**S284 TMA 00 Model Answer**

**Note to students: -**

1. This model answer was produced by the module team using Microsoft Office 365 and all the functions available to OU students. The template was also generated by the module team using Office 365.
2. Your answers may not look identical to those below, but this model answer is a good indicator of how you are expected to lay out, present and hand in your work at Level 2 study.
3. The model answers include some comments in BLUE which are not part of the model answer but are additional information to help you.
4. Remember to ASK YOUR TUTOR if there is anything here you did not understand / could not do.
5. The model answer has been provided to help you with your studies – all S284 students who submitted TMA 00 received a copy of this model answer. Please do not share by email, in forums, or elsewhere on social media or the web – this document has been provided in its original form to help you with your S284 TMA submissions and with study skills in this module.
6. Remember now to take some of your self-directed study time to compare this document and your own TMA 00 submission. This reflection will help you when TMA 01 is due.

Good luck with S284 – from the Module Team.

**S284 TMA 00**

**Question 1**

**Astronomical unit** (AU) – average distance between Earth and Sun – about 150 million km.

**Solar radius** (RꙨ) – radius of Sun – about 700 000 km – 200 times smaller than 1 AU.

**Light year** (ly) – distance light travels in a year – about 10 trillion km or 60 000 AU.

**Parsec** (pc) – distances to/sizes of galaxies – about 3 ly – also kpc (103), Mpc (106), Gpc (109)

*Time to study section and make notes: 20 minutes*

Notes:

The question specifically asked for no more than a few sentences or bullet points so check that your answer is no more than this. In TMAs you’ll get guidance on how much to write – follow this advice, as often the number of sentences is related to the marks available. The four key distance units presented in this section are shown in bold.

Notice the ‘solar’ symbol (an O with a dot in it) is included as a subscript on the R for solar radius. This symbol may be found from the Word 365 menu: Insert | symbols | symbol and select the appropriate item. (Its character code is A668 if you need to search for it and it may also be inserted by typing “A668 alt-x”.) If you cannot get this to work, typing “R\_sun” is an acceptable alternative.

You may also have written something in your summary about the precise values of these distance units, but this additional information isn’t necessary as the precise values can always be looked up (in the Extended Summaries Booklet for instance). What’s more important is to have an overall feel for the relative sizes of these quantities. Try and be careful not to write superfluous information beyond what a question asks – there are rarely if ever additional marks, and you will spend time on something that isn’t required!

Notice also that the length of time taken to study this section and make notes on it has been included in the answer. If a section requiring “two units of study time” takes you 20 minutes to study, you can scale that time to other sections as appropriate.

**Question 2**

(Equation 1.4)

Notes:

To insert an equation in Office 365, click the Insert tab, then the Equation option. The Equation tab includes options for superscript, subscript, symbols, brackets and fractions, and the Word help file can assist if you are not yet familiar with type-setting an equation. This example included several of the key skills required to write an equation for S284 – if you want to investigate how to use the Word 365 equation editor, click on the equation above to open the equation tab, then click by one element of the equation – you can now explore how to use this Word function.

A list of all the equations needed in S284 is given in the Extended Summaries Booklet, so you do not have to remember equations off by heart, but you do have to understand the equations and know what they mean and know which one to use when, and what all the symbols are. You will not be told which equation to use in the exams (or in TMAs) – this is part of your learning and understanding of the S284 course material.

If you find the equation above daunting, or don’t know what some of the symbols mean, then it’s a good idea to revisit your maths skills using the S284 bootcamp resources. If after revising your maths skills you are still not sure you understand the equation terms above, please contact your tutor to discuss whether your maths knowledge is at the standard assumed for S284.

**Question 3**

1. An H-R Diagram (reproduced from Topic 2, Figure 2.12)



Notes:-

1. Here for clarity we have drawn the H–R diagram electronically. However, the H–R diagram frequently comes up in TMA questions and the exams, and you may be expected to be able to draw it – so do practise this. You may have hand-drawn it and taken a photo or scanned in your hand drawn option – this is fine, and you should know how to embed images and diagrams and figures into a Word document.

There are always marks in a question like this for drawing the correct axes, which includes labelling them (including a title and units) and being able to add at least 3 values (tick-marks or subdivisions) on each axis. In this specific case the *x-*axis is temperature (*T*/K) and the *y*-axis is luminosity (*L*/LꙨ). Sometimes different labels are used in the H–R diagram – you will learn about these in S284 but should also know values and so forth for the alternatives. Read the TMA and exam questions carefully to see which axes you are asked to plot. If no quantity is specified, we usually plot luminosity (on the *y-*axis) versus temperature (*x-*axis).

1. Astronomy Picture of the Day:

See Explanation.  Clicking on the picture will download
the highest resolution version available.

**Nearby Spiral Galaxy NGC 4945 (from Astronomy Picture of the Day (1))**

(Credit: Martin Pugh (<https://www.martinpughastrophotography.space)>)

References.

1. <https://apod.nasa.gov/apod/astropix.html> (accessed 22.08.2019)

Notes:

1. You (almost certainly) will not have the same picture as the module team here. However, your image should have a title which refers to the source of the image, an appropriate reference (so others could find your image, which should be the web address and the access date), and a credit. In this case the image has copyright, so if we wanted to use it in the public / commercial domain we would need the permission of the credited ‘author’, but this is not necessary for adding the image to your TMA. All these elements would be required to get full marks on a question like this.

(c) Screen shot of Fig 2.9 Interactive H-R diagram for Main Sequence Stars (from Topic 4 Ex 2.1)

Text

Description automatically generated

References:

Fig 2.9 Interactive H-R diagram for Main Sequence Stars (from Topic 4 Ex 2.1) (2021) Available at <https://learn2.open.ac.uk/mod/oucontent/view.php?id=1848206&section=2.2.1> (Accessed: 3rd April 2021)

Notes:

(c) You should have the same picture as the module team. Your screenshot should contain the details you were asked for, including the evolutionary track of the 5 MꙨ star and the info-box. The screenshot should show the graph, axes and information but not your entire computer screen or additional information. It should not omit the axes or key information nor zoom in too far. You can resize your screenshot in Word. You should have a title which refers to the source of the image, and an appropriate reference. All these elements would be required to get full marks on a question like this.

**Question 4**

Values of *m* and *d* for selected stars within the constellation Cygnus (reproduced from Table 2.2, Topic 1, Section 2.1.3 of S284).

|  |  |  |
| --- | --- | --- |
| **Star** | **Apparent magnitude, *m*** | **Distance, *d* / pc** |
| Alpha Cygni | 1.25 | 800 |
| Beta Cygni | 2.93 | 130 |
| Gamma Cygni | 2.23 | 560 |
| Delta Cygni | 2.87 | 51 |
| Epsilon Cygni | 2.48 | 22 |

Notes:

Tables should always be clear and easy to read. Ensure all the values are correct in the table you have written out. Are your row headings clear and do they include the UNITS of the value shown in the table? Units should be in the header columns or rows, as shown for parsecs here (using the / notation), and not in the table cells themselves. Note that formatting of the table makes it much easier to read. We used “fit to contents” formatting for each column. The first column text is left justified, the remaining table entries are centre justified.

**Question 5**



**From the gradient *c* = 3 × 108 m s-1 (1 sf.)**

x

x

x

x

x

x

4.5

5.0

Frequency, *f* / 1014 Hz

5.5

6.0

6.5

7.0

7.5

8.0

4.0

3.5

1.6

1.2

1.4

1.8.8

2.0

2.2

2.4

Inverse wavelength, (1/) / 106 m-1

To show the relationship between frequency, *f*, and wavelength, , for visible light in the electromagnetic spectrum

Notes:

Graphs should always be easy to read, using as much of the paper as possible, and with titles, axis labels, units and numerical values clearly shown (as above). Marks are always awarded for this. We chose to draw this graph using the Office 365 word drawing package, and an image of blue-lined graph paper freely available to download from the web (use a search engine of your choice) but you could draw it entirely by hand and scan or photograph the result and insert the image into the Word document. Alternatively, you can use the Excel package in Office 365 to enter the data, draw a scatter plot, and then fit a ‘trend line’ to draw the best fit line to the data and even provide the gradient to you. All these methods are acceptable.

Some important points to remember are that the gradient should be calculated from within the data points, across as wide a range of the data as possible (marks will be awarded for doing this correctly). If the straight line cannot pass exactly through all plotted points, there should be an equal number of data points above and below the line. The end data points may also not necessarily lie on the straight line. If you are not comfortable with graph plotting, or these mathematical activities (which were covered at various times in S111, SM123 and MST124), then we encourage you to use your self-directed study time to look again at the resources and bootcamp materials.

If, after looking at this resource, you are still struggling with the maths, please contact your tutor to discuss whether you are ready to study S284.