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University of Tanta
Faculty of Pharmacy

Model Answer

Pharm.Chem. Dept.
4th Year Pharmacy

Drug Design (5131) Final Examination

June 2nd, 2021 - 09:30AM **Time Allowed: 120 minutes** **Total points: 150**

- *This exam booklet consists of (18) different pages.*
- *The exam contains* **100** *questions, each question worth* **1.5** *points.*
- *Questions are T/F type Qs, MCQs in which you will have to select the* ***ONE BEST*** *answer.*
- *In Part-One questions, Use WHO's ATC coding and INN systems whenever possible.*
- *Fill the answers into the table provided in the separate answer sheet.*
- *Any answers outside of the answer sheet will not be graded.*

Part-One: Questions # (1 – 34) ..... (40 minutes, 50 points)

Inspect the following structures of CGRP and then proceed to answer questions 1-5

- H—Ala—Cys—Asp—Thr—Ala—Thr—Cys—Val—Thr—His
  Arg—Leu—Ala—Gly—Leu—Leu—Ser—Arg—Ser—Gly
  Gly—Val—Val—Lys—Asn—Asn—Phe—Val—Pro—Thr
  Asn—Val—Gly—Ser—Lys—Ala—Phe—OH

- H-AC(1)DTATC(1)VTHRLAGLLSRSGGVVKNNFVPTNVGSKAF-OH

- CC1C(=O)NC(C(=O)NC(CSSCC(C(=O)NC(C(=O)NC(C(=O)N1)C(C)O)CC(=O)O)NC(=O)C(C)N)C(=O)NC(C(C)C)C(=O)NC(C(C)O)C(=O)NC(CC2=CN=CN2)C(=O)NC(CCCNC(=N)N)C(=O)NC(CC(C)C)C(=O)NC(C)C(=O)NCC(=O)NC(CC(C)C)C(=O)NC(CC(C)C)C(=O)NC(CO)C(=O)NC(CCCNC(=N)N)C(=O)NC(CO)C(=O)NCC(=O)NCC(=O)NC(C(C)C)C(=O)NC(C(C)C)C(=O)NC(CCCCN)C(=O)NC(CC(=O)N)C(=O)NC(CC(=O)N)C(=O)NC(CC3=CC=CC=C3)C(=O)NC(C(C)C)C(=O)N4CCCC4C(=O)NC(C(C)O)C(=O)NC(CC(=O)N)C(=O)NC(C(C)C)C(=O)NCC(=O)NC(CO)C(=O)NC(CCCCN)C(=O)NC(C)C(=O)NC(CC5=CC=CC=C5)C(=O)O)C(C)O

1. CGRP contains only one disulphide linkage between
   A) C1 &C6 B) C2 &C6 C) C2 & C7 D) C2 & C8 E) None of these

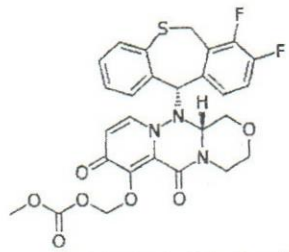
2. The above CGRP SMILES is:
   A) Isomeric SMILES B) Canonical SMILES
   C) Either A) or B) as it makes no difference D) None of these

3. The following is true about CGRP, except
   A) It is not used as a peptide replacement therapy.
   B) It contains one -S-S- bond.
   C) Its N terminal AA is A.
   (D) Its C terminal AA is A.
   E) Its C terminal AA is F.

4. If CGRP is to be pegylated, it should be through the AA.
   A) 2 B) 7 C) 17/35 (D) 24/35 E) None of these

5. CGRP can be modulated by the following ligands, except:
   A) MABs targeting CGRP receptor. B) Nonpeptide small molecules.
   C) Small molecules. (D) None of these.

6. The following is true about Baloxavir Marboxil, except:
   (A) It is a prodrug
   B) It is used to manage HBV
   C) It is used to manage HDV
   D) Its mechanism of action is the same as oseltamivir
   E) None of these

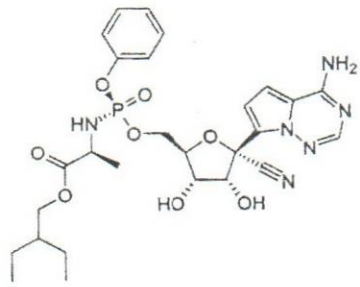


Baloxavir Marboxil

7. Bulevirtide is an antiviral drug acting via:
   A) Blocking HBV entry into cells B) Blocking HCV entry into cells
   C) Blocking HDV entry into cells (D) Both A) and B)
   E) Both A) and C)

8. The following statements about drugs (Atoltivimab, Odesivimab, Maftivimab and Ansuvimab) used to manage Ebola virus, are true, except:
   A) The drugs can be used as standalone or cocktail of three MABs
   B) The only standalone MAB is Ansuvimab.
   C) All four drugs are glycoprotein directed MABs
   D) The molecular weight of each drug is around 140- 150 KD
   (E) None of these

9. The following statements are true about Remdesivir, **except:**
   A) It is a protide technology based drug
   B) It gained an emergency used authorization/ full approval in certain countries.
   C) Its introduction was based upon repurposing concept
   (D) Its introduction was ligand based
   E) It is used to manage COVID 19

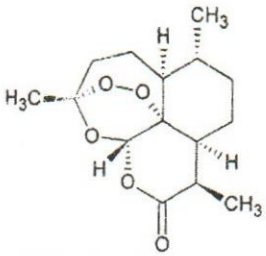


Remdesivir

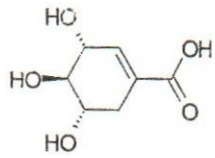
10. All marketed vaccines for COVID19 are industrially produced via

A) Adenovirus based technology.
B) mRNA based technology.
C) attenuated/ killed COVID -19 virus based technology.
D) a cocktail of all of the above
E) any of A), B) or C) depending upon the innovator company.

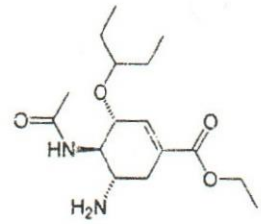
11. The following molecules can be industrially produced using GE organisms EXCEPT



A) Artemisinin

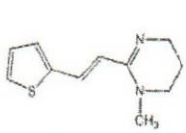


B) Shikimic acid

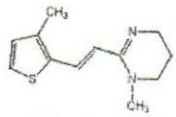


C) 2-Keto-L-gulose D) Oseltamivir

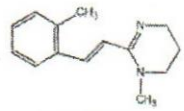
12. CoMFA based 3D QSAR for a set of pyrantel analogues shown hereunder



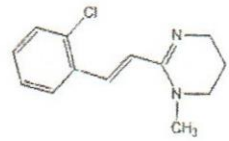
Pyrantel



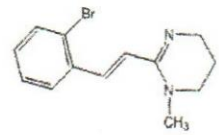
Morantel



Analog I

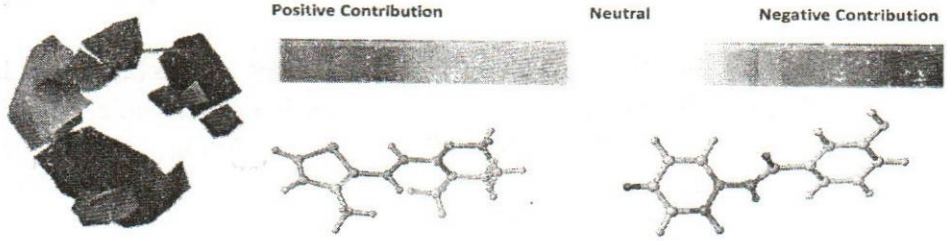


Analog II



Analog III

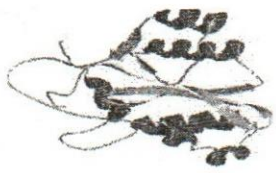
is represented by



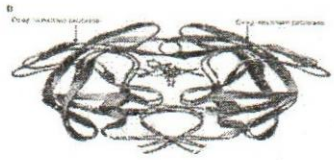
(a) (b)

A) a B) b C) Either a or b D) None of these

13. Of the following quaternary structures representing certain HIV enzymes, the one that possesses both allosteric and orthosteric sites is:



(a)

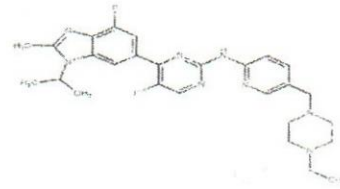


(b)

(c)

A) a B) b C) c D) None of these

14. The following CHEMBL molecule feature of the CDK modulator (structure shown) indicates



that all the following is true except:

A) It is a small molecule
B) It is administered orally.
C) It is first in class
D) It is achiral
E) None of these

15. The following is false about click chemistry, except:

A) It can be used to synthesize both small and large molecules
B) It needs a deconvolution step to identify hits and leads
C) It is used to produce almost quantitative yields of small molecules
D) It is environmentally friendly.
E) It is tedious and time consuming.

16. The Healthcare product that is classified as drug device combination is:

A) Oligonucleotides
B) siRNA based therapeutic
C) CAR-T cell-based healthcare product
D) Drug eluting stents
E) None of these

17. In terms of their molecular weight, the therapeutic toxins (1), common Mabs (2), single domain nanobodies (3) and Fab fragment antibodies (4), can be arranged in the descending order:

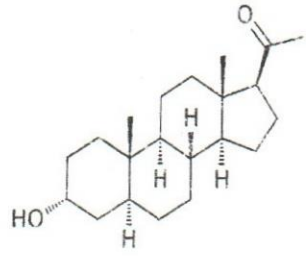
A) 1<2<3<4 B) 1<2<4<3 C) 2<1<3<4 D)4<3<2<1 E) None of these.

18. Of the above (c.f. question # 17) therapeutic proteins (1-4), the one used to manage glabellar lines associated with certain facial muscles is:

A) (4) B) (3) C) (2) D) (1)

19. The following is True about Brexanolone (structure opposite) EXCEPT:

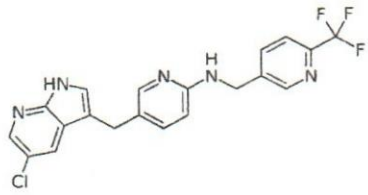
A) It is a pregnane derivative
B) It is an ingredient of the first on demand vaginal pH regulating contraceptives
C) It is a neurosteroid -ve GABA modulator
D) It is used to manage postpartum depression
E) None of these



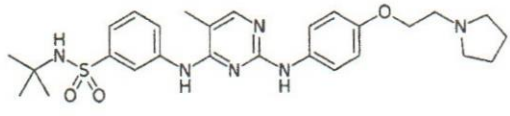
20. Romosozumab is used to manage osteoporosis. Accordingly, its first ATC code is:

A) A B) B C) L D) V (E) M

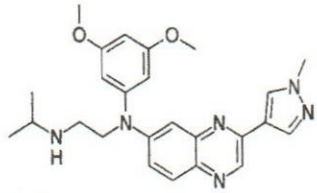
Inspect the following tyrosine kinases and then answer questions 21-23



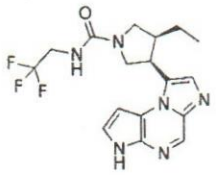
Erdafitinib



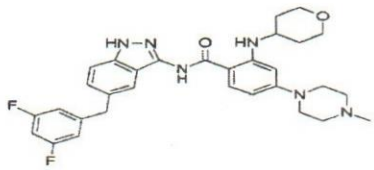
Pexidartinib



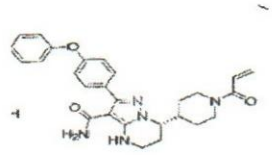
Fedratinib



Upadacitinib



Entrectinib



Zanubrutinib

21. The first level ATC code of all the above drugs is/ should be L, Except:

A) Entrectinib B) Erdafitinib C) Pexidartinib (D) None of these

22. Of the above drugs, the on that is a tissue agonist irrespective of the type of tumor is:

A) Erdafitinib B) Pexidartinib C) Upadacitinib (D) Entrectinib

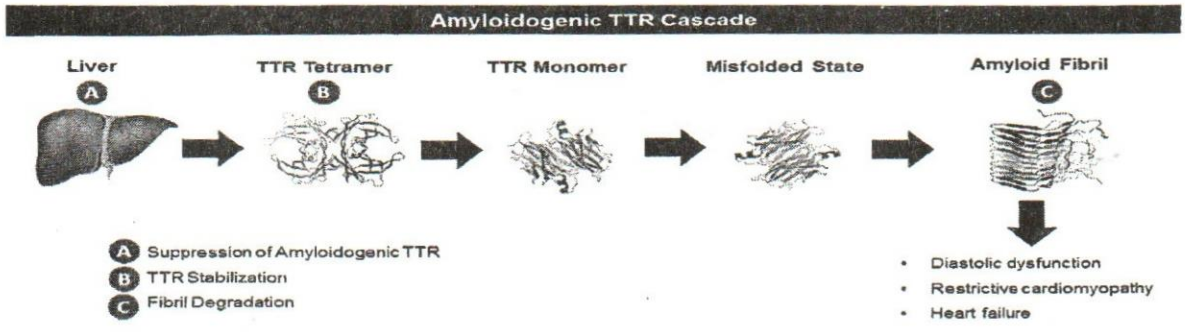
E) None of these

23. Of the above drugs, the one that inhibits BTK is:

A) Entrectinib B) Upadacitinib C) Fedratinib (D) Zanubrutinib

D) None of these

24. The drug used to manage ATTR- CM shown in the below diagram is:

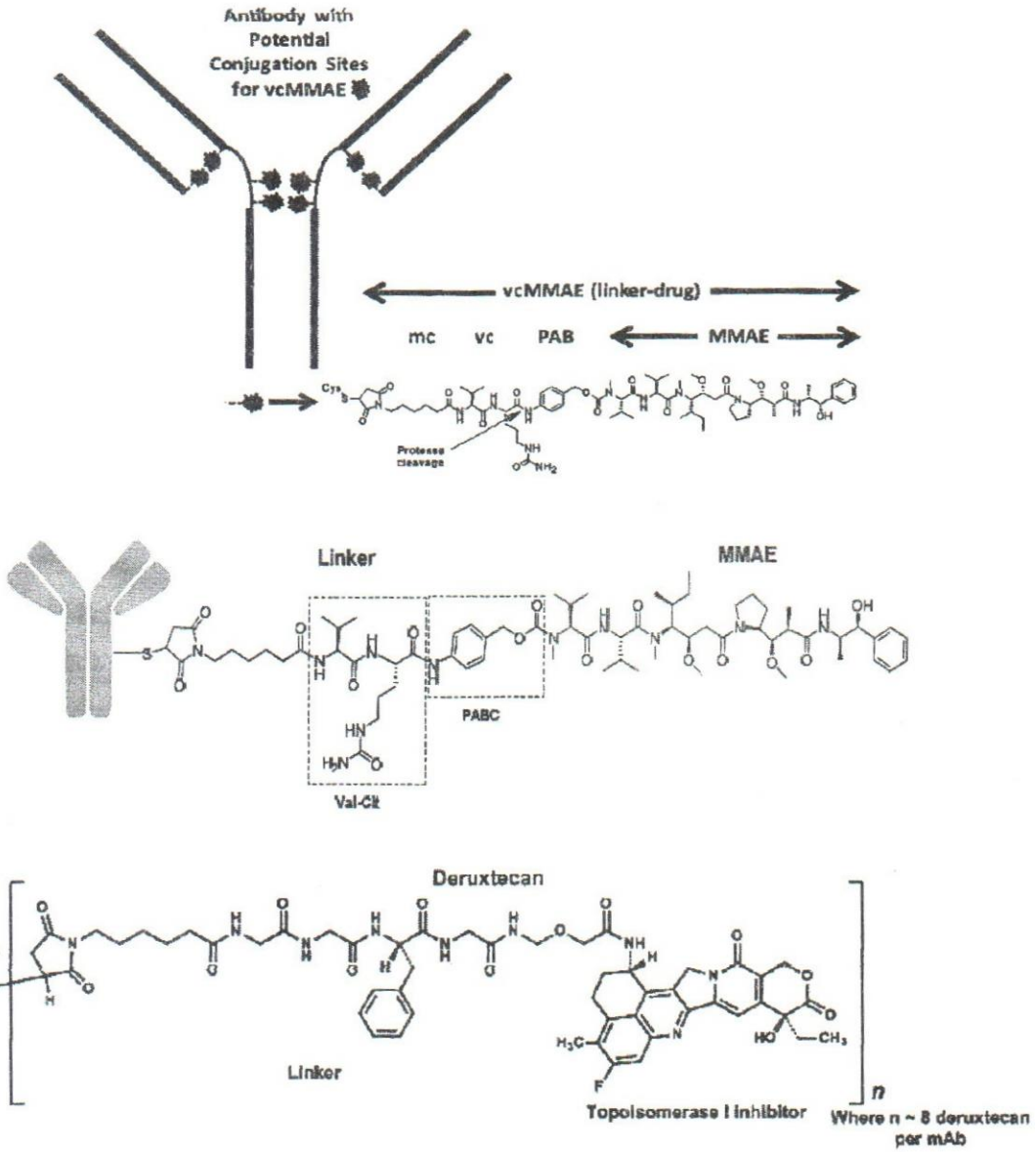


A) A monoclonal antibody B) A nanobody

C) A tetanus/ botulinum toxin D) An ADC

(E) None of these

Inspect the following figures and then answer questions 25-26



25. The payload of all the above ADCs is a topoisomerase I inhibitor, because

A) Vedotin is the only tubulin polymerization inhibitors.
B) Deruxtecan is a topoisomerase I inhibitor.
C) Both A and B
D) Both Vedotin and deruxtecan are topoisomerase I inhibitors.
E) None of these

26. My answer in question 25 above is based on using a linker containing:

D) Acrylamide B) Succinamide C) Succinimide D) None of these

Ac-Ser-Tyr-Ser-Nle-Glu-His-D-Phe-Arg-Trp-Gly-Lys-Pro-Val-NH_2 **Afamelanotide**

Ac-Nle-cyclo[Asp-His-D-Phe-Arg-Trp-Lys]-OH **Bremelanotide**

27. The following is false about these drugs, EXCEPT:

A) Both are melanocortin receptor agonists used for the same indication

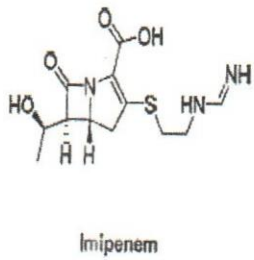
B) All their AAs are L- AAs.

C) Both are cyclic peptides

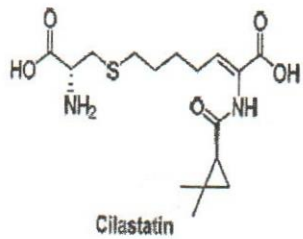
D) Both have -S-S- linkage

E) None of these

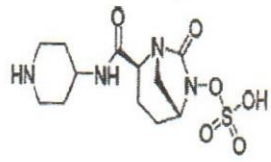
28. All is false about the below first 3 drug combination EXCEPT:



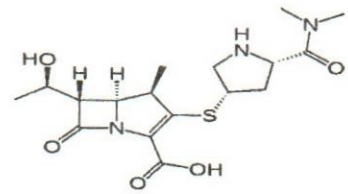
Imipenem



Cilastatin



relebactam



meropenem

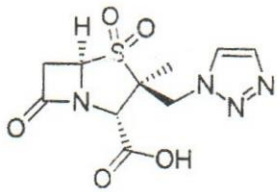
A) Meropenem can substitute Imipenem in said combination

B) Cilastatin is a betalactamase inhibitor

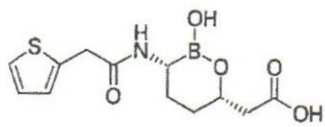
C) Relebactam can be substituted by cilastatin

D) None of these

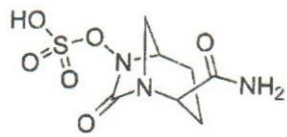
29. The following is false about the below drugs EXCEPT:



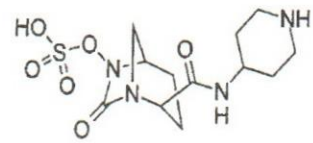
Tazobactam



Vaborbactam



Avibactam



Relebactam

A) None betalactam betalactamases cannot substitute betalactam betalactamases

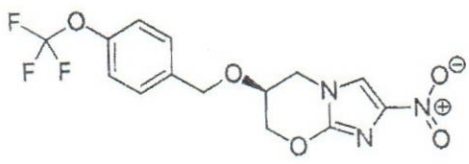
B) None betalactam betalactamases can substitute betalactam betalactamases

C) Either A or B depending on which betaclatamase is to be substituted

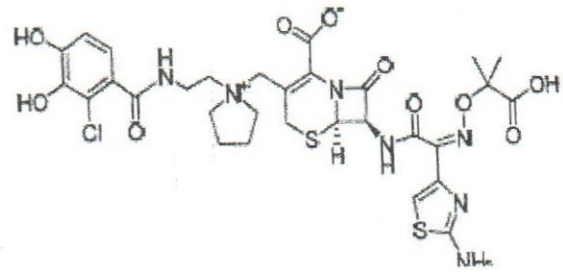
D) Either A or B depending on which antibiotic is present in the combination.

E) None of these and all the above is true.

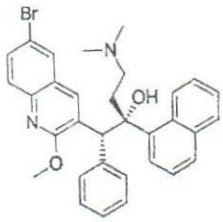
Inspect the following figures and then answer questions 30-31



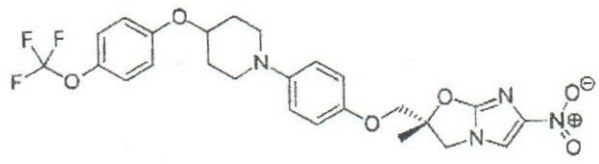
Pretonamid



cafiderocol



bedaquiline



delamanid

30. The antimicrobial API that is designated as QIDP is:

A) Bedaquiline B) Delamanid C) Pretonamid (D) Cafiderocol

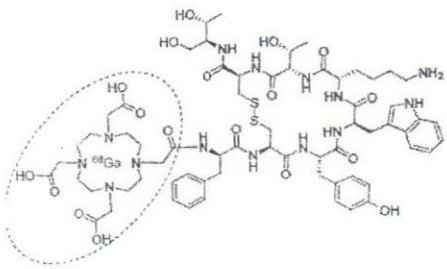
E) None of these

31. The drug indicated to manage MDR TB is:

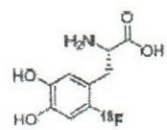
A) Bedaquiline B) Cafiderocol C) Delamanid D) A or B or C

(E) None of these

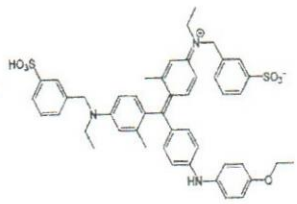
Inspect the following figures and then answer questions 32-34



Gallium dotatoc



Fluorodopa F-18



Tissue Blue

EXEM FOAM

EXEM Foam

32. The drug used for PET localization of certain neuroendocrine tumors is:

A) EXEM Foam B) Fluorodopa F-18 (C) Gallium dotatoc D) Tissue Blue

33. The drug used as a staining agent during ophthalmic surgery is:

A) EXEM Foam B) Fluorodopa F-18 C) Gallium dotatoc (D) Tissue Blue

34. The drug used as an ultrasound contrast agent to assess fallopian tube patency is:

(A) EXEM Foam B) Fluorodopa F-18 C) Gallium dotatoc D) Tissue Blue

Part-Two: Questions # (35 – 67) ..... (40 minutes, 50 points)

35. Aldesleukin

A) Is a man made Interleukin-2 monoclonal antibody
B) Is a recombinant DNA hormone
C) Is a recombinant DNA enzyme
D) Is a recombinant DNA cytokine (Interleukin-2)
E) None

36. All are true about reteplase except

A) It has longer half-life of 13–16 minutes.
B) It binds fibrin with lower affinity than alteplase
C) It is able to penetrate inside the thrombi, an enhanced fibrinolytic activity will be achieved.
D) It has fewer amino acids than alteplase
E) None

37. All are true about tenecteplase except

A) It is a recombinant fibrin-specific plasminogen activator
B) It has lower fibrin specificity than alteplase
C) It has greater resistance to inactivation by its endogenous inhibitor (PAI-1) compared to native t-PA.
D) It has a tetra-alanine substitution of amino acids in the protease domain
E) None

38. Pegylated IFN-α2a is a branched monomethoxy PEG conjugate of IFN-α2a that has in vitro antiviral activity only 7% of that of the nonpegylated molecule.

A) True B) False

39. In monoclonal antibody, the figure hereunder is for

??

A) Chimeric monoclonal antibody
B) Humanized monoclonal antibody
C) Fully human monoclonal antibody
D) None

40. All are true about trastuzumab except

A) It is a monoclonal antibody targeting HER2.
B) It binds to the HER2 found on surface of cancer cells.
C) It acts mainly by complement mediated killing of the HER2 positive cells.
D) It acts mainly by antibody-dependent cellular cytotoxicity of the HER2 positive cells
E) None.

41. All are true about obinutuzumab except
A) It works by targeting the CD20 antigen on normal and malignant B-cells.
B) It is a glycoengineered molecule
C) It is designed to improve efficacy through greater affinity to the effector receptor, thereby increasing complement mediated activity.
D) It is naked antibody
E) None

42. All are true about Ibritumomab tiuxetan except
A) It is a monoclonal antibody radioimmunotherapy
B) The drug in conjunction with the chelator tiuxetan, to which a radioactive isotope (either yttrium-90 or indium-111) is added.
C) It binds to CD20 antigen on the surface of normal and malignant B cells.
D) The attached isotope mostly leads to beta emission
E) None

43. Avelumab
A) PD-1 inhibitor
B) PD-L1 inhibitor
C) CTLA-4 inhibitor
D) VEGF inhibitor
E) None

44. Omalizumab' target is
A) HER2 B) TNF C) IgE D) CD20

45. Omalizumab is used for
A) Treatment of rheumatoid arthritis
B) Treatment of psoriasis
C) Treatment of uncontrolled asthma
D) Treatment of anthrax toxin
E) None

46. Raxibacumab is used for
A) Treatment of rheumatoid arthritis
B) Treatment of psoriasis
C) Treatment of uncontrolled asthma
D) None

47. Dornase alfa is used in the treatment of
A) Osteoporosis
B) Psoriasis
C) Cystic fibrosis
D) RA
E) None

48. Adalimumab is
A) Soluble TNF receptor
B) IL-1 monoclonal antibody
C) IL-1 receptor
D) TNF monoclonal antibody
E) None

49. Imetelstat sodium

A) Is an anti- CTLA-4 monoclonal antibody
B) Is an anti- PD-1 monoclonal antibody
C) Is a monoclonal antibody for telomerase
D) Is an antisense telomerase inhibitor
E) None

50. Etanerecept is

A) TNF monoclonal antibody
B) IL-1 monoclonal antibody
C) IL-1 receptor
D) Soluble TNF receptor
E) None

51. Efalizumab is used for

A) Treatment of rheumatoid arthritis
B) Treatment of psoriasis
C) Treatment of uncontrolled asthma
D) Treatment of anthrax toxin
E) None

52. Bevacizumab is a monoclonal antibody of

A) TNF B) IL-1 C) VEGF D) Anthrax toxin E) None

53. Raxibacumab target is

A) TNF B) IL-1 C) VEGF D) Anthrax toxin E) None

54. Nivolumab is

A) PD-1 inhibitor
B) PD-L1 inhibitor
C) CTLA-4 inhibitor
D) VEGF inhibitor
E) None

55. All are true about blinatumomab except

A) These drugs are made up of parts of 2 different mAbs,
B) They can attach to 2 different proteins at the same time.
C) One part attaches to CD3, a protein found on immune cells called T cells.
D) Another part attaches to CD19, protein found on some leukemia and lymphoma cells.
E) None

56. Denosumab

A) Is an anti-RANKL monoclonal antibody
B) Is an anti-RANK monoclonal antibody
C) Is an anti- CTLA-4 monoclonal antibody
D) Is an anti- PD-1 monoclonal antibody
E) None

57. Denosumab is used

A) Treatment of rheumatoid arthritis
B) Treatment of psoriasis
C) Treatment of uncontrolled asthma
D) Treatment of osteoporosis
E) None

58. All are true about fomivirsen except

A) It is an antisense drug
B) It is used in the treatment of cytomegalovirus retinitis
C) It is used in the treatment of homozygous familial hypercholesterolemia
D) It is 21 nucleotides in length

59. Mipomersen is

A) An antisense drug
B) A synthetic phospho oligonucleotide 20 nucleotides
C) A cytokine drug
D) Used in the treatment of homozygous familial hypercholesterolemia
E) A and D

60. EF is an adenylate cyclase which alters cellular homeostasis mechanisms, thereby resulting in edema. It is the lethal factor of anthrax toxin.

A) True B) False

61. All are true about Lisdexamfetamine except

A) It consists of dextroamphetamine bonded covalently to lysine through an amide bond.
B) It requires conversion into dextroamphetamine via enzymes in the cytoplasm
C) It increases dextroamphetamine duration of action
D) None

62. Although 5-ALA itself is not a photosensitiser, it can induce the intracellular formation of PpIX, a very efficient photosensitiser. It was observed that the Tumor cells incubated with 5-ALA-GNP showed a high amount of PpIX, about five times higher than that in the Normal cells.

A) True B) False

63. The membrane potential of tumor cells is more positive than the normal cells, which can facilitate the binding of the positive 5-ALA-GNP and lead to a significant uptake. Therefore, the use of GNPs can significantly improve the delivery of 5-ALA into Tumor cells.

A) True B) False

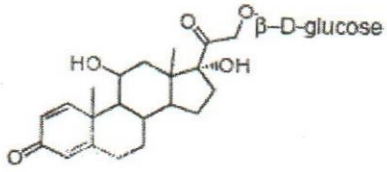
64. Ipilimumab is

A) PD-1 inhibitor B) PD-L1 inhibitor
C) CTLA-4 inhibitor D) VEGF inhibitor
E) None

65. In ADEPT, a gene expression vector encoding an activating enzyme is delivered to tumor cells. Next, a nontoxic prodrug is administered systematically and converted by the enzyme to the toxic parent drug.

A) True B) False

66. All are true about the compound here under except



Prodrug of prednisolone

A) It is an example of site directed bioactivation, enzyme dependent prodrug.
B) It is a prodrug that is activated by glycosidase enzymes
C) It is more hydrophobic than the parent drug
D) It can be absorbed in intestine more efficiently compared to their parent drugs.
E) None

67. All are true about BIO-MD opioid prodrug except

A) The prodrug portion of the molecule decreases the affinity of the molecule for the opioid receptor
B) The BIO-MD opioid prodrug consists of the opioid-linker-AA
C) When administered orally, trypsin in the gastrointestinal tract releases the amino acid portion of the prodrug
D) The linker undergoes intracellular cyclization to cyclic lactame.
E) None

Part-Three: Questions # (68 – 100) ..... (40 minutes, 50 points)

68. Phase II metabolism include reactions which:

A) add a polar molecule to a functional group already present on a drug molecule.
B) add a polar functional group to a drug molecule.
C) are synthetic reactions.
D) Both A and C
E) Both B and C.

69. Which of the following enzymes is involved in catalyzing a Phase I metabolic reaction?

A) UDP-glucuronosyl transferase B) Glutathione S-transferase
C) Sulfotransferase D) Mixed function oxidase
E) Glutathione S-transferase

70. Which of the following groups is **least** susceptible to cytochrome P450 enzymes?

A) terminal methyl groups B) allylic carbons
C) benzylic carbon atoms D) aromatic carbon atoms
E) sterically-hindered quaternary carbon atoms

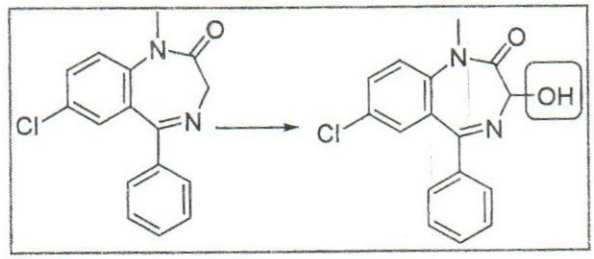
 # Questions 71-74 refer to the following enzymes, match each enzyme to one of the statements:

A) CYP450 B) Epoxide hydrolase C) Peptidase D) Monoamine oxidase

71. Is involved in metabolism of vast majority of known drugs	(A)	B)	C)	D)
72. Is involved in amide hydrolysis	A)	B)	(C)	D)
73. Its inhibitors are useful therapeutic agents	A)	B)	C)	(D)
74. Is involved in epoxide hydrolysis after alkene oxidation	A)	(B)	C)	D)

75. The following reaction is the example of oxidation of _____ carbon atom.

A) aromatic B) aliphatic C) benzylic
D) allylic (E) alpha to carbonyl



76. The reaction in question **#75** is most probably catalyzed by a/an_____:

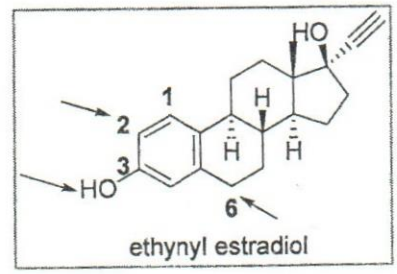
A) Alcohol dehydrogenase (B) CYP450 C) epoxide hydrolase
D) peptidase E) sulfotransferase

77. Which of the following statements regarding CYP450s is **FALSE**?

A) CYP3A4 is the most abundant isoform in the liver
B) CYP450s are responsible for oxidative drug/xenobiotic metabolism
(C) CYP3A4 is the third isoform identified among the A subfamily of the CYP3 family
D) CYP2D6 shares at least 40% sequence homology with the CYP2C19 isoform

78. All the following metabolic transformations of ethynyl estradiol are expected to improve the solubility and increase the urinary excretion compared to the parent drug **EXCEPT**:

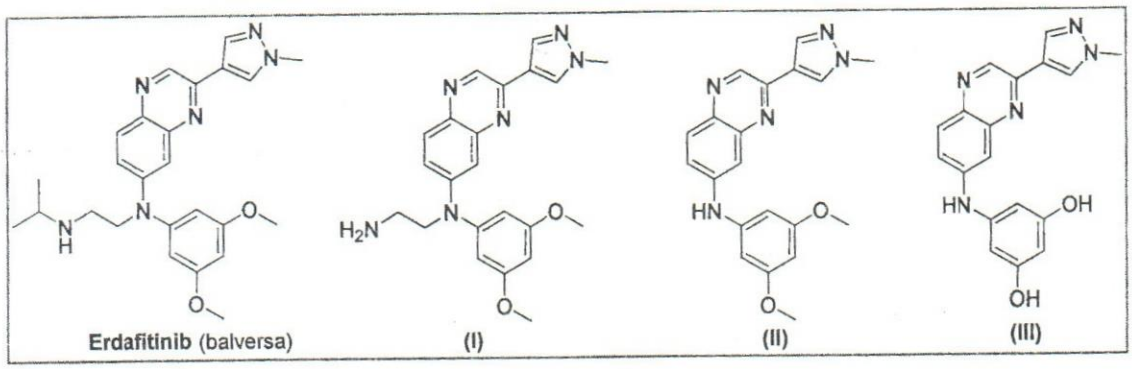
A) Aromatic hydroxylation of C-2
B) Hydroxylation of C-6
C) Sulphate conjugation of 3-OH
(D) Methylation of 3-OH



ethynyl estradiol

79. Which of the following are potential CYP450 metabolites of Erdafitinib?

A) (III) only B) (I) & (III) only C) (II) & (III) only
(D) all of (I), (II) and (III) E) None of (I), (II) and (III)

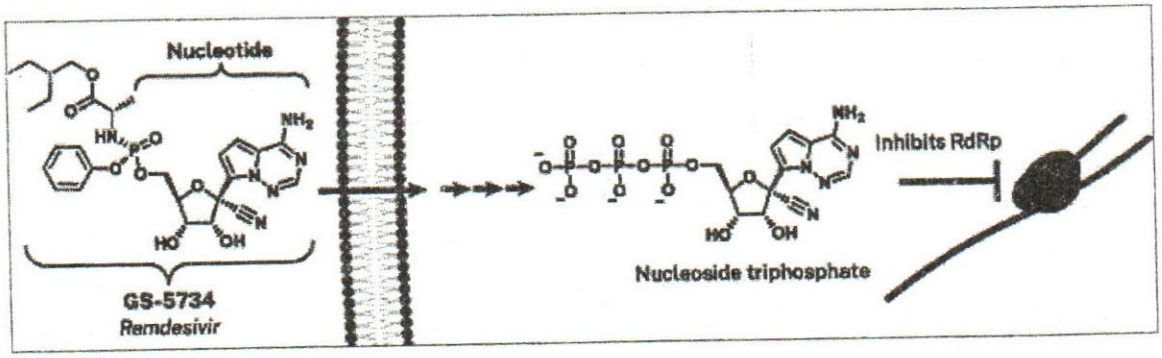


80. In the potential metabolites for Erdafitinib (c.f. question # 79), the reaction that leads to formation of metabolite (III) is called _____

A) amide hydrolysis
B) oxidative *O*-dealkylation
C) oxidative *N*-dealkylation
(D) a combination of both B & C
E) None of the above

81. Remdisivir is transformed intracellularly, to the active nucleoside triphosphate. Which of the following would be **CORRECT** about Remdisivir metabolism:

A) Remdisivir would be subject to hydrolysis by esterase and phosphoramidase enzymes, then phosphorylation by kinases to the corresponding active nucleoside triphosphate.
B) LogP value of Remdisivir is **lower** than the corresponding active nucleoside triphosphate.
C) Remdisivir is an inactive prodrug that has **enhanced** cell permeability compared to the active form.
(D) Both A & C.
E) All of the above



82. During drug development process, drug metabolism should be taken into consideration during the following phase(s):

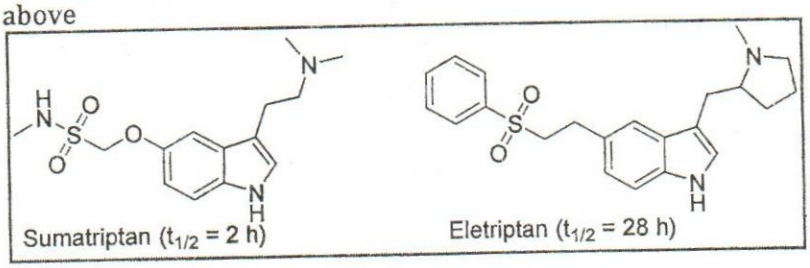
A) Early research and development (R&D)
B) Preclinical testing of drug candidates in animals
C) Clinical development phases I-IV
D) Both A & B
(E) All of the above

83. Regarding the analytical drug metabolism studies, which statement is **INACCURATE?**

A) involves four major steps; isolation, separation, identification and quantitation
B) needs highly sensitive analytical methodologies to detect < μM concentrations
(C) liver microsomal enzymes provide a better model than intact hepatocytes *In vitro*
D) comparative biotransformation profiles indicates interspecies differences
E) None of the above

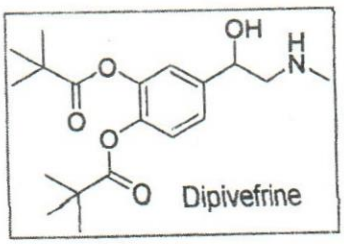
84. Regarding the duration of action of antimigraine drugs, Sumatriptan and Eletriptan, which of the following statements is **FALSE**?

A) **Both** Sumatriptan and Eletriptan have tertiary amine group
B) **Both** Sumatriptan and Eletriptan are susceptible to metabolic oxidative *N*-dealkylation
(C) The *N*-dealkylated metabolites of **Both** can be further metabolized by oxidative deamination
D) The cyclic amine (pyrrolidine) structure in Eletriptan increases its metabolic stability
E) None of the above



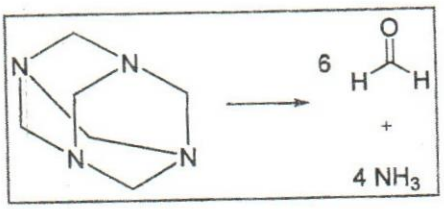
85. Dipivefrine is an epinephrine prodrug for treatment of open-angle glaucoma. Dipivefrine _____

A) is an ester of pivalic acid with catechol -OH groups of epinephrine.
B) has an increased lipophilicity compared to epinephrine; thus, improved corneal wall penetration.
C) will be subject to ester hydrolysis in the cornea.
D) All of the above
E) None of the above



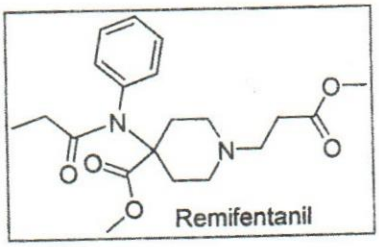
86. Hexamine is a prodrug that _____

A) decomposes in **blood** to the active form
B) releases formaldehyde in the acidic pH of the **urine**
C) is highly unstable and too toxic for direct use
D) both B & C
E) All of the above



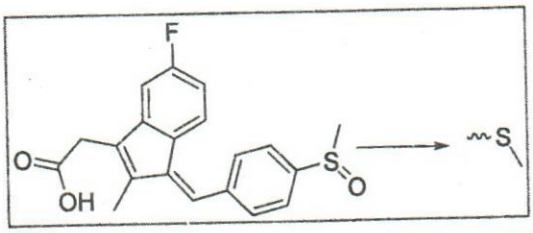
87. Remifentanil is rapidly metabolized to remifentanil acid which has 1/4600th the potency of the parent compound. Remifentanil is thus _____

A) considered a soft drug
B) considered a hard drug
C) metabolized by esterases
D) an ester prodrug
E) both A and C



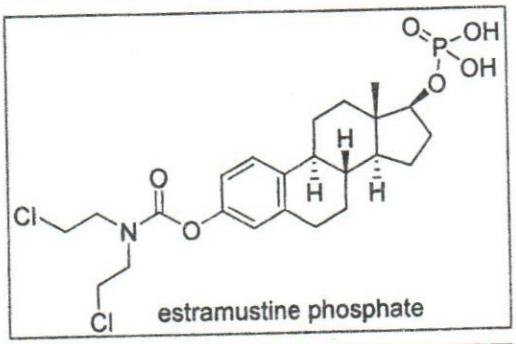
88. Sulindac is an inactive prodrug designed to reduce GI irritation associated with the active sulfide form. Sulindac _____

A) must be reduced metabolically to the sulfide.
B) is a bioprecursor prodrug
C) is a carrier-linked prodrug
D) both A and B
E) both A and C



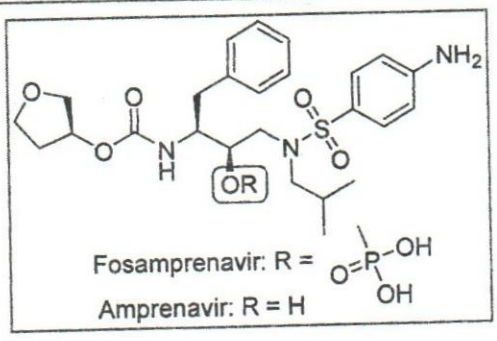
89. Estramustine phosphate is classified as _____

A) mutual prodrug (codrug)
B) carrier-linked prodrug
C) bioprecursor prodrug
D) both A & B
E) both A & C



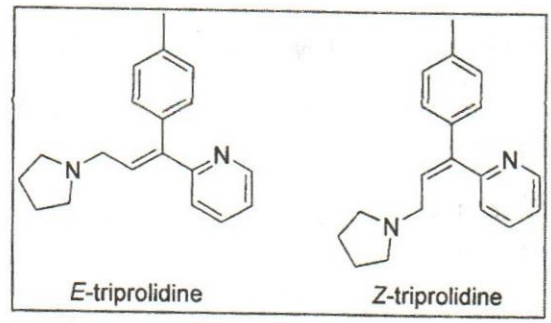
90. The opposite structure is for the antiviral Fosamprenavir, which _____

A) is a phosphate ester of amprenavir.
B) undergoes bioconversion by alkaline phosphatases.
C) has increased aqueous solubility compared to amprenavir.
D) All of the above
E) None of the above



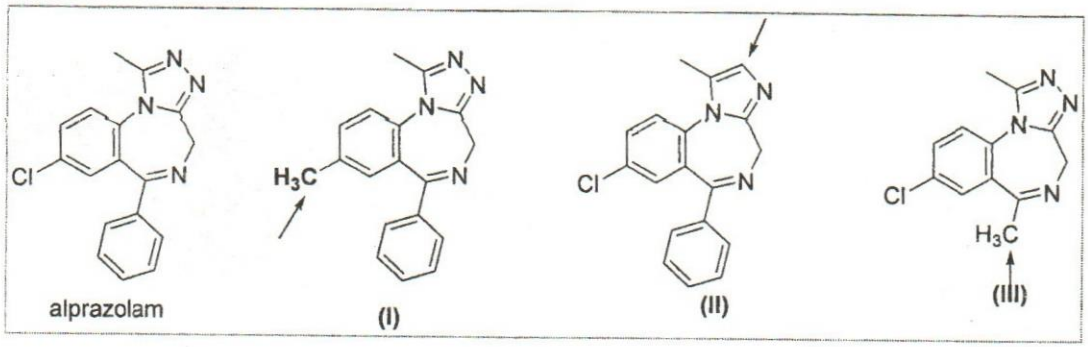
91. The antihistamine activity of *E*-triprolidine was found to be 1000-fold greater than the corresponding *Z*-isomer. This provides an example of the effect of _____ on pharmacological activity.

A) Conformational isomerism
B) Geometric isomerism
C) Optical isomerism
D) Bioisosterism
E) None of the above



92. Examine structure of alprazolam and related structures (I-III) below. Potential bioisosters of alprazolam could be _____

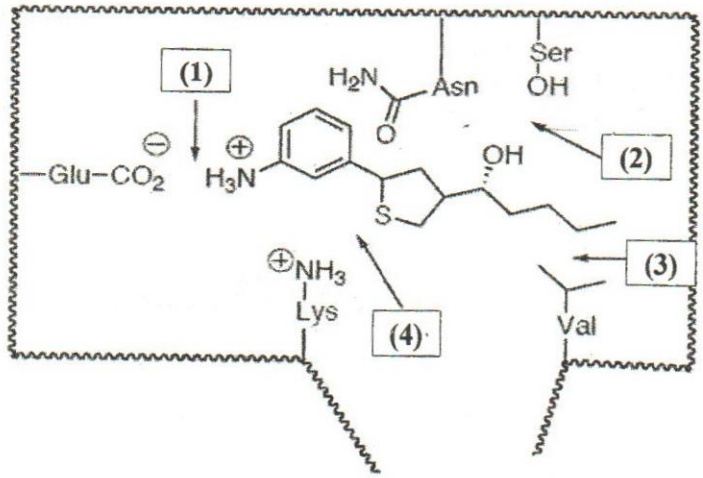
A) Structure (I)
B) Structure (II)
C) Structure (III)
D) Both (I) & (II)
E) Both (I) & (III)



93. According to the induced-fit theory of drug-receptor interaction

A) Drug-receptor complex can result from a conformational change in the receptor molecule.
B) The target structure is rigid but the ligand structure is flexible
C) Both target and ligand structures are rigid
D) Both target and ligand structures are flexible
E) Both A & D

Examine the following diagram (the wavy line represent receptor surface). Then indicate what drug-receptor interactions are involved at each arrow. Then answer questions 94-96 below:



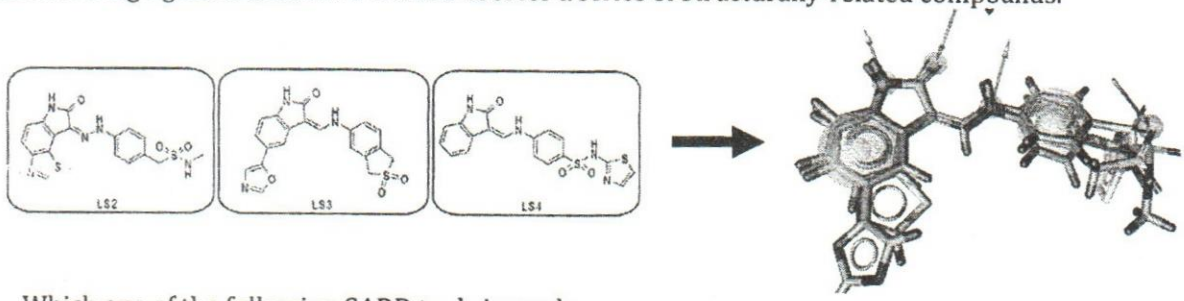
94. Type of bond that can be formed at arrow **(1)** is _____ bond
A) Covalent (B) electrostatic C) hydrophobic D) hydrogen E) halogen

95. Type of bond that can be formed at arrow **(2)** is _____ bond
A) Covalent B) electrostatic C) hydrophobic (D) hydrogen E) halogen

96. Type of bond that can be formed at arrow **(3)** is _____ bond
A) Covalent B) electrostatic (C) hydrophobic D) hydrogen E) halogen

97. Drug design with the help of computers may be used at the following stage(s) of drug discovery
A) hit identification
B) hit-to-lead optimization
C) lead optimization
(D) All of the above
E) None of the above

98. The following figure is a result of a CADD tool for a series of structurally-related compounds.



Which one of the following CADD tools is used:
(A) Pharmacophore modeling
B) Docking simulation
C) Homology modeling
D) Fragment-based drug design
E) *De Novo* drug design

99. Which of the following is False about pharmacophore modeling:
A) a model of the biological target can be built based on the knowledge of its ligands
B) the model may be used to design new molecules that interact with the same target
C) the ligands are represented in **3D** and superimposed to each other
(D) a model can be determined by **only** 2 feature points and one inter-feature distance
E) the model can contain hydrogen bond donors, hydrogen bond acceptors and hydrophobic groups

100. When the 3D target structure is not known, the following CADD tool can be used:
A) Pharmacophore modelling of known ligands
B) QSAR modelling of known ligands
C) Docking simulation
(D) Both A and B
E) None of the above

Best Wishes