IB Chemistry SL/HL

Option D: Drugs and Medicines

Workbook

D1. Pharmaceutical products

1. List **three** effects that drugs or medicines have on the functioning of the body.
   a).....
   b).....
   c).....

2. What is meant by “natural healing process”?
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   .....
   .....

3. What is the placebo effect? Describe how the clinical testing of a new medicine includes a placebo group.
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   .....
   .....

4. What are the **three** stages involved in research, development and testing of new medicines?
   a).....
   b).....
   c).....
   Do most, some, few or very few tested medicines find their way to the market?
   .....

5. What can go wrong if this procedure is not followed? Discuss the example of Thalidomide.
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   .....
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   .....

6. State the **four** methods of administering drugs. For each method state a) an advantage, b) a disadvantage and c) a case where it is use.

Method	Advantage	Disadvantage	Use

7. How many types of injections are there? Make a simple drawing showing the skin layers and the three types. State where each method is used.
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8. What is lethal dose LD_{50}?
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9. Heroin has LD_{50}=1mg/kg. What does that mean?
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   .....

10. What is effective dose ED_{50}?
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    .....

11. Discuss the term “therapeutic window”. What does a narrow therapeutic window of a drug indicate? What does a broad therapeutic window indicate?
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    .....

12. What is tolerance to a drug? State **two** reasons why tolerance may lead to fatal overdose.
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    .....
    a).....
    b).....

13. In what is a main effect different than a side effect?
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    .....
    .....

14. Can a side effect become main effect and vice versa? State an example and explain.
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15. What is physical dependence?
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    .....

16. What is psychological dependence?
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    .....
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17. What does physical and psychological dependence have to do with drug addiction?
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    .....
    .....

D2. Antacids

18. Are antacids acids or bases?
    .....

19. State **four** types of compounds that are found in antacids and write a balanced equation for the reaction of each one with the hydrochloric acid in stomach.
    a).....
    .....

b).....
.....
c).....
.....
d).....
.....

20. Equal masses of which of the following compounds neutralizes more HCl? $Mg(OH)_2$ or $NaHCO_3$? Explain.
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.....

21. Why is there acid in stomach?
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.....

22. Antacids often combine with alginates. Why?
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.....

23. Antacids often combine with dimethicone. Why?
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.....

D3. Analgesics

24. What are analgesics? What are their **two** categories?
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a).....
b).....

25. The sense of pain is created at the pain receptors all over our body and reaches the pain receptor sites in our brain. Where do each category of analgesics act?
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26. What are prostaglandins? How do they affect fever and swelling?
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27. How does aspirin reduces pain, fever and inflammation?

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28. How does morphine fight pain?

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29. Is aspirin an acid or an ester? Draw the molecule of aspirin, circle the **two** main functional groups and state their names.

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30. Why can't salicylic acid be taken orally?

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31. Why is sodium salicylate preferable compared to salicylic acid?

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.....

32. Why is sodium acetic salicylic acid preferable compared to sodium salicylate and salicylic acid?

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33. Apart from being an analgesic, aspirin also prevents heart attacks. Describe how this is done.

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.....
.....

34. Name **three** disadvantages of aspirin.
    a).....
    b).....
    c).....

35. Why should you **never** give aspirin to a child?
    .....
    .....

36. Paracetamol (acetaminophen) is a mild analgesic. Which part of each structure is common with aspirin?
    .....

37. Name **one** advantage and **one** disadvantage of paracetamol.
    .....
    .....

38. What are the effects of paracetamol overdose?
    .....
    .....

39. Morphine, heroin and codeine are strong analgesics. Which ones are natural and which ones are synthetic?
    .....
    .....
    .....

40. Describe the common parts and the different parts between the chemical structures of morphine and heroin. (use correct chemistry terms!)
    .....
    .....
    .....

41. Which structural group modification to the structure of morphine results in the structure of heroin?
    .....
    .....
    .....
    .....

42. For opiates, state:
    - their advantages for their use as strong analgesics
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    .....
    - their disadvantages
        - the physiological/psychological/social effects
    .....
    .....
    .....
        - of their short/long-term use
    .....
    .....
    .....

D4. Depressants

43. What are the “depressants”?
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44. The effect of depressants depends on the dose. Describe how their effect changes from low, to moderate, to high, and to extremely high doses. For each dose state what is the specific name given to the depressants.
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    .....
    .....

45. Why are depressants often described as antidepressants?
    .....
    .....

46. What type of depressant is ethanol?
    .....

47. Discuss three social effects of the use and abuse of alcohol.
    a).....
    b).....
    c).....

48. State three short-term health effects of the use and abuse of alcohol.
    a).....
    b).....
    c).....

49. State three long-term health effects of the use and abuse of alcohol.
    a).....
    b).....
    c).....

50. What are the synergetic effects (risks) when alcohol is taken with aspirin?
    .....
    .....

51. What are the synergetic effects (risks) when alcohol is taken with sedatives?
    .....
    .....

52. Ethanol can be detected in breath.
    - What type of reaction is involved in this detection method?
    .....
    - Which chemical compound is used for the detection of alcohol?
    .....
    - What does the breath analyzer detect?
    .....
    - How reliable is this method and why?
    .....
    .....

53. Ethanol can also be detected in blood and urine using Gas Liquid Chromatography and Infra-red Spectroscopy. For each method:
    - Make a simple drawing of the detecting procedure
    - Explain how the alcohol content is determined. Which quantity is proportional to the alcohol concentration in each case?
    Chromatography
    .....
    .....

Spectroscopy

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.....

54. Three common depressants are diazepam (Valium®), nitrazepam (Mogadon®) and fluoxetine hydrochloride (Prozac®).
    Find their chemical structures in the data booklet. Two of them have similar structure. Which ones?
    .....
    Which parts do they have in common and which parts are different?
    .....
    .....
    What do all these three drugs have in common in their structure?
    .....
    .....

D5. Stimulants

55. What are the "stimulants"? How do they compare to depressants?
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    .....
    .....

56. List the physiological effects (on body and brain) of stimulants.
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    .....
    .....

57. Name **three** effects of amphetamines and **three** side effects.
    a).....
    b).....
    c).....

    a).....
    b).....
    c).....

58. What is meant by “sympathomimetic drugs”?

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59. Compare adrenaline to amphetamines in terms of their effect.

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Find their structures in the data booklet and compare them:

- what is the common part in their structures

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.....

- which parts are different?

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.....

60. How does nicotine affect blood vessels and what influence does it have on the heart rate and blood pressure? Name **two** more short-term effects of nicotine.

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a).....

b).....

61. Name **three** long-term **physiological** effects of nicotine.

a).....

b).....

c).....

62. Name **three** risks associated with smoking tobacco.

a).....

b).....

c).....

63. Discuss smoking tobacco in terms of psychological dependence, tolerance and withdrawal symptoms.

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64. How does caffeine affect blood vessels and what influence does it have on the migranes?

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65. How does caffeine affect nerve cells and what influence does it have on the human body (name **four** effects)?
    a).....
    b).....
    c).....
    d).....

66. What are the **three** effects of caffeine when consumed in large amounts?
    a).....
    b).....
    c).....

67. Caffeine is a respiratory stimulant. What is meant by that?
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    .....

68. Compare the chemical structures of caffeine and nicotine. What do they have in common?
    .....
    .....

D6. Antibacterials

69. Against what are antibiotics used? Do they fight viruses?
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    .....

70. Penicillin is a well known antibiotic. Who found it first?
    .....
    How?
    .....
    .....
    Who further developed penicillin as a drug?
    .....

71. What does penicillinase has to do with penicillin?
    .....
    .....

72. Compare penicillin G, penicillin V and cloxacillin in terms of chemical structure and resistance to penicillinase and acids. Show which part is common in their structure.
    .....
    .....

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73. How does penicillin destroy the bacteria?
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74. Why doesn't penicillin affect the human cells?
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75. Name **three** reasons why antibiotics should not be over prescribed.
a).....
b).....
c).....

76. Are antibiotics used in animal feedstock? Are there any dangers linked to that?
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77. Why is it important that a patient comply with the recommended treatment, and especially for anti-TB drugs?
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D7. Antivirals

78. Compare viruses and bacteria in terms of size, cell structure, and reproduction.
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79. Describe **three** ways by which antivirals can fight virus activity (in terms of enzyme activity, cell invasion and genetic material).
a).....
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b).....
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c).....
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80. What is HIV and what AIDS?
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81. What cells does HIV affect and how? Describe the process of the cell infection by HIV.
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82. State two reasons why effective treatment of HIV with antiviral drugs is very difficult.

a).....
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b).....
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