

Astronomy 104

Pass/Fail Test

CORRECT SOLUTIONS

Make sure your scantron has your name and code on it.

**Show a picture ID,
and
turn in the test paper with the scantron.**

**It is advisable to circle
the answers on the test paper.**

**There were many scrambled versions.
Here is a solved copy of one of the versions.**

- 1 Depends on the version.**
- 2 Depends on the version.**
- 3 Depends on the version.**

D Astronomy books are full of impressive pictures of deep-sky objects. Why don't they look as good in the telescope?

A: These pictures were taken with large telescopes which can see much more small detail.

B: These pictures were taken from spacecraft, so that the atmosphere does not disturb picture taking.

C: The atmosphere absorbs the type of light these object shine in.

D: When these pictures were taken, light was collected for many hours.

E: These pictures were taken from spacecraft, so that the stars are much closer.

You can take pretty pictures with small telescopes, too, but deep-sky objects are all quite dim, so you need to collect much light (for a long time).

B Did the Sun exist five thousand light years ago?

A: No.

B: This question makes no sense.

C: Yes.

D: This question makes sense, but no one knows the answer.

E: It did, but it was not a star at the time.

Light year is not time, but distance: the distance light travels in one year.

E Do the laws of nature exclude interstellar travel?

A: No. In fact manned spaceships have already visited a few stars.

B: No. In fact unmanned (robotic) spaceships have already visited a few stars.

C: Yes, because the stars are so far away so that travel should take more than a million years.

D: Yes, because radiation in interstellar space would break up spaceships.

E: No, but we would need a much more effective energy source than we have now.

The only way to reach a star (not a planet) is to have the rocket engine working for the full duration of the trip (which takes years), providing 1g acceleration. The energy source for such an engine is presently prohibitive.

A Every year more than a hundred supernovae are discovered. How does a supernova appear in the sky?

A: It is a star that appears in a galaxy, shines as bright as the galaxy for a few weeks, then it slowly fades.

B: It appears as a bright star zooming across the sky in a few seconds, then it suddenly vanishes.

C: It appears as a smoking sphere in a telescope, occasionally spitting out rays of light, and then moves away from Earth within a few days.

D: We cannot see them unless we approach them with a spaceship.

E: Supernovae are invisible, all that is detected is their gravity.

Supernovae are very large explosions (large stars blow up), very bright, but they are also rare. No supernova has been seen in our galaxy during the last 300 years.

D Has "Big Bang Theory" (correctly called Big Bang Cosmology) been proven?

A: It has been proven wrong.

B: It might be proven in the future, but we'll need much more research to prove it.

C: It is uncertain because it is only a theory.

D: It has been proven correct.

E: It cannot be scientifically proven because it is a question of religious preference.

A 'theory' does not mean (contrary to everyday use) 'speculation' in science. While the correct interpretation of the expansion of the Universe was controversial a hundred years ago, by now it is sure and established truth.

B How are stars, such as the Sun, born?

A: When galaxies blow up.

B: From a collapsing gas cloud.

C: In dying black holes.

D: In supernova explosions.

E: They are thrown out of supermassive black holes located in the centers of galaxies.

All other theories of star formation have been proven wrong by 70 years ago, despite the fact that some grade school textbooks did not get the message.

A How does a star look like in a good telescope?

A: A bright dot.

B: A large disk but without surface features.

C: A large disk with a lot of surface features.

D: An irregular-shaped patch of light, with a few rays stretching out in several directions.

E: A small disk with a few surface features.

All stars are too far to be seen as anything more than dots, even with the largest telescopes.

D How does the Milky Way look like in the sky in a dark location?

A: It is a tiny, faint patch of barely visible light.

B: Like a bright cloud, looks twice as large as the Moon.

C: It is not visible without a telescope at all.

D: It is a faint band of hazy light in a strip all around the sky.

E: We cannot see the Milky Way at all because we are inside it.

The Milky Way is the washed-together light of billions of stars in the Galaxy, bright enough to see without instruments in a dark location. It circles the whole sky.

D How fast does a comet move in the sky, compared to the stars?

- A: It does not move.
- B: It crosses the sky in a few hours.
- C: It crosses the sky in a few seconds.
- D: It shifts a little each day.
- E: It takes a few years to shift visibly.

A comet orbits the Sun, just like Earth does. Earth's orbit takes a year, a comet's orbit usually takes even (much) longer. It shifts a little bit per day, compared to the stars.

C How high does the International Space Station rise above sea level?

- A: A few hundred thousand miles.
- B: A few million miles.
- C: Two hundred and fifty miles.
- D: A few light years.
- E: A few billion miles.

Most normal spaceship needs only be up enough to get outside the atmosphere of Earth to avoid burning up due to air resistance. Only a few special spacecraft (such as communication satellites) go higher up.

E How large is the diameter of the Earth?

- A: 12,000 miles.
- B: 4.1 light years.
- C: 95 million miles.
- D: 14 billion light years.
- E: 7,500 miles.

The diameter of Earth is 13,000 km = 7,500 miles.

D How large is the Universe (rounded)?

A: 10 light years.

B: 10 trillion light years.

C: 1 light year.

D: 10 billion light years.

E: 10 million light years.

The precise meaning of the size of space is unclear in a curved space, and it is not clear either what it means the whole Universe, but the farthest galaxy ever discovered is almost 14 billion light years away.

A How many craters can you see on the Moon by the naked eye?

A: None, because they are too small for that.

B: A few (5 to 10).

C: A few thousand.

D: A few million.

E: There are no craters on the Moon because there is no volcanism there.

The dark spots we see in the Moon with the naked eye are not craters; they are ancient frozen-lava basins. The largest crater is 250 km across, too small to see without a telescope.

E How many galaxies are there in the Solar System?

A: 10 .

B: A few thousand.

C: Billions.

D: 1 .

E: 0 .

Trick question: none. The Solar System is the Sun and the planets, only a very-very small part of our Galaxy.

C How many spaceships have arrived at the closest star, Proxima Centauri?

A: One, with humans.

B: Six all-robotic.

C: None.

D: A few people have traveled there in the last decade.

E: One, without humans.

At present it is impossible to send spaceships much beyond the orbit of Pluto. Even the fastest ones we have would take over a hundred thousand years to arrive at another star.

A How many stars are there in the Solar System?

A: 1 .

B: 10 .

C: 0 .

D: Billions.

E: A few thousand.

The Sun is the only star in the Solar System: planets are not stars. Do not confuse the Solar System with the Galaxy or with the Solar Neighborhood.

E How many stars are visible to the naked eye?

A: A few hundred.

B: A few million.

C: A few billion.

D: A few trillion.

E: A few thousand.

There are 5,000 stars down to 6th magnitude; out of these 1400 are brighter than 5th. The billions of other stars of the Galaxy are too dim to see without telescopes.

D How many stars or planets have been discovered to host intelligent life (aliens; do not count Earth)?

A: About twenty.

B: Millions.

C: A few hundred.

D: None.

E: A few.

Clearly, there is no intelligent life within the Solar System. (Outside Earth.) This makes the closest one farther than four light years, extremely hard to detect.

D How old is the Sun (rounded)?

A: 4 ,000 years.

B: 4 million years .

C: 4 trillion years.

D: 4 billion years .

E: 400,000 years.

More accurately, 4.3 billion years, same as Earth and the planets.

B How old is the Universe?

A: 2 thousand years.

B: 14 billion years.

C: 6 thousand years.

D: 4.5 billion years.

E: it has always existed.

The Universe is much older than the Sun.

C In which of the following circumstances is it impossible for any liquid water to exist?

- A: No magnetic field.
- B: 212 F or hotter.
- C: No air pressure.
- D: Lack of oxygen in the atmosphere.
- E: No gravity.

Liquid water requires pressure and a range of temperature. The boiling point depends on the pressure and can be higher or lower than 212F. In the bottom of the ocean at hydrothermal vents water exists (with life in it!) well over 250F.

D Is it possible to change a chemical element into another at all?

- A: There are many common chemical processes that can change one chemical element into another. However, these do not occur in Nature, only in chemistry labs.
- B: There are many common chemical processes that can change one chemical element into another. These often occur in Nature.
- C: There is no way to change a chemical element into another at all, whether the process is chemical or not. Even in atomic reactors chemical elements do not change.
- D: Chemical processes cannot change one chemical element into another, but nuclear reactors/bombs can.
- E: Chemical processes can change one chemical element into another only at exceptionally high temperature.

Chemical elements are determined by the type of their nuclei, which are extremely hard to change. That would require the concentration of a huge amount of energy in that nucleus, only possible in a nuclear reactor/bomb or in the core of the Sun.

E Is the far side of the Moon always in darkness?

- A: Only at new moon.
- B: Always.
- C: For six month in a row every year.
- D: Never.
- E: Only for two weeks a month.

A misconception. We never see the far side as it never turns our way, but it does turn the Sun's way as the Moon spins.

E Is the Sun smaller or bigger than a star?

- A: The Sun is one of the largest stars of all.
- B: The Sun is much larger than any star, although it is not in the center of the Universe.
- C: The Sun is much larger because it is in the center of the Universe.
- D: The Sun is one of the smallest stars of all.
- E: The Sun is an average star.

Most stars are ten times smaller than the Sun, but some of them are much larger, up to a thousand times as large.

B Laser is a type of ... what?

- A: a beam of atoms.
- B: light.
- C: nuclear radiation.
- D: unknown radiation.
- E: a beam of electrons.

Laser is light; it is coherent light, meaning that the wave fronts of each part are synchronized.

B Radar is very rarely used in astronomy. How far does it reach, max?

- A: To all stars in the Solar Neighborhood.
- B: Only within the Solar System.
- C: To all stars in the Galaxy.
- D: To almost everything in the Universe.
- E: Only to the Moon at farthest.

The closest stars are more than 100,000 times farther than the farthest planet, which makes it impossible to detect a radar echo from them. Even a radar echo from Neptune is quite an achievement.

D What are the dark areas on the Moon that form the "face" we can see with the naked eye?

- A: Volcanic craters.
- B: Impact craters.
- C: Oceans of water.
- D: Lava-filled basins.
- E: Mountains.

They are ancient basins that got filled with lava 3.8 billion years ago (magma flows). The magma froze off and volcanic activity stopped at that time. They are not craters.

A What causes the tides of the sea?

- A: The gravity of the Moon.
- B: A change in the pressure of the atmosphere.
- C: The magnetism of the Sun.
- D: The magnetism of the Moon.
- E: The gravity of the Sun.

Magnetism only acts on magnetic materials (iron, cobalt, nickel) and electric currents (i.e. moving charges), not on the water of the oceans.

A What causes weightlessness in a spaceship?

A: The spaceship is not supported on wheels or any other way.

B: There is no air in space.

C: There is no magnetism in space.

D: The rotation of the spaceship.

E: The rocket engine is working nonstop while the spaceship is in space.

There is gravity in spaceships because they do not usually go very high up (i.e. not far from Earth). But a freely flying spaceship has Earth's gravity act equally on the ship and on the person inside, so the astronaut does not feel the gravity.

C What dangerous radiation is generated in astronomical observatories?

A: Dangerously strong magnetic fields.

B: Dangerously strong radio waves.

C: None.

D: Alpha & beta rays due to nuclear processes.

E: Large antennas give out strong gamma rays.

Astronomical instruments do not produce radiation. (They do not even use radar.) They observe what comes from the sky only.

C What do asteroids orbit around?

A: Nothing.

B: Earth.

C: The Sun.

D: The center of the Galaxy.

E: Planets.

Asteroids are the same as (rocky) planets, only much smaller (from one to a thousand miles in size.) All these orbit the Sun.

D What do comets orbit around?

- A: Earth.
- B: The center of the Galaxy.
- C: Nothing.
- D: The Sun.
- E: Planets.

Comets are the same as (icy) planets, only much smaller (up to a few miles in size.) All these orbit the Sun.

A What does 'burning' really mean?

- A: Fast fusion with oxygen.
- B: Disintegration of atoms into electrons and nuclei.
- C: Destruction of molecules due to heat.
- D: Production of heat in a chemical process.
- E: Disintegration of atoms into electrons, protons, and neutrons.

Burning is a chemical process, fusion with oxygen. Production of heat alone does not qualify as burning.

E What instrument do you need to see the Milky Way?

- A: A large telescope.
- B: Binoculars.
- C: A radio antenna.
- D: We cannot see the Milky Way at all because we are inside it.
- E: None.

The Milky Way is a band of light, all the way around the sky, visible to the naked eye without a telescope in a dark location.

A What is a constellation?

- A: A bunch of unrelated stars which form a shape due to perspective only.
- B: A bunch of stars held together by magnetic forces.
- C: Another name for a bright galaxy.
- D: A bunch of stars held together by their gravity.
- E: A bunch of stars that were formed together.

Constellations are no real objects. The stars that seem to form a shape are in fact unrelated, located at very different distances from us.

B What is a galaxy?

- A: A chunk of ice falling into the Sun.
- B: A system formed by a large number of stars.
- C: A cloud of gas that glows because it is hot.
- D: Glowing gas illuminated by a few very hot stars.
- E: A planet orbiting giant planets like Jupiter.

Galaxies are not gas: they are units that form the whole universe; collections of billions of stars. Not to be confused with star clusters, which are small parts of galaxies containing only thousands of stars, not billions.

A What is a light year?

- A: A distance; the closest star is a few light years away (exclude the Sun).
- B: A distance; the closest star is a few million light years away (exclude the Sun).
- C: A time; stars normally live a lot longer than for a light year of time.
- D: A distance as large as the size of the Solar System.
- E: A time; stars normally live for a light year of time.

Light year is distance and not time, despite the name. A light year is a distance light travels in one year, equal about 70,000 astronomical units.

B What is a shooting star?

- A: A small-size meteorite.
- B: A dust particle hitting Earth.
- C: An inch-size rock or piece of ice hitting Earth.
- D: A comet hitting Earth.
- E: A star hitting Earth.

A millimeter-sized piece of rock or ice hitting the atmosphere at huge speed has enough energy to produce the impression of a 'falling star'.

E What is an organic substance?

- A: One created by the bodies of living organisms.
- B: One that is free of contamination.
- C: One that was naturally created, without human action.
- D: One not containing chemicals.
- E: One containing complex molecules that include carbon atoms.

Commercial language abuses people's lack of understanding about what 'chemicals' are. All products are in fact made of chemicals, even water is a chemical. Organic truly refers to large molecules, which can be built based on chains of carbon atoms holding them together.

E What is aurora?

- A: Light from the Sun before dawn, reflected on the surface of Earth.
- B: Light caused by electric discharge between clouds.
- C: Light from the Sun before dawn, scattered in the atmosphere.
- D: A ring of light that occasionally appears around the Moon.
- E: Light caused by charged particles originating in the Sun, hitting the atmosphere close to the N and S poles.

Aurora Borealis (Northern Lights) is seen in Alaska very often, but not in MS, as a vibrating, red/green light in the sky.

C What is Copernicus famous for?

- A: He discovered the universal law of gravity.
- B: He discovered the mathematically precise laws of the motion of the planets.
- C: He suggested that the planets, including Earth, revolve around the Sun.
- D: He turned martyr of conscience and was burned on the stake for heresy.
- E: He discovered that the Moon is revolving around Earth.

Copernicus did not discover that Earth was a planet, he revived the thousand-years-old idea of Eratosthenes. Copernicus did not even have a very airtight proof of it.

E What is in the center of the Universe?

- A: The Sun.
- B: The Galaxy.
- C: A large black hole.
- D: Earth.
- E: The Universe does not have a center.

No such thing.

E What is needed in order to change sulphur into gold?

- A: To change the number of electrons in an atom.
- B: To turn one type of molecule into another.
- C: To use very strong acids.
- D: To change the crystal structure of the solid substance through heating.
- E: To turn one type of atomic nucleus into another.

Chemical elements are determined by the type of their nuclei, changing them would require the concentration of a huge amount of energy in that nucleus.

E What is the best time to observe the Moon early night?

- A: At full Moon.
- B: At new Moon.
- C: At last quarter.
- D: Just before sunset.
- E: At first quarter.

The full Moon has little visible detail as there are no shadows on it; the last quarter is not up early night.

A What is the largest magnification you would reasonably use with any telescope on Earth?

- A: around 500.
- B: around 5,000,000.
- C: around 50.
- D: around 50,000.
- E: around 5,000.

Too large magnification can in principle be achieved, but it would only magnify the blur caused by the atmosphere and not show smaller detail. (Seeing.)

E What is the light of the Milky Way in actual fact?

- A: The light of glowing gas nebulae.
- B: A reflection of sunlight in Earth's atmosphere.
- C: A reflection of sunlight on interstellar gas.
- D: The glow of the upper atmosphere due to cosmic radiation.
- E: The light of a few billion stars washed together.

It's starlight. Looking at the Milky Way in the sky in a small telescope resolves it into a zillion 'small' stars.

B What is the most important factor causing the seasons of the year?

- A: The Sun is less active during the winter, due to sunspots.
- B: The Sun is higher up in the sky at noon in the summer than in the winter.
- C: The Sun is more active during the summer, due to sunspots.
- D: The Sun is closer to us in the summer than in the winter.
- E: The Sun is up for a longer time in the summer than in the winter.

The Sun is in fact closest to us in January. At the North Pole in the Summer the Sun is up all day. These cannot be the reason for summer then.

D What is the most important measure of a telescope?

- A: Its magnification.
- B: Its azimuth.
- C: Its focal length.
- D: Its diameter.
- E: Its resolving power.

The diameter of a telescope determines the amount of light it can collect, and most astronomical objects are dim.

D What is the relation of astrology to astronomy?

- A: One cannot say that astrology is fake, because it is a form of religion.
- B: Astrology is science, astronomy is fake.
- C: Both astrology and astronomy are fake.
- D: Astronomy is science, astrology is fake.
- E: Both astronomy and astrology are branches of science.

Astrology is based on which planet is on which constellation. Planets are small and too far away to affect human events, and constellations don't even really exist.

C What is the source of dangerous radiation on Earth (exclude atomic reactors/bombs and nuclear laboratories)?

- A: A microwave oven.
- B: A strong magnet.
- C: There is none.
- D: A very loud speaker in a concert.
- E: A high-voltage electric power line.

Contrary to everyday belief, electric devices and power lines do not give out noticeable radiation. Each of their photons here has extremely little energy, and only one can act at a time.

C What is the Sun mostly made of?

- A: Rock.
- B: Helium.
- C: Hydrogen.
- D: Metals.
- E: Oxygen.

By mass, 80% hydrogen, 20% helium (rounded). The rest is only a little.

A What is infrared (IR)?

- A: A type of light with longer wavelength than red.
- B: A type of telescope used in astronomy.
- C: A type of nuclear radiation.
- D: Dangerous radiation from atomic reactors.
- E: Pieces of dust zooming around in space.

Wavelength of light is color; infrared is invisible to us ('redder' than red).

B What is ultraviolet (UV)?

- A: A type of telescope used in astronomy.
- B: A type of light with shorter wavelength than blue.
- C: Pieces of dust zooming around in space.
- D: Nuclear radiation from the Sun.
- E: Dangerous radiation from atomic reactors.

Wavelength of light is color; ultraviolet is invisible to us ('bluer' than blue).

D What keeps people on the other side of Earth from falling down, away from Earth?

A: People live only on one side of Earth. The other side is covered with oceans.

B: The gravity of the Moon.

C: The effect of air.

D: The gravitational force between them and Earth.

E: The magnetic force from Earth.

Magnetic forces do not act on people, rock, water, or even on air. It's gravity.

D What particles of matter do magnetic fields act on?

A: All charged particles.

B: All particles.

C: All moving particles.

D: Moving charged particles.

E: Electrons only.

Moving charged particles is the same as electric current, and magnetic fields act on them in a sideways direction.

D What solid or liquid substances do magnetic fields act on?

A: Metals and rock.

B: All metals.

C: None.

D: Iron, cobalt, nickel.

E: Already magnetized metals.

You cannot pick up a penny with a magnet. Try it out if you do not believe it. It's copper. (A nickel is also not made of nickel.)

A What percentage of the stars have planets orbiting them?

- A: More than half of them.
- B: All.
- C: None: all planets revolve around the Sun, not stars.
- D: Less than a millionth of a percent.
- E: Only a few out of a hundred.

Exoplanets have been discovered (with one exception) only after 2003. By today we know that a large portion of stars, if not all, are born with planets.

D What provides the energy of the Sun?

- A: The black hole in its center.
- B: It is hot and cooling off, slowly giving off its already existing heat.
- C: It is burns hydrogen into water.
- D: It turns hydrogen into helium.
- E: It turns helium into carbon and oxygen.

Only a nuclear reaction is capable to provide enough energy to heat the Sun. The Sun is made mostly hydrogen, and it is very hot inside, allowing for nuclear fusion.

D When the shape of the Moon is like the letter D, why is the half of the Moon's disk dark?

- A: Because the shadow of the Earth is cast on it.
- B: Because the Moon is located opposite to the Sun in the sky at that time.
- C: Because the shadow of the Sun is cast on it.
- D: Because it is night on that part of the Moon.
- E: Because the shape of the Moon is not a perfect circle.

The Sun rises and sets on the Moon as it does on Earth, only slower. Half of the sphere-shaped Moon (as of Earth) is in darkness (night). This has nothing to do with the shadow of Earth, contrary to public perception.

A When were the stars of the sky born?

A: Stars are being born at all times.

B: At the time of the Big Bang.

C: 4-5 billion years ago.

D: 6 thousand years ago.

E: They have always been there.

Starbirth is an ongoing process that started right after the Big Bang, and will continue in the future for a very long time.

D Where do planets get their light?

A: They use chemical processes to keep themselves glowing hot.

B: They are hot, so they glow, but they have no energy source inside.

C: They reflect the light they receive from Earth.

D: They reflect sunlight.

E: They use nuclear processes to keep themselves glowing hot.

Planets, asteroids, and comets reflect sunlight; stars (and the Sun) shine on their own.

E Where do stars get their light?

A: They reflect the light of interstellar nebulae.

B: They reflect light from their planets.

C: They reflect light from the Galaxy.

D: They reflect sunlight.

E: They glow on their own.

Planets, asteroids, and comets reflect sunlight; stars (and the Sun) shine on their own, because they are hot.

C Where has the gold we have on Earth originally formed?

- A: Inside Earth.
- B: Inside a main sequence star.
- C: Inside a supernova.
- D: In interstellar space.
- E: Inside the Sun.

Planets, asteroids, and comets reflect sunlight; stars (and the Sun) shine on their own, because they are hot.

B Where in the Universe are comets located?

- A: Comets are in Earth's atmosphere.
- B: Comets, like planets, are part of the Solar System.
- C: Comets are in space but closer than the Moon.
- D: Comets, like the stars or the sky, are part of our Galaxy.
- E: Comets, like galaxies, are everywhere in the Universe.

Planets, asteroids, and comets orbit around the Sun.

D Where is the Sun located in the Universe?

- A: Halfway from the center of the Galaxy in a spiral arm.
- B: In the center of the Universe.
- C: In the center of the Milky Way Galaxy.
- D: Halfway from the center of the Galaxy, between two spiral arms.
- E: None of the other answers is correct because the Sun is not in the Galaxy at all, nor is it in the center of the Universe.

The Sun is not in the center of the Galaxy, and not in one of its spiral arms. Space inside spiral arms contains interstellar gas, but the Sun resides inside an (almost) empty bubble.

C Which constellation is the closest of all to Earth?

- A: The Seven Sisters.
- B: Orion.
- C: This question makes no sense.
- D: Leo.
- E: The Milky Way.

Constellations are no real objects. Their stars are at various distances.

D Which direction does the Sun move in the sky from morning to evening?

- A: E to S to Straight Up to N to W.
- B: E to Straight Up to W .
- C: S to N.
- D: E to S to W .
- E: N to S.

Obvious.

A Which of the following does not get its light from the Sun?

- A: A star.
- B: Pluto.
- C: Venus.
- D: A comet.
- E: The moons of Jupiter.

Obvious.

D Which of the following is not a star?

- A: Alpha Orionis.
- B: Proxima Centauri.
- C: Sirius.
- D: Jupiter.
- E: The Sun.

Jupiter is a planet, the rest are stars.

E Which of the following takes up most of the Solar System?

- A: Comets.
- B: The planets combined.
- C: The Sun.
- D: Asteroids.
- E: Empty space.

As everywhere in astronomy, space is huge and bodies in it are tiny in comparison. Even the Sun.

D Which one is the brightest star in the sky?

- A: Proxima Centauri.
- B: Polaris.
- C: Venus.
- D: Sirius.
- E: Orion.

Venus is the brightest, but it is not a star. Polaris (the North Star) is not particularly bright, it is only aligned with the axis of Earth.

E Which one is the closest star?

- A: Mars.
- B: Andromeda.
- C: Sirius.
- D: The North Star.
- E: The Sun.

The Sun is a star.

D Which one is the closest star (exclude the Sun)?

- A: The North Star.
- B: Mars.
- C: Andromeda.
- D: Proxima Centauri.
- E: Sirius.

Proxima - the name literally means 'closest'. The North Star is not particularly close, it is only aligned with the axis of Earth.

A Who discovered the law of universal gravitation?

- A: Isaac Newton.
- B: Galileo Galilei.
- C: Nicolaus Copernicus.
- D: Johannes Kepler.
- E: Albert Einstein.

Einstein discovered a few things, including relativity, but the law of gravity is not one them. He would have been 300 years too late.

B Why can we not see the stars during the day?

- A: Because the atmosphere of Earth blocks their light during the day.
- B: Because the bright blue glow of the sky overwhelms starlight.
- C: Because stars reflect sunlight, but during the day stars are not located in opposite direction from the Sun.
- D: Because all stars set in the morning, the same way as the Sun sets in the evening; they come up again after sunset.
- E: Because in the bright environment the human pupil contracts.

Obvious.

A Why does the Hubble Space Telescope make very good images?

- A: Because it is in space where there is no seeing.
- B: Because its lenses/mirrors are exceptionally good quality.
- C: Because it can detect infrared radiation that the human eye cannot see.
- D: Because the Hubble Space Telescope is the largest telescope we have.
- E: Because it is in space, closer to the stars than we are.

The HST is not very large, not very good optically, but it is in space where there is no atmosphere. The blur caused by the atmosphere is called 'seeing'.

A Why doesn't the Moon fall down?

- A: It is falling but it is also moving sideways.
- B: Because there is no air on the Moon.
- C: Because the gravity of Earth keeps it up.
- D: Because gravity does not act at such a distance.
- E: Because the magnetism of Earth keeps it up.

Moving sideways and falling downwards, added together, makes it following a circle.

D Why is it that the constellation of Orion cannot affect events in human life?

- A: Because Orion is not in the Zodiac.
- B: Because it is not along the ecliptic.
- C: Because the shape of Orion changes very fast.
- D: Because constellations are not real objects.
- E: Because Orion is more than a hundred light years away from us.

The stars of Orion are at various distances, so there is no such thing in reality as a 'constellation'.

B Why is Polaris special?

- A: Because it is the brightest star in the sky.
- B: Because the axis of Earth points at it.
- C: Because it is always straight up.
- D: Because it is actually a planet.
- E: Because it is the largest star in the sky.

Polaris is not particularly bright, a 'middling' star in the sky. But it is aligned with the axis of Earth.

E Will the Sun turn into a supernova?

- A: Yes, and it has already turned supernova several times.
- B: Yes, as soon as it uses up all of its helium.
- C: Yes, in 5 billion years.
- D: Yes, in a few hundred thousand years.
- E: No.

Only very heavy stars (at least 8 times the Sun in mass) blow up as supernova. Exceptionally, this can happen also to close binaries, but the Sun is single.

B State Kepler's I law.

A: A planet swipes equal areas in equal times as it orbits the Sun.

B: The shape of the orbit of the planets is an ellipse, and the Sun is in one of the foci.

C: Planets revolve around the Sun.

D: The motion of a planet is maintained by the force of the gravity of the Sun.

E: A planet's distance from its star (a) is related to its period of revolution (T) and the mass of the star (M) as $a^3 = M T^2$.

To understand in more detail, read the textbook's appropriate chapter. You need to spend some time on this.

B State Kepler's II law.

A: A planet's distance from its star (a) is related to its period of revolution (T) and the mass of the star (M) as $a^3 = M T^2$.

B: A planet swipes equal areas in equal times as it orbits the Sun.

C: Planets revolve around the Sun.

D: The shape of the orbit of the planets is an ellipse, and the Sun is in one of the foci.

E: The motion of a planet is maintained by the force of the gravity of the Sun.

To understand in more detail, read the textbook's appropriate chapter. You need to spend some time on this.

A State Kepler's III law.

A: A planet's distance from its star (a) is related to its period of revolution (T) and the mass of the star (M) as $a^3 = M T^2$.

B: A planet swipes equal areas in equal times as it orbits the Sun.

C: The motion of a planet is maintained by the force of the gravity of the Sun.

D: The shape of the orbit of the planets is an ellipse, and the Sun is in one of the foci.

E: Planets revolve around the Sun.

To understand in more detail, read the textbook's appropriate chapter. You need to spend some time on this.

D What are Kepler's laws?

A: They explain what force drives the planets around the Sun along their orbits.

B: They state the fact that the planets revolve around the Sun.

C: They derive the revolution of the planets around the Sun with mathematical accuracy from the law of gravity.

D: They explain with mathematical accuracy how the planets revolve around the Sun.

E: They state the fact that the planets revolve around the Sun is explained by gravity.

To understand in more detail, read the textbook's appropriate chapter. You need to spend some time on this.

E How do we know black holes exist when no light can ever leave them?

A: We often observe when they collide with each other.

B: They suck in all sorts of stars from their vicinity.

C: They block the light of stars behind them.

D: Light cannot leave them but radio signals can.

E: They still have their gravity.

An isolated black hole is invisible. But when matter falls on the black hole, it heats up and radiates as it is crunched up before it reaches inside. Once inside, infalling matter is gone for good.

C What is a black hole?

A: A star with no fuel left to shine.

B: A place where objects can jump from one galaxy to another.

C: A star with very strong gravity.

D: A star that is much fainter than its bright companion.

E: Normally, the core of a red giant star, which may be occasionally ejected.

Strictly speaking, a black hole is not a 'star' any more. It is a remnant of a huge star blowing up (which is rare), or else a million/billion solar mass object in the center of a galaxy.
