

Q1-Q35 Multiple Choice (70 pts). Choose the single best answer.
USE SCANTRON

1. If the EAR for a vitamin is 3.0 mg/day then the RDA is:
 - a. 1.7 mg/day
 - b. 2.5 mg/day
 - c. 1.2 mg/day
 - d. 3.6 mg/day
 - e. none of the above

- 2 – 4. Match each vitamin with the appropriate disease or condition associated with its deficiency
2. _____ Pernicious anemia
 - a. Thiamin
 - b. Cobalamin
 - c. Niacin
 - d. riboflavin

3. _____ Neural tube defect
 - a. B₁₂
 - b. Thiamin
 - c. Biotin
 - d. Folic acid

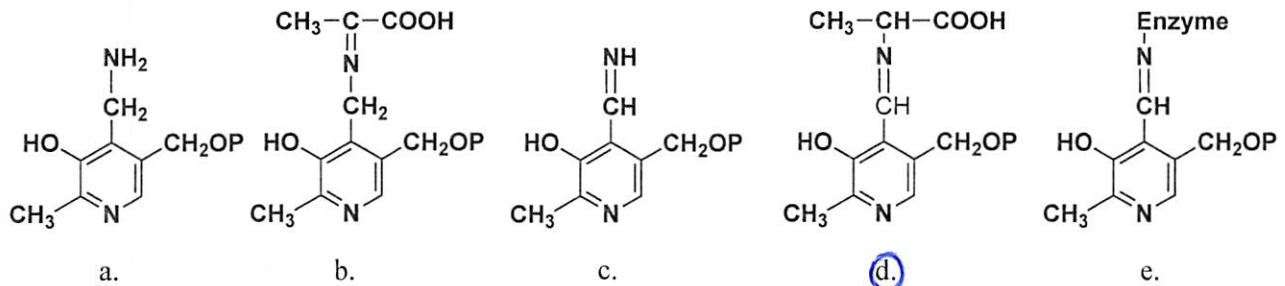
4. _____ Beriberi
 - a. B₅
 - b. Pyridoxal
 - c. B₁
 - d. Niacin

- 6-8. Match the test for deficiency of a vitamin, with the vitamin:
5. _____ Vitamin B₁
 - a. folate level in erythrocytes
 - b. urine methylmalonic acid level
 - c. transketolase assay in red blood cells
 - d. Amino acid decarboxylase

6. _____ Vitamin B₉
 - a. Homocysteine levels in red blood cells
 - b. erythrocyte glutathione reductase activity
 - c. erythrocyte transaminase activity
 - d. Folate levels in erythrocytes

7. _____ Riboflavin
- transketolase assay in red blood cells
 - erythrocyte glutathione reductase activity
 - Homocysteine level in erythrocytes
 - erythrocyte transaminase activity

8. Which imine form of pyridoxal below yields an amino acid upon hydrolysis [P= HPO₃⁻]:

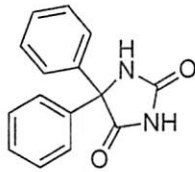


9. Which of the following is FALSE about Leucovorin:

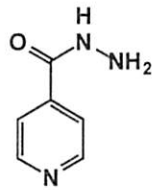
- Can allow ordinarily lethal dose of pyrimethamine to be used against malaria
 - Can allow ordinarily lethal dose of methotrexate to be used against tumor
 - Is N₅-methyl THFA
 - Is more effective in killing tumor cells than normal cells
10. Which of the following inborn errors of metabolism is NOT likely responsive to vitamin B₁ treatment?
- Transketolase defect
 - Cystathionurea
 - Maple syrup urine disease
 - Pyruvate dehydrogenase defect
11. What is the reason that vitamin B₁₂ deficiency will lead to folic acid deficiency?
- Because B₁₂ helps enterohepatic circulation of N₅-methyl THFA
 - Methyl B₁₂ can methylate homocysteine
 - Because B₁₂ is needed for N₅-methyl THFA to be converted back to THFA
 - B₁₂ is a required cofactor for DHFA reductase that reduces DHFA to THFA
12. Preparations containing > 0.8 mg of folic acid require prescription because high dose of folate supplements have what risk?
- Could reduce the effect of trimethoprim
 - Could reduce the effect of methotrexate
 - Could mask the megaloblastic anemia symptoms of B₁₂ deficiency and leave the neurological damages unchecked
 - Could inhibit DNA methylation and lead to megaloblastic anemia

13. In principle, which drugs or vitamins below could possibly result in iatrogenic Vitamin B₆ deficiency if used chronically, based on the structures shown:

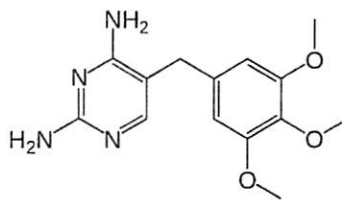
- Phenytoin
- Trimethoprim
- c** Isoniazid and Carbidopa
- Isoniazid and Trimethoprim
- Isoniazid and Pyrimethamine



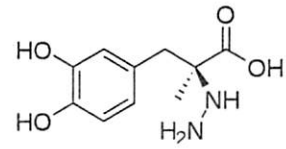
Phenytoin



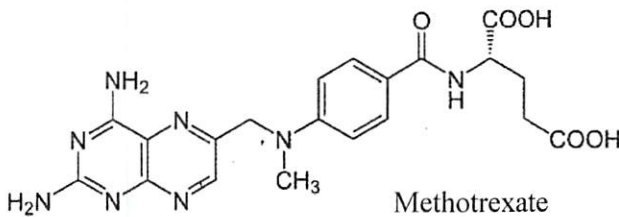
Isoniazid



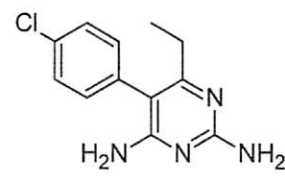
Trimethoprim



Carbidopa



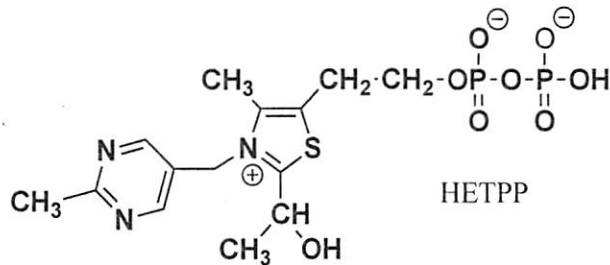
Methotrexate



Pyrimethamine

14. Which of the following is a possible fate for the hydroxyethyl TPP form of thiamine:

- a** Transfer of two carbons to an oxidized lipoic acid
- Transformation of carbon-carbon double bonds to carbon-carbon single bonds
- Decarboxylation to yield CO₂ and pyruvate
- Attack by ethanol to reduce systemic ethanol levels and benefit alcoholics



HETPP

15. Isoniazid can precipitate some symptoms of pellagra because:

- Isoniazid binds to vitamin B₃, which leads to B₃ deficiency
- Isoniazid binds to vitamin B₁, which leads to B₁ deficiency
- Isoniazid binds Zn, which stops the conversion of tryptophan to niacin
- d** Isoniazid binds to pyridoxal phosphate, which stops the conversion of tryptophan to niacin

16. Choose the FALSE statement about vitamin C.

- Act as a cofactor for hydroxylation of proline that is important for collagen synthesis
- b** Will make urine test for sugar false positive because vitamin C will oxidize the copper used in the test
- Act as a cofactor for the synthesis of norepinephrine
- Act as a cofactor for hydroxylation of lysine that is important for collagen synthesis

17. Elevated plasma Homocysteine, associated with decreased conversion to methionine, is correlated with increased risk of cardiovascular disease. Which is the most effective supplementation in lowering the level of homocysteine?
- 5-Methyl tetrahydrofolate
 - Pyridoxal, folic acid, and cobalamin
 - Methyl cobalamin
 - Thiamine, folic acid, and cobalamin
18. Vitamin B₆ is contraindicated in levo-DOPA therapy against Parkinson's disease. Which of the following statement on this is TRUE?
- Vitamin B₆ enhances decarboxylation of levo-DOPA, which prevents it from crossing blood-brain barrier.
 - Vitamin B₆ inhibits synthesis of dopamine from levo-DOPA
 - Levo-DOPA can lead to vitamin B₆ deficiency by reacting with it
 - Carbidopa can be used as an alternative to levo-DOPA because it can cross blood-brain barrier
19. Choose the TRUE statement about biotin.
- Is highly abundant in egg whites, which can cause "egg white injury"
 - Can be used to lower cholesterol level
 - Participate as a cofactor for a number of decarboxylation reactions
 - Can be used to treat an inborn error of metabolism in biotinidase
20. Which one is FALSE for pantothenic acid?
- Its coenzyme form participates in pyruvate dehydrogenase
 - It is part of coenzyme A
 - Its dimer can be used to lower cholesterol level
 - It can be used to treat hair loss
21. An patient with pernicious anemia due to intrinsic factor deficiency would most likely benefit from:
- Change to a diet that is rich in vitamin B₁₂
 - IM injection of 100 mg of vitamin B₁₂
 - IM injection of 100 mg of intrinsic factor
 - Oral supplementation of long-acting hydroxycobalamin
22. Choose the statement on Niacin that is FALSE.
- Is the precursor to the enzyme cofactors NADP⁺/NAD⁺
 - Its coenzyme form participates in fatty acid β-oxidation
 - Can be used to lower LDL levels at its daily value
 - Its coenzyme form participates in P450-catalyzed oxidation
23. Which of the following is True about the fat-soluble vitamins?
- mineral oil impairs their absorption
 - they are rapidly degraded by heating
 - it takes time to bring on a deficiency state
- Answer A if (i) and (ii) are true
 Answer B if (i) and (iii) are true
 Answer C if (ii) and (iii) are true
 Answer D if all are false

24. All-*trans* retinoic acid;

- i) regulates cell synthesis of macromolecules after binding to the retinoid X receptor
- ii) is synthesized from all-*trans* retinaldehyde by CYP26
- iii) is highly effective in the treatment of promyelocytic leukemia

Answer A if only (i) is correct

Answer B if only (ii) is correct

Answer C if only (iii) is correct

Answer D if all are correct

25. β -Carotene is;

- i) the most effective carotenoid source of vitamin A
- ii) the safest form of vitamin A for smokers
- iii) present at high levels in sweet potato

Answer A if (i) and (ii) are correct

Answer B if (i) and (iii) are correct

Answer C if (ii) and (iii) are correct

Answer D if all are correct

26. Which of the following is/are True;

- i) no carotenes contain oxygen
- ii) all carotenoids are carotenes
- iii) all carotenes have vitamin A activity

Answer A if only (i) is correct

Answer B if only (ii) is correct

Answer C if only (iii) is correct

Answer D if none are correct

27. When a photon of light hits rhodopsin, the first isomerization step in the visual cycle generates;

- i) all-*trans*-retinal
- ii) all-*trans*-retinol
- iii) 11-*cis*-retinol

Answer A if only (i) is correct

Answer B if only (ii) is correct

Answer C if only (iii) is correct

Answer D if none are correct

28. Vitamin D2 is;

- i) obtained by UV irradiation of cholecalciferol
- ii) has a longer half-life than vitamin D3
- iii) present at high levels in cod liver oil

Answer A if only (i) is correct

Answer B if only (ii) is correct

Answer C if only (iii) is correct

Answer D if none are correct

29. CYP24A1 is responsible for formation of;

- i) calcidiol
- ii) calcitriol
- iii) calcitroic acid formation

Answer A if only (i) is correct

Answer B if only (ii) is correct

Answer C if only (iii) is correct

Answer D if none are correct

30. The vitamin D plasma level;

- i) found in healthy adults with good sun exposure is 50-70 ng/ml
- ii) needed to prevent rickets is at least 15 ng/ml
- iii) cut-off for deficiency is <20 ng/ml

Answer A if (i) and (ii) are correct

Answer B if (i) and (iii) are correct

Answer C if (ii) and (iii) are correct

Answer D if all are correct

31. Menadione

- i) is found predominantly in hydrogenated vegetable oils
- ii) is converted to MK-4 by reaction with geranylgeranylphosphate
- iii) is also known as vitamin K3

Answer A if (i) and (ii) are correct

Answer B if (i) and (iii) are correct

Answer C if (ii) and (iii) are correct

Answer D if all are correct

32. Vitamin K

- i) deficiency is associated with a high PIVKA-II value
- ii) is important to bone health because it is required for synthesis of γ -carboxylated osteocalcin
- iii) has an Upper Limit of 1000 micrograms/day

Answer A if only (i) is correct

Answer B if (i) and (ii) are correct

Answer C if all are correct

Answer D if none are correct

33. Regarding vitamin E,

- i) α - β - γ - and δ -tocopherols have antioxidant properties
- ii) The naphthoquinone ring is critical for antioxidant activity
- iii) Tocopherols each have 8 stereoisomers

Answer A if (i) and (ii) are correct

Answer B if (i) and (iii) are correct

Answer C if (ii) and (iii) are correct

Answer D if all are correct

34. For vitamin E,

- i) the Daily Value is 30 mg RRR α -tocopherol
- ii) deficiency causes neurological problems in humans
- iii) α TTP selectively transfers 2(R)-tocopherols into VLDL

Answer **A** if (i) and (ii) are correct

Answer **B** if (i) and (iii) are correct

Answer **C** (ii) and (iii) are correct

Answer **D** if all are correct

35. The Haber-Weiss reaction:

- i) consumes superoxide anion and hydrogen peroxide
- ii) generates hydroxyl radical
- iii) requires Fe for catalysis

Answer **A** if (i) and (ii) are correct

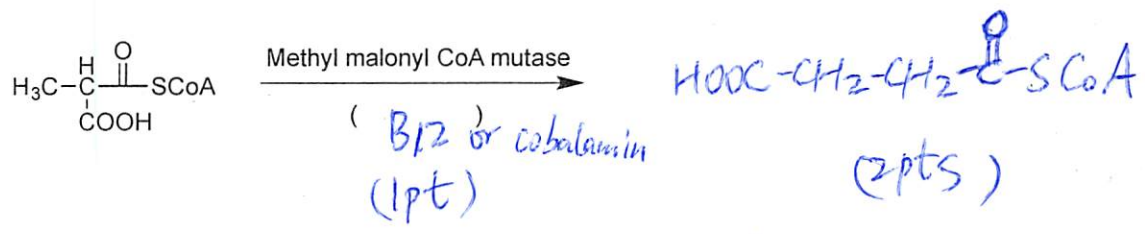
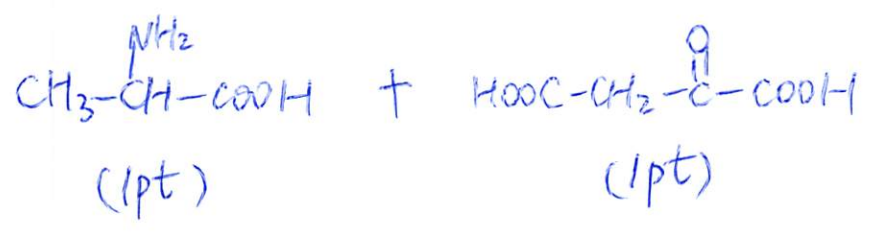
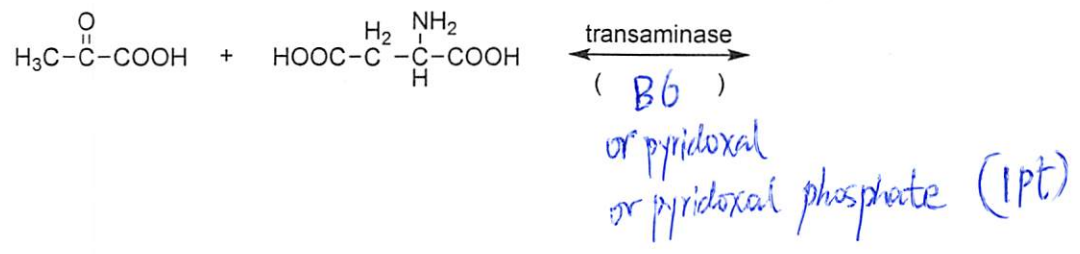
Answer **B** if (i) and (iii) are correct

Answer **C** if (ii) and (iii) are correct

Answer **D** if all are correct

Draw

36. Please write the products for the following transformations (2 pts) and specify which vitamin (1 pt) participated as a cofactor. (total of 6 pts)



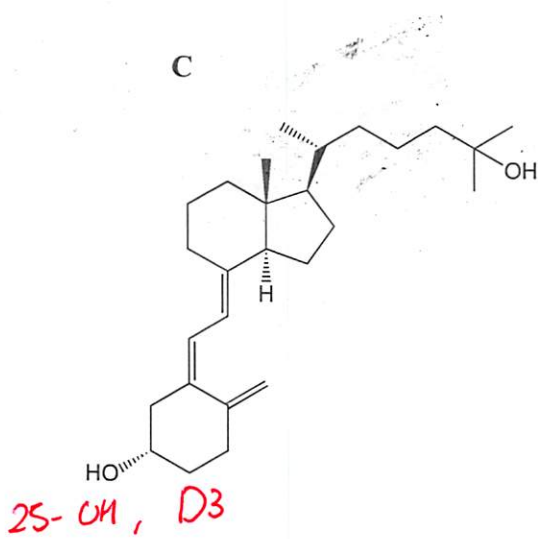
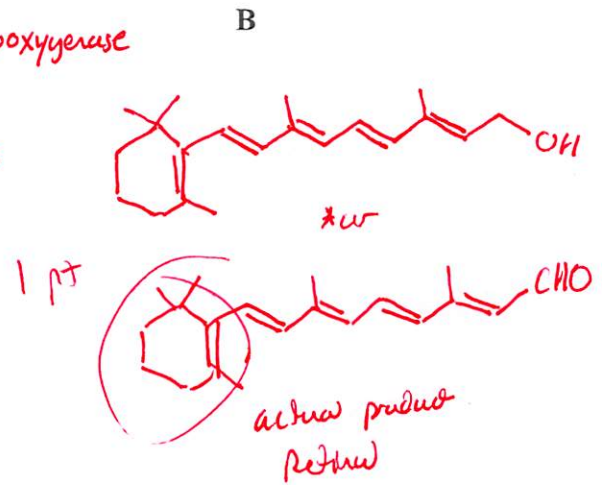
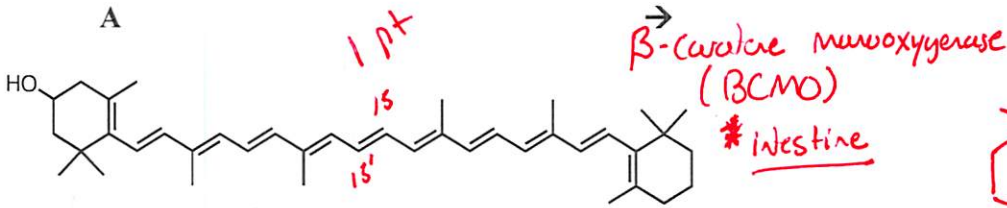
*Note: if they write the name of the product, "succinyl CoA", then give them "2 pts".
same for the first question.

37. (8 pts)

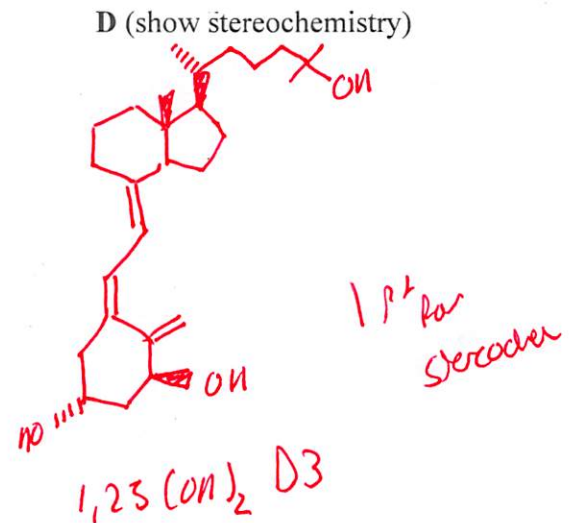
The structures shown below (A and C) are precursors to the active forms of fat-soluble vitamins.

Both require an enzymatic transformation to generate the active species.

- i) Draw the full structures of B and D. (4)
- ii) Identify the enzymes responsible for formation of B and D and the major tissues where they catalyze these reactions. (4)

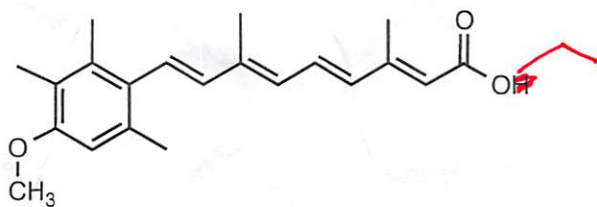


1 α -Hydroxylase
→
Cyp27B1
~~CYP27B1~~
~~27B1~~
Kidney



38. (7 pts)

a) Etretinate, shown below, is a 2nd generation oral retinoid used to treat psoriasis before it was removed from the market. Fill in the blank. (1)



* correction given in class

b) Explain fully why etretinate was removed from the market (4)

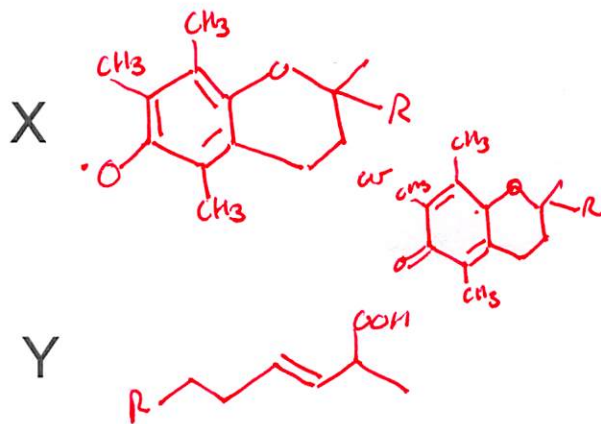
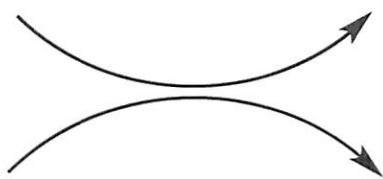
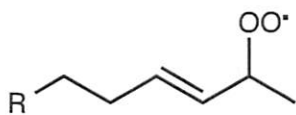
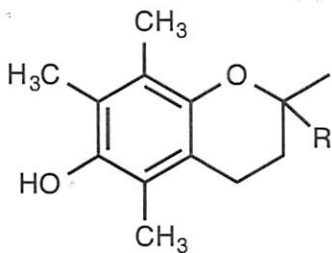
Very long half life 3-4 months
 teratogenic birth defects more than a year after discontinuation
 I pledge program ect....

c) Acitretin is a related compound that remains on the market. What precautions need to be taken with its use to avoid the problems that occurred with etretinate? (2)

Alcohol consumption can lead to esterified to form Etretinate
 * gave 1pt for Ipledge, avoid pregnancy ect....

39. (7 pts)

a) Vitamin E effectively quenches lipid peroxyl radicals (ROO[•]) according to the scheme below. Draw full structures for X and Y. (2)



b) How can vitamin E be regenerated from X? (1)

Vitamin C or ascorbic acid

c) Y still poses a biological risk because it can alter membrane function. Identify the enzyme that detoxifies Y and the mineral that is critical for its function. (4)

Glutathione peroxidase, Se

1pt

1pt

2pt for mineral

* gave 1pt for Glutathione Reductase