1. Fill out the blanks in the table below.

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Physiological Function</th>
<th>Deficiency symptoms</th>
<th>Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. What are the key structural requirements for vitamin A activity of the retinol series of compounds?

3. Fill in the boxes for the pathway below:
4. Explain in terms of conformational changes, the role of Vitamin A in the visual cycle. How would a Vitamin A deficiency lead to night blindness?

5. Name two good dietary sources of Vitamin A aside from carotenoid-containing plants:

A: A patient is worried about hypervitaminosis A because he/she eats a diet high in carrots. Should he/she be concerned by vitamin A produced by the cleavage of β-carotene (found in carrots)? Why or why not?

6. The “Vitamin D” normally ingested is not a true vitamin. Please explain how this can be and identify the molecule responsible for the physiological effects of “Vitamin D”. Can “Vitamin D” be considered a hormone? Can any other vitamins be considered hormones too?
7. Fill in the blanks on this diagram:
8. How is 7-dehydrocholesterol converted to Vitamin D3? Show this reaction.
9. Explain the relationship between Vitamin D and PTH.

10. How many micrograms of Vitamin D need to be consumed to achieve the DV?

11. Menadione itself has no intrinsic vitamin activity, but can be activated by reaction with what endogenous constituent? What is the product of this reaction?
12. Why is Vitamin K’s cofactor activity so crucial?

13. How exactly does warfarin exert its anticoagulant effects?

14. How is Vitamin K metabolized and removed from the body?
15. Show how Vitamin E can function with Vitamin C as antioxidants.

16. Explain why, from a chemical standpoint \(\alpha\)-tocopherol is a more potent antioxidant than \(\gamma\)-tocopherol.

17. Why do tocotrienols not contribute to the daily Vitamin E requirement?

18. Which is the most toxic of the reactive oxygen species? Show how it can be generated from superoxide anion and hydrogen peroxide. What is the name of this reaction?
19. Show how lipid hydroperoxides are detoxified by the glutathione pathway.

20. Which minerals and vitamins are critical to the proper functioning of the glutathione pathway?