What's Up! January 2022 Quiz (Telescopes and Observing) Answers

by John Rowland

1. All the following are considerations when buying a first telescope, but which one is the least important?

a) Aperture (i.e. its light-gathering power)
b) Focal length (i.e. how long its tube is, if a refractor or reflector)
c) Resolving power (i.e. how much detail it will show)
d) Steadiness of the mount (i.e. how quickly it settles down if touched or knocked)
e) Ease of use (i.e. how simple it is to set up and use)

The answer is focal length because there's nothing you can do to change the other factors (all of which are important); you're stuck with them. But you can change the effective focal length of a telescope through the use of Barlow lenses or focal reducers. There's nothing intrinsically significant about a telescope's focal length.

2. The magnification of a telescope:

a) Is entirely dependent on its aperture and nothing else.
b) Can be found by dividing its aperture by the eyepiece focal length.
c) Can be found by dividing its focal length by the eyepiece focal length.
d) Can be found by multiplying its focal length by the eyepiece focal length.
e) Is entirely dependent on its focal length and nothing else.

It's c). There's nothing else to say except to appreciate that magnification is not a fixed thing; it can be changed using different eyepieces.

3. An equatorial mount:

a) Is a mount originally designed for use at or near the equator but modified for use at other latitudes?
b) Is simple to set up because it only has one axis of rotation.
c) Is simple to use once you've set its main axis to point at the zenith.
d) Can be used to follow objects by only moving it about one axis of rotation.
e) Is one of the few mount types well suited to observing objects near the pole star.

Equatorial mounts have nothing to do with the equator so a) is rubbish. b) is also wrong not only because this type of mount is not that simple to set up, but has two rotation axes. If it only had one, it couldn't point to anywhere in the sky. The only mounts that have a single axis of rotation are those used for transit telescopes. c) is wrong because an equatorial mount's main axis does not point at the zenith; it points to the pole. d) is right and is the primary advantage of an equatorial mount. e) is wrong because it is particularly difficult to move an equatorially mounted telescope to observe objects near the pole. Such objects could be only a few arc minutes away from each other but require the telescope and mount to rotate by as much as 180°.

4. Which telescope mount requires you to occasionally perform a "meridian reversal" (aka "meridian flip")?

a) German
b) English (aka Yoke)
c) Fork
d) Horseshoe
e) Alt-Azimuth

It's the German. All the others permit continuous observing (and/or imaging) as objects move from east to west across the meridian. The tubes of telescopes on German mounts can hit the mount sometimes as objects cross the meridian, so tracking has to stop and the instrument swung to the other side of the mount. This can be a very annoying interruption because it happens at the very time when the object is highest in the sky. It's also an irritating procedure involving finding the object again, and when you do, it's oriented opposite to how it was before the flip. And it's an absolute no-no for long exposure imaging. See this video for more information.

5. Barlow lenses are useful accessories. Which of these statements is correct?
   a) A x2 Barlow will double the magnification.
   b) A x2 Barlow will halve the focal ratio.
   c) A x3 Barlow will reduce the brightness of an extended image to one third.
   d) A x3 Barlow used with a 6mm eyepiece gives the same magnification as no Barlow and an 18mm eyepiece.
   e) All Barlows bring the final focal plane closer to the objective or primary mirror.

It's a) because Barlow lenses work by increasing the effective focal length of the telescope, so for a given eyepiece, a x2 Barlow will double the focal length and thus the magnification. b) is wrong because in fact the focal ratio is doubled, not halved. c) is wrong because the image size will triple so its area will increase nine times, so the same amount of light is spread out by that factor so its intensity or brightness will be reduced to 1/9th. In d), the maths is all screwed up; a x3 Barlow with a 6mm eyepiece will behave as if the eyepiece was a 2mm, not an 18mm. e) is wrong; the opposite is the case.

6. Which of these is a good technique to follow?
   a) For the best viewing, telescopes stored indoors should be used as soon as possible after taking them outside in the cold.
   b) If a telescope mists up during use, it should be taken indoors to warm up.
   c) Whilst observing, it's a good idea to keep eyepieces in your pocket with their dust caps on rather than keeping them cold in an exposed position outdoors.
   d) If you keep losing the object you're observing, increase the magnification to help you relocate it.
   e) When observing using high magnifications, manually hold the telescope firmly to help keep the image steady.

The good technique is c). All the others are not only not good, but definitely not advised. Telescopes stored indoors need time to cool down to near ambient temperature before use. See this article. Re b), it's too much of a hassle and takes too long to demist a scope by taking it back indoors. Best option is to play a hair-drier set to "Fan only" onto the offending surface(s). Re eyepieces, if you allow them to cool down too much, when you use them, the water vapour from your eyeball can condense on the eyepiece's eye lens. It's best to keep them warm (and dust free); eyepieces are the telescope components that do not need to cool to ambient temperature. Re d), that's the worst thing you can do as it will reduce the sky field of view and make finding the object more difficult. Do the opposite. As for e), you cannot hold a telescope steady by manually holding it. Just leave it alone; any oscillations will soon subside.

7. Although some of these may be possible methods, the ***best*** procedure when setting up a finder telescope attached to a larger instrument is:
   a) In daylight, centre a distant object in the finder then move the main instrument so the object is centred in that.

b) In daylight, centre a distant object in the main instrument then move the finder so the object is centred in that.
c) At night, point the main instrument at Polaris then move the finder so Polaris is centred in that.
d) At night, point the main instrument at any object on the meridian then move the finder so the object is centred in that.

The best procedure is b). Using this method, you can easily see what you're doing – such as finding and turning the alignment adjustment screws on the finder brackets. c) is a definite possibility but it'll be dark, and with some mounts, it's not that easy to point at Polaris. d) is possible but objects on the meridian move across the sky faster than objects in any other direction; aligning on a moving target can be tricky. And a) is quite ridiculous if you think about it.

8. "Seeing" is the word that describes the steadiness of the atmosphere and how this affects the image quality when higher magnifications are used. Which of these statements is WRONG?

a) Seeing is often inferior when it's very clear and windy.
b) Nearby lenticular clouds are an indicator of good seeing.
c) Vegetation (bushes etc.) in the vicinity of an observatory often improves seeing.
d) Twinkling stars in a crystal clear sky are indicators of good seeing.
e) Still nights with a little haze can produce good seeing.

Stars twinkle because the atmosphere is unsteady. Viewing under these conditions will cause severe image degradation, especially when higher magnifications are used, so d) is wrong. All the other statements are correct. a) because wind causes turbulence and turbulence causes poor seeing. b) because lenticular clouds indicate the atmosphere is in lamina flow – the opposite of turbulent. c) Hard surfaces such as concrete store up heat during the day then release it by convection at night; vegetation evens out this effect. Re e), whilst a little haze may decrease image contrast slightly, haze doesn't form when the atmosphere is turbulent, and the gentle blanket effect of haze reduces the rate of heat loss to the sky, which in turn reduces convective turbulence.

9. Filters can improve the visibility and/or contrast when viewing various astronomical objects. Which of these statements is WRONG?

a) A neutral density filter improves visual observation of the moon.
b) The popular Optolong Enhance narrowband filter produces an (almost) full colour image from a colour camera.
c) A narrowband Ha filter captures only the blue light of an Emission Nebula
d) An IR (Infrared filter) will reduce star "bloat" in all scopes.
e) Light pollution filters are not very effective against broadband LED streetlights.

It's c), because Ha is red, not blue. All the others are correct statements. a) is correct because these filters simply reduce the glare. e) is correct because LPRs target a small but specific set of wavelengths, but LED streetlights emit a whole range of wavelengths.

10. An accurate method to align the polar axis of an equatorial mount is to use the Star Drift (AKA Declination Drift) method. When using this method, which of the following is correct?

a) A meridian star that drifts north shows the axis is too far east.
b) A meridian star that drifts east shows the axis is too far south.
c) A star near the celestial equator low in the west that drifts north shows the axis is too high.
d) The polar axis drive should be turned off during these tests.
e) A star near the celestial equator low in the east that drifts north shows the axis is too high.

It's e). See https://skyandtelescope.org/astronomy-resources/accurate-polar-alignment/

11. Regarding the brightness and quality of the image a telescope delivers, which of the following is not primarily dependent on the aperture alone?

a) The minimum magnitude of stars visible.
b) The resolving power.
c) The upper limit of useful magnification.
d) The lower limit of useful magnification.
e) The apparent brightness of extended images.

All through a) to d) are dependent only on the aperture, nothing else. There are many learned articles on how aperture alone determines these limits, but for faintest stars, finest detail and magnification it's intuitive that the bigger the telescope the more you can see. As for the lower limit of useful magnification, it's not intuitive; one has to go into optics theory. If you want to know more, see this article. In simple terms though, the lower limit of useful magnification is aperture in mm divided by 7. Apparent brightness however depends on focal ratio (focal length divided by aperture) and magnification.

12. A 150mm (aperture) f/5 telescope is used with a 30mm (focal length) eyepiece that delivers a 70° field of view (the angular diameter of the visual field when you look through the eyepiece). What is the angular diameter of the actual area of sky that this combination captures?

a) 5.21°
b) 3.21°
c) 2.21°
d) 1.21°
e) There is insufficient information in the question for it to be answered.

There is a "standard" equation for this, that states the true field of view = apparent field of view (70°) divided by magnification. The magnification is 150 x 5 ÷ 30 = 25. So according to this equation, the true FOV = 70° ÷ 25 = 2.8°. Unfortunately, this standard equation is only valid for small angles so cannot be used for angles as high as 70°. One has to use trigonometry to arrive at the accurate answer. A 30mm eyepiece delivering a 70° FOV means that the field lens radius of this eyepiece must be 30tan35° mm. This equals 30 x 0.70 = 21.0 mm. The focal length of the telescope is 150mm x 5 = 750mm. The tangent of the angle subtended by the eyepiece field lens radius at a distance from the primary of 750mm = 21/750 = 0.028. The angle whose tan is 0.028 is 1.604°. This is therefore the actual field of view radius, so its diameter is twice that, and is 3.208 (3.21 to two decimal places).

*[The online Quiz was **opened** on 1/1/2022, **closed** on 15/1/2022 and answers **released**]*
Ref: https://yorkastro.org.uk/whats-up/whats-up-january-2022/#Quiz