INSTRUCTIONS TO PARTICIPANTS:

1. Fill in all required details below, before time is up.

2. You are to fill up all responses to section P(A) and relevant responses to section P(C) on the separate Answer Sheet word document provided. Export this word document to PDF before submitting.

3. There will be a star chart provided as part of the question. Responses to the corresponding questions in that section are to be answered on the star chart itself.

4. You can either annotate on the PDF itself or on the separate .PNG file provided.

5. All final responses shall be written legibly and unambiguously.

6. Ensure that all documents you want assessed are combined into one single .zip folder before uploading.

7. Details on each page:
   - Your participant code.
   - **DO NOT WRITE YOUR NAME ON YOUR ANSWER SCRIPT.**

Participant Code	

P(A) Multiple Choice Questions [22]

Attempt **ALL** questions in this section. Indicate your answer clearly in the answer sheet.

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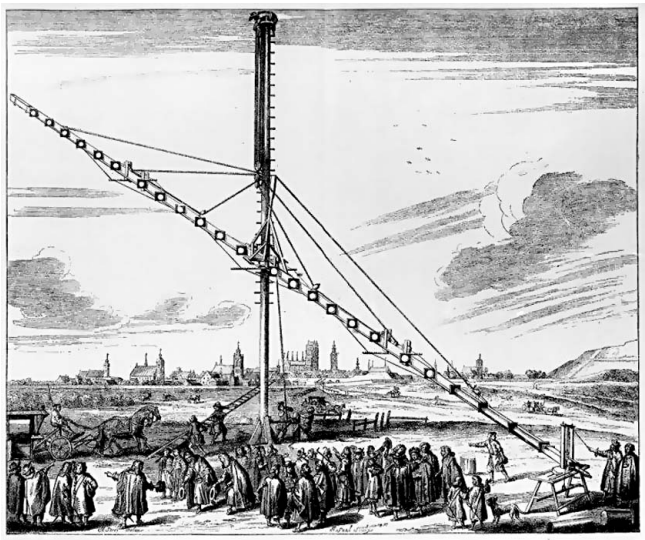
1. Joe is looking to purchase a computerised telescope mount for long-exposure astrophotography. Which mount type should he select? **[2]**
   A. Altitude-Azimuth
   B. German Equatorial
   C. Transit Mount
   D. All three mounts are equally suitable

2. Which constellation represents the Cretan Bull in Greek Mythology? **[2]**
   A. Boötes
   B. Cepheus
   C. Horologium
   D. Taurus

3. When Bob centered his Newtonian telescope on M41, he noticed that the stars at the edge of the cluster were distorted, resembling little white comets. How can he correct this? **[2]**
   A. Add a focal reducer
   B. Recollimate the primary mirror
   C. Add a coma corrector
   D. Add a 3× Barlow lens



4. In 1673, a 46 m long telescope was erected by Johannes Hevelius. In that era, other similarly long telescopes were also built. Why were these old telescopes so long? **[2]**
   A. To increase magnification with a long focal length objective lens
   B. To limit the amount of chromatic aberration
   C. It was easier to manufacture thin lenses with longer focal lengths
   D. Longer scope bodies results in less unwanted vibrations

5. Which of the following constellation's boundaries do not intersect the celestial equator? **[2]**
   A. Libra
   B. Ophiuchus
   C. Cetus
   D. Cancer

6. How many of the following statements are **TRUE**? **[2]**

   I The first point of Aries does not currently lie within the constellation boundary of Aries
   II Polaris lies exactly on the North Celestial Pole
   III Both the Magellanic clouds are irregular galaxies
   IV In the Southern Hemisphere, Scorpius is not visible during winter

   A. 1
   B. 2
   C. 3
   D. 4

7. Which of the following constellations does the sun not pass through at any point in the year? **[2]**
   A. Leo
   B. Pegasus
   C. Aquarius
   D. Sagittarius

8. Imagine the obliquity of the Earth suddenly became zero with no change to its orbital eccentricity. How would the appearance of the solar analemma change? **[2]**
   A. The analemma would look like the arc of a great circle
   B. The analemma would look like a dot
   C. The analemma would look like a lopsided oval
   D. The analemma would look like a symmetrical figure 8

9. What is the declination of the southernmost star visible from Romania (48° N)? **[2]**
   A. -24°
   B. -31°
   C. -42°
   D. -69°

10. A telescope has focal ratio f/6, an aperture of diameter 30cm, with an eyepiece of focal length 50mm. What is the magnification of this telescope? **[2]**
   A. 42×
   B. 24×
   C. 18×
   D. 36×

11. For each of the following statements, indicate on the answer sheet whether they are true or false. **[2]**

    i. It is impossible to observe Venus and Mercury at midnight local time

    ii. Solar System objects closer to the horizon experience more visible distortion

    iii. Telescopes with the same focal length but larger apertures will have more prominent optical aberrations

    iv. Two stars visibly close in the night sky are physically close together

P(B) Star Charts [8]

Answer **ALL** questions in this section. Indicate your answers on the images provided.

Trace the constellations of **Corona Australis** and **Lepus** in images 1 and 2 respectively. **[2]**

For each of the following two images:

- Circle **TWO** stars and state their common names or Bayer designations. **[2]**
- Cross out with an 'X' and label **TWO** Messier Objects. **[4]**

Image 1

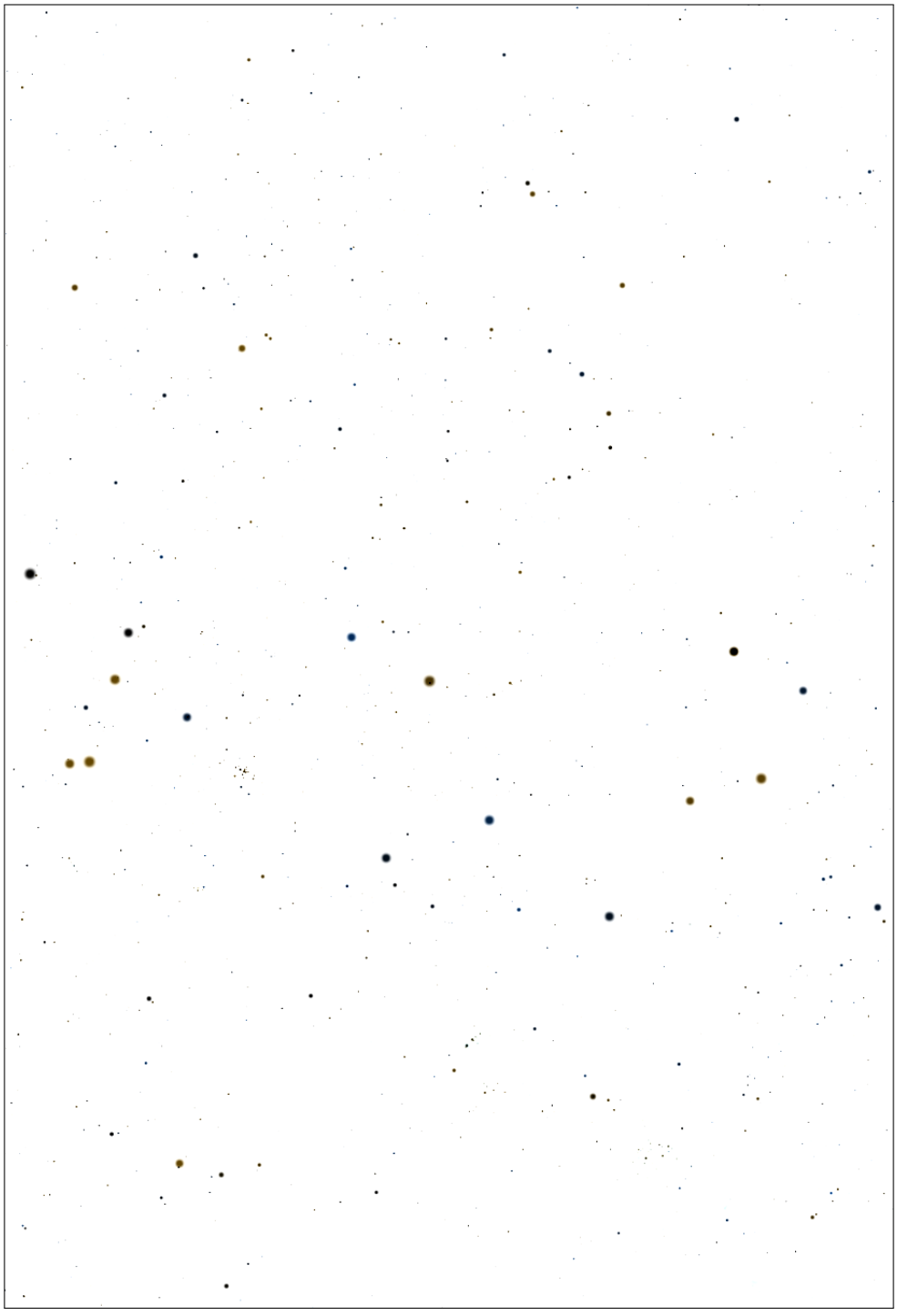
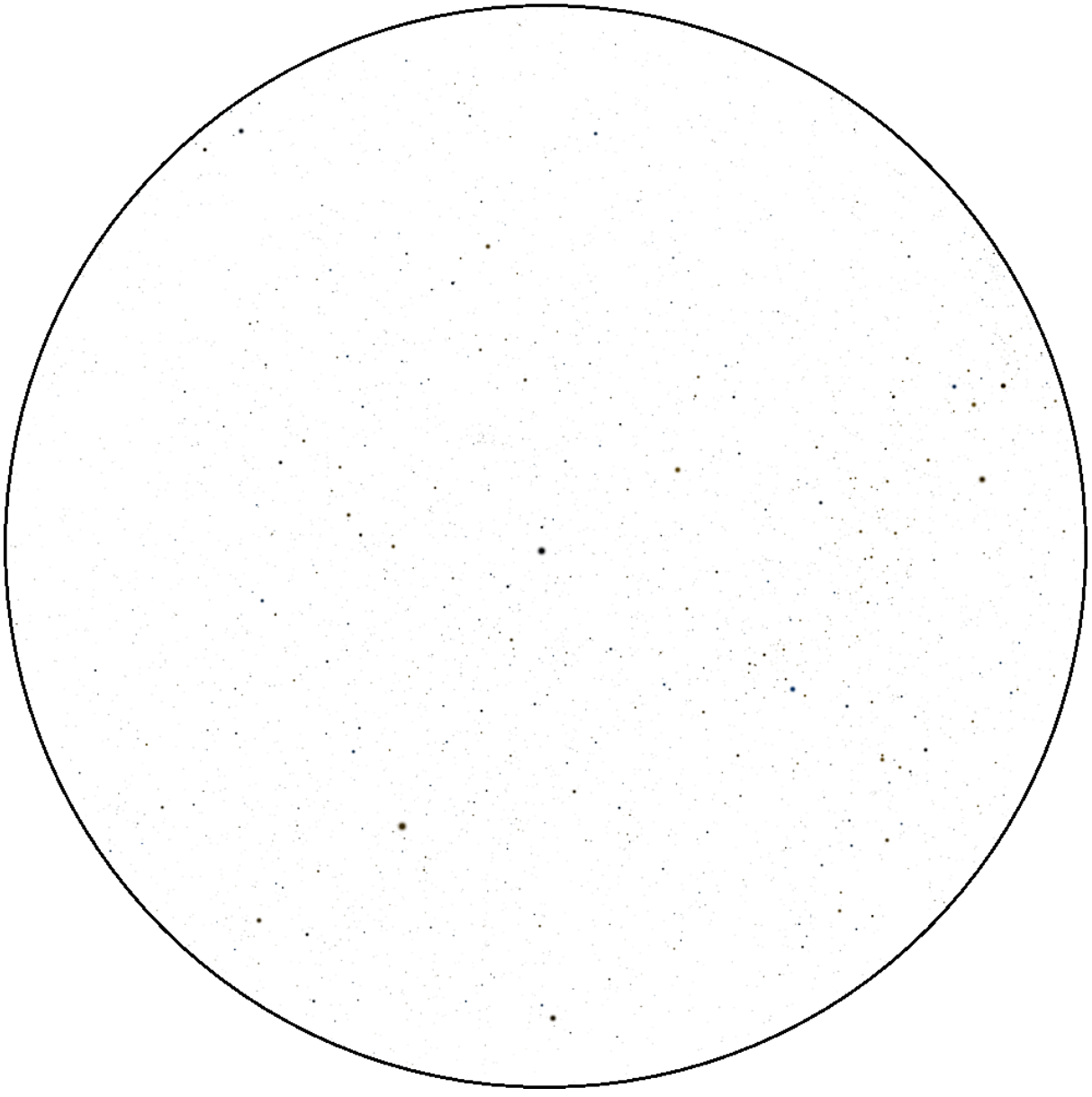


Image 2

P(C) All Sky [20]

Answer **ALL** questions in this section. Where appropriate, indicate your answer clearly in the answer sheet.

You are lost at sea, adrift on a raft with no land in sight. Whilst your situation is bleak and hope for rescue is minimal, you realise that there is no light pollution or clouds, and you are finally able to do some proper night sky observation.



Using this starchart, answer the following questions:

1. You first attempt to get your bearings straight. Mark on the star chart the cardinal directions North and South right outside the boundaries of the star chart with 'N' and 'S' respectively. **[1]**

2. Trace and label the local meridian on the starchart. **[1]**

3. **SIX** zodiac constellations are visible on this night.
   (a) Trace out and label **THREE** of the zodiac constellations. **[3]**
   (b) Hence, trace and label the ecliptic. **[1]**
   (c) Cross out with an 'X' the point at which the sun would rise. **[1]**

4. Now that you have a good sense of direction, you begin admiring the night sky.
   (a) You notice that the Summer Triangle is visible. Label its three constituent stars on the star chart, and trace out the asterism by connecting them. **[1]**
   (b) Strangely, **TWO** prominent stars are not visible in the night sky. Identify the missing stars, and mark their original locations with a 'X' **[2]**
   (c) Trace out and label any other **THREE** non-zodiac constellations (they must be **fully visible**). **[3]**
   (d) Cross out with an 'X' and label any **THREE** deep sky objects. **[3]**

5. Lost in wonder at the beauty of the night sky, you only now realise that you still have your phone on you. It is currently 12am in Singapore (UTC+8) on the 11th of March.

   Thanks to your efforts in studying for the Singapore Astronomy Olympiad, you recall that the star Arcturus has the celestial coordinates of RA/DEC: $14^{\mathrm{h}}16^{\mathrm{m}}/+19°10'$
   (a) Cross out with an 'X' and label the star Arcturus on the star chart. **[1]**
   (b) Hence, calculate the latitude and longitude of your current location. **[3]**

End of Paper