Here?.....	30
<b>Module 2</b> .....	<b>31</b>
THE HISTORY OF ASTRONOMY	
Ancient Stargazers.....	32
Chinese Astronomers.....	33
Babylonian Astronomers.....	33
Greek Astronomers.....	34
Mayan Astronomers.....	35
Renaissance Era Stargazers.....	36
Modern Astronomers.....	41
Where Do We Go From Here?.....	48
<b>Module 3</b> .....	<b>49</b>
UNDERSTANDING THE BASICS	
Measurement.....	49
Distance.....	50
The Astronomical Unit (AU).....	51
The Light-year (LY).....	52
The Parsec.....	52
Time.....	57
Speed and Velocity.....	59

Mass and Weight .....	63
Gravity .....	63
Weight .....	65
Doppler Effect .....	67
Rotation .....	70
Revolution .....	70
Energy .....	71
Where Do We Go From Here? .....	76

## **Module 4.....77**

### OUR SOLAR SYSTEM

How Was the Model of Our Solar System Developed? ...	77
Geocentric Universe Model .....	78
Heliocentric Universe Model .....	78
Mathematics of the Geocentric Universe Model— The <i>Almagest</i> .....	80
Support for the Heliocentric Model Continues ...	83
Mathematics of the Heliocentric Universe Model— Nicolaus Copernicus .....	83
Heliocentric Universe Model—The Copernican Revolution .....	85
Heliocentric Universe Model—Refinements Since Isaac Newton .....	88
The Current Model of Our Solar System .....	95
Where Do We Go From Here? .....	98

## **Module 5 .....99**

### THE SUN

How Far Away Is the Earth from the Sun? .....	99
How Big Is the Sun .....	101
Experiment: Estimate the Diameter of the Sun .....	104
How Much Mass Makes Up the Sun? .....	105
What are the Different Parts of the Sun? .....	108
The Sun's Core .....	108
The Radiative Zone .....	109
The Convection Zone .....	109
The Photosphere .....	109
The Chromosphere .....	109
The Corona .....	110
How Does the Sun Work? .....	111
Just What is Electromagnetic Energy? .....	115
Photons .....	117
Electromagnetic Energy Spectrum .....	118
Important Properties of Electromagnetic Energy ...	126
Electromagnetic Energy and the Sun .....	130
Where Do We Go From Here? .....	132

## **Module 6 .....133**

### THE INNER PLANETS

Basic Orbital Mechanics .....	133
Perihelion and Aphelion .....	135
Orbital Inclination Angle .....	136
Planet Obliquity Angle .....	136
Orbital Speed .....	137
The Planet Mercury .....	142

Size of Mercury.....	142
Estimating the Diameter of Mercury .....	142
Estimating the Volume of Mercury .....	144
Layers of Mercury.....	144
Mercury's Surface Features.....	145
Mercury's Atmosphere and Magnetic Field .....	146
Temperatures on Mercury .....	146
Orbital Mechanics Properties of Mercury .....	147
Mercury Day.....	150
Moons and Rings of Mercury.....	150
Mass Property of Mercury .....	151
Spacecraft Missions to Mercury .....	151
The Planet Venus.....	154
Size of Venus.....	155
Estimating the Volume of Venus .....	155
Layers of Venus.....	155
Venus' Surface Features.....	156
Venus' Atmosphere and Magnetic Field .....	157
Temperatures on Venus .....	159
Orbital Mechanics Properties of Venus .....	160
Venus Day.....	162
Moons and Rings of Venus.....	162
Mass Property of Venus.....	162
Spacecraft Missions to Venus .....	163
The Planet Earth .....	166
Size of Earth .....	167
Estimating the Volume of Earth.....	167
Layers of Earth.....	168
Earth's Surface Features.....	169
Earth's Atmosphere and Magnetic Field.....	170
Temperatures on Earth.....	173
Orbital Mechanics Properties of Earth .....	174
Earth Day .....	176
Moons and Rings of Earth.....	177
Mass Property of Earth.....	177
The Planet Mars.....	180
Size of Mars.....	181
Estimating the Volume of Mars .....	181
The Layers of Mars.....	181
Mars' Surface Features .....	182
Mars' Atmosphere and Magnetic Field.....	183
Temperatures on Mars .....	185
Orbital Mechanics Properties of Mars.....	185
Mars Day.....	188
Moons and Rings of Mars.....	188
Mass Property of Mars .....	189
Spacecraft Missions to Mars .....	190
Where Do We Go From Here? .....	194

**Module 7.....195**

THE MOON

Size of the Moon.....	196
Estimating the Volume of the Moon .....	196
Layers of the Moon.....	196
Surface Features.....	197
The Moon's Atmosphere.....	199



The Moon's Surface Temperature .....	200
The Phases of the Moon .....	200
The Moon's Gravity.....	202
Orbital Mechanics Properties of the Moon.....	203
Where Do We Go From Here? .....	208

**Module 8.....209**

TELESCOPES

Optical Telescopes .....	209
The Thin Lens.....	209
The Focal Point.....	210
Where the Image Will Be Located.....	211
Magnification of the Original Object .....	211
Optics of Your Eye.....	217
The Optical Telescope .....	223
Radio Telescope.....	232
Infrared Telescopes.....	233
X-ray Telescopes.....	234
Where Do We Go From Here? .....	238

**Module 9.....239**

THE OUTER PLANETS

The Planet Jupiter.....	239
Size of Jupiter.....	240
Estimating the Volume of Jupiter .....	241
Layers of Jupiter.....	241
Jupiter's Surface Features .....	242
Jupiter's Atmospheric Layer and Magnetic Field...243	
Orbital Mechanics Properties of Jupiter .....	244
Jupiter Day.....	247
Moons and Rings of Jupiter .....	247
Mass Property of Jupiter .....	248
The Planet Saturn.....	252
Size of Saturn .....	253
Estimating the Volume of Saturn.....	253
Layers of Saturn.....	253
Saturn's Surface Features.....	255
Saturn's Atmospheric Layer and Magnetic Field...255	
Orbital Mechanics Properties of Saturn .....	256
Saturn Day .....	259
Moons and Rings of Saturn.....	259
Mass Property of Saturn.....	261
The Planet Uranus.....	265
Size of Uranus.....	266
Estimating the Volume of Uranus.....	266
Layers of Uranus .....	267
Uranus' Surface Features.....	267
Uranus' Atmospheric Layer and Magnetic Field...268	
Orbital Mechanics Properties of Uranus.....	269
Uranus Day .....	271
Moons and Rings of Uranus .....	271
Mass Property of Uranus.....	273
The Planet Neptune .....	275
Size of Neptune .....	276
Estimating the Volume of Neptune.....	276

Layers of Neptune.....	276
Neptune's Surface Features.....	278
Neptune's Upper Atmospheric Layer and Magnetic Field.....	278
Orbital Mechanics Properties of Neptune.....	279
Neptune Day.....	283
Moons and Rings of Neptune.....	283
Mass Property of Neptune.....	284
Where Do We Go From Here?.....	288

## **Module 10 .....289**

### DWARF PLANETS & THE ASTEROID BELT

The Dwarf Planet Pluto.....	290
Details of Pluto.....	290
Moons Around Pluto.....	292
The Dwarf Planet Ceres.....	292
Details of Ceres.....	293
The Dwarf Planet Eris.....	294
Details of Eris.....	294
The Dwarf Planet Makemake.....	295
Details of Makemake.....	295
The Dwarf Haumea.....	296
Details of Planet Haumea.....	296
The Dwarf Planets in Review.....	296
The Asteroid Belt.....	299
Classification of Asteroids.....	301
Interesting Facts About the Asteroid Belt.....	302
Where Do We Go From Here?.....	304

## **Module 11 .....305**

### THE UNIVERSE

How is the Universe Studied?.....	306
Electromagnetic Energy.....	306
Cosmic Rays.....	307
Objects in the Visible Universe.....	308
North Circumpolar Constellations.....	309
South Circumpolar Constellations.....	312
Northern Winter/Southern Summer Constellations.....	314
Northern Spring/Southern Autumn Constellations.....	317
Northern Summer/Southern Winter Constellations.....	320
Northern Autumn/Southern Spring Constellations.....	324
Interstellar Medium.....	330
Black Holes.....	331
Where Do We Go From Here?.....	336

## **Module 12.....337**

### THE STARS

What Makes A Star Shine?.....	337
Star Temperatures.....	338
Star Brightness.....	342
Brightness Magnitudes.....	347

Determining a Star's Radius.....	347
Determining the Distance to a Star.....	352
Classifying the Stars.....	355
Star Explosions.....	357
Where Do We Go From Here? .....	362

**Module 13.....363**

GALAXIES

Different Types of Galaxies.....	363
Quasars.....	366
The Milky Way Galaxy.....	368
The Local Group.....	372
Where Do We Go From Here? .....	374

**Module 14 .....375**

CELESTIAL NAVIGATION

Angle Measurements.....	376
Addition of Angles .....	379
Subtraction of Angles .....	380
Longitude and Latitude.....	382
Celestial Navigation.....	385
Very Simple Estimation of Your Position .....	386
Estimation of Your Position Using a Sextant and the <i>Nautical Almanac</i> .....	388
Estimation of Your Position Using Other Celestial Objects.....	392
Where Do We Go From Here? .....	394

**ANSWERS TO ON YOUR OWN QUESTIONS....395**

**INDEX.....471**

**IMAGE CREDITS ..... 491**