

Participant Code: _____

1 Ursa Major [6]

Answer **ALL** sub-questions and write your responses on this question paper. You have five minutes to align your telescope and answer all sub-questions. After the allocated time has elapsed, this question sheet shall be collected by an examiner. You will not be able to reference previous questions.

Find a deep sky object (DSO) from Ursa Major. The object is labelled with its Messier number.

(a) Show the in-focus object to the examiner [1]

You have a single chance to be evaluated. If your telescope alignment is incorrect the examiner will correct the alignment on your behalf for the next part of this question. If you are unable to locate the object, you may also request for the examiner to align the telescope at the object on your behalf. No marks will be awarded for incorrect or assisted alignment.

(b) State the conventional name of this object [1]

(c) Ursa Major includes a prominent asterism. Name the star within this asterism closest to the object found in (a) and state its Bayer designation [2]

(d) This DSO is approximately 0.13 solar masses and consists of concentric shells. State the DSO type [1]

(e) Name another DSO of identical type (conventional/Messier designation) [1]

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2 Venus [6]

Answer **ALL** sub-questions and write your responses on this question paper. You have five minutes to align your telescope and answer all sub-questions. After the allocated time has elapsed, this question sheet shall be collected by an examiner. You will not be able to reference previous questions.

Find a star map with Venus labelled. Venus is at eastern elongation and is 0.72AU from the Sun.

(a) Show the in-focus star map to the examiner [1]

You have a single chance to be evaluated. If your telescope alignment is incorrect the examiner will correct the alignment on your behalf for the next part of this question. If you are unable to locate the object, you may also request for the examiner to align the telescope at the object on your behalf. No marks will be awarded for incorrect or assisted alignment.

(b) State the constellation Venus is located [1]

(c) State the constellation the Sun is located [2]

(d) Estimate the month this star map was taken [2]

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3 Virgo [6]

Answer **ALL** sub-questions and write your responses on this question paper. You have five minutes to align your telescope and answer all sub-questions. After the allocated time has elapsed, this question sheet shall be collected by an examiner. You will not be able to reference previous questions. A scientific calculator is required.

Find a galaxy in Virgo labelled with its Messier number

- (a) Show the in-focus object to the examiner [1]

You have a single chance to be evaluated. If your telescope alignment is incorrect the examiner will correct the alignment on your behalf for the next part of this question. If you are unable to locate the object, you may also request for the examiner to align the telescope at the object on your behalf. No marks will be awarded for incorrect or assisted alignment.

- (b) Provide the galaxy type (Spiral, Elliptical, Irregular, Lenticular, Irregular) [1]

- (c) Name another DSO of the same type (either conventional/Messier designation) [1]

- (d) The galaxy in part (a) has an apparent magnitude of 8.6, is 16.4 Mpc away from Earth and has an approximate radius of 3.89×10^9 AU. The solid angle of the galaxy can be approximated by its angular size in the sky. Calculate its surface brightness [3]

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4 Canes Venatici [3]

Answer **ALL** sub-questions and write your responses on this question paper. You have five minutes to align your telescope and answer all sub-questions. After the allocated time has elapsed, this question sheet shall be collected by an examiner. You will not be able to reference previous questions.

Find a galaxy in Canes Venatici labelled with its Messier number

- (a) Show the in-focus object to the examiner [1]

You have a single chance to be evaluated. If your telescope alignment is incorrect the examiner will correct the alignment on your behalf for the next part of this question. If you are unable to locate the object, you may also request for the examiner to align the telescope at the object on your behalf. No marks will be awarded for incorrect or assisted alignment.

- (b) Plumes of gas have been observed exiting this galaxy in its northeastern and southern regions. Provide a reason for this phenomenon [2]