Observational test

Question 1.

Find the field of view of the telescope with the eyepiece provided by the attendant.

Answer: The attendant will provide a chronometer.

The student should select and observe any star from the "*Bright Stars catalogue visible from Greece*" that is provided by the attendant. The name of the star and its declination is written on the data sheet. **(1 point)**
(Note: If the student selects α UMi the attendant should not warn him).

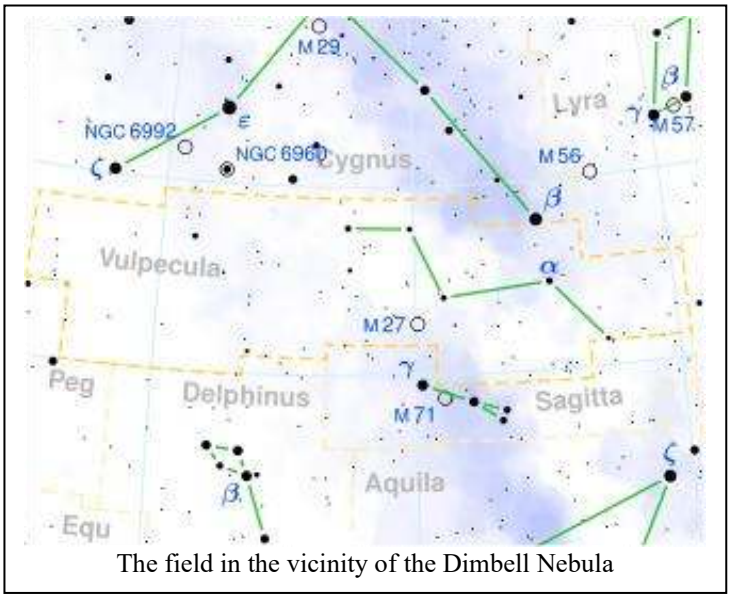
The student measures and writes down the *crossing time* of the star that he/she has selected.
(Marking scheme: ±4 s: 100%, ±6 s: 80%, ±8 s: 60%, ±12 s: 40%, ≥ 12 s: 0). **(5 points)**
The field of view is then calculated by the student on the spot, by using the formula:

$$FoV = \omega \times t \times \cos(dec) = \frac{360^\circ}{23^h\,56^m\,4^s.1} \times t \times \cos(dec)$$ **(4 points)**

(Example: for Capella [dec = 46°.0, cos (46.0) = 0.6947] and transit time t = 3^m31^s = 3.53 min we get: $FoV = \frac{(360 \times 24)'}{1436.001\,\text{min}} \times 3.53\,\text{min} \times 0.6947 = 36'.9$)
[Maximum allowed time **10 minutes**]

Question 2.

Locate the bright star *γ Sagitta* (*RA* = $19^h\,58^m\,45.39^s$, *Dec* = +19° 29′ 31.5″), which lies between the constellations of Lyra and Delphinus. Then aim and locate the famous Dumbbell Nebula, M27 (*RA* = $19^h\,59^m\,36.34^s$, +22° 43′ 16.09″) in the center of the field of view. The observing spot is rather dark and you cannot read the setting circles!



The field in the vicinity of the Dimbell Nebula

Answer: The student should recognize the constellation of Sagitta and tell the attendant to which direction is the "*head of the arrow*" **(2 point)**
Then points the telescope at *γ Sagitta*, which is the brightest star of the constellation. **(3 point)**
The students should notice that the two targets have very similar *Right Ascension*. Therefore given the *RA* and *Dec* of the bright star *γ Sagitta* (m = 3.51 mag), should be able to quickly locate *M27* as the equatorial mounting is already aligned. Then should keep the *RA* axis locked, release the Dec knob and turn the telescope by about 3.25 degrees towards Polaris. The Dumbell Nebula will appear in the field of view. **(5 point)**

[Marking scheme: Points given according to time spent. Total time required: ≤4 min: 100%, ≤5 min: 80%, ≤6 min: 50%.
[Maximum allowed time **6 minutes**]
(Note: If the student fails to locate M27 and complains, the attendant does it 30 s)

Question 3:

At 14 o'clock local time in the morning of the spring equinox a rare transit of Mercury is going to take place. A team of astronomers reaches a mountain top, early in the morning, in order to align his telescope and then observe the transit. The site is new and they do not know the geographical coordinates. Unfortunately the sky is covered with clouds. No stars are visible. The telescope cannot be aligned. The sky is overcast until 11 o'clock. The Sun becomes visible. An experienced astronomer manages to roughly align the telescope in less than 2 minutes! He only uses a water bubble.

You are given the telescope of the 7th IOAA and a water level. Assume that it is spring equinox and that the time is 12 o'clock. A fake Sun is shining. Could you align the telescope?

(Note: Obviously for this exercise, a telescope tube is not necessary, therefore, for the sake of convenience, the telescope will be equipped with a rough paper-tube and without counter weights.

Answer: First the student levels the tripod with the help of the water bubble. Then he/she adapts the equatorial mount on the tripod. Because it is spring equinox, the declination of the Sun is 0°. At this point the student should immediately set the Declination circle of the telescope at 0° and secures the break knob. The declination axis is calibrated. Then he/she rotates the RA axis and, by using the water bubble, makes the tube of the telescope horizontal (pointing toward the East). He rotates the RA setting circle to show 0 hours. Then he/she rotates again the RA axis until the setting circle shows 6 hours. Obviously, if the azimuth axis had been correctly set, at this point the telescope should be pointing somewhere on the local meridian. Then, exactly at 12 o'clock, when the sun crosses the meridian, he turns the azimuthal axis of the telescope until the he observes the Sun above or below the direction where the telescope is pointing. Now the telescope is pointing toward the local meridian. Finally he turns the latitude (altitude) axis of the telescope, up or down, until he aims the sun. The polar axis of the telescope is immediately aligned!

(Note: This is an indoors exercise). [Maximum allowed time **16 minutes**]