PHARMACOLOGY

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General Pharmacology

1. Which has a half life of 6 hours
    a) Aspirin...3-5 hrs
    b) digoxin...3-5 hrs40 hrs
    c) atenolol
    d) diazepam...3-5 hrs20-40 hrs

2. Irreversible antagonists; which is correct
    a) requires regeneration of receptors for further agonist action
    b) can be displaced by increasing concentration of agonist...partial agonist
    c) can be displaced by increasing potency of agonist...partial agonist
    d) can be displaced by increasing efficacy of agonist...partial agonist

3. Calculate a phenytoin loading dose for a 70 kg male; Target concentration 10 mg/L, Vd 0.5 L/kg
    a) 350 mg
    b) 300 mg
    c) 400 mg
    d) 3500 mg

    LD = Target Concentration x VD = 10 x (0.5 x 70) = 350
    Maintenance Dose = Target Concentration x Clearance

4. Which of the following is a phase I reaction? ...phase I reactions include reduction/oxidation/hydration
    a) sulphation...phase II
    b) glucuronidation...phase II
    c) hydration
    d) acetylation...phase II

5. 15) How many mg in 2ml of a 0.5% weight per volume solution?
    a) 10mg
    b) 1 mg
    c) 100mg
    d) 0.1 mg
    e) 5mg

    % wv = g/100ml
    Therefore 0.5% = 0.5g/100ml
    Therefore 2ml = 2 x 0.5 ÷ 100 = 0.01g = 10mg

6. The volume of distribution ...VD = amount of drug in body ÷ [drug in medium]
    a) is calculated by dividing the amount of drug by it's clearance
    b) if high suggests homogeneous distribution throughout tissues...nope, high = in more body compartments
    c) if low suggests homogeneous distribution throughout tissues...nope, low = in less body compartments
    d) of aspirin is greater than pethidine...aspirin is bound to albumin = low, pethidine = 5L
    e) **of midazolam is greater than warfarin**...correct 50L vs 2L (warfarin bound to albumin 99%)

7. The volume of distribution ...VD = amount of drug in body ÷ [drug in medium]
    a) **is proportional to half life**...larger distributions take longer to clear (no direct equation found)
    b) is inversely proportional to clearance...nothing to do with it, T ½ is though
    c) is used to work out maintenance dose...MD = Target Concentration x Clearance
    d) is measured in mg/L...measured in L/Kg
    e) is high in warfarin...low, warfarin is highly protein bound

8. Calculate the half life of digoxin in a patient with a renal clearance of 8.4L/min and Vd of digoxin of 5 L/Kg in a 70 Kg man
    a) 8 hours
    b) 14 hours
    c) 29 hours
    d) 36 hours
    e) 44 hours

    T ½ = log2 x VD ÷ Clearance = 0.7 x (5 x 70) ÷ 8.4 = 29.2

9. The half life of lignocaine is
    a) 1 minute
    b) 5 minutes
    c) 10 minutes
    d) 30 minutes
    e) **120 minutes**...

10. The volume of distribution...VD = amount of drug in body ÷ [drug in medium]
    a) is less than 70 L for fluoxetine...2500L, antipsychotics tend to have long T ½ (therefore large VD)
    b) is calculated by dividing rate of elimination by concentration...see above
    c) is inversely proportional to half-life...proportional (see previous question)
    d) **is about 5L/kg for pethidine**...correct, 70% protein bound
    e) is effected by the route of drug administration...it's an apparent volume, irrespective of route

11. The bioavailability of a drug...fraction of unchanged drug reaching circulation after administration (area under curve)
    a) must be 100% if given by inhalation...variable 5 to < 100%, variable onset, IV is 100%
    b) is typically 75 % if given intravenously...100%
    c) is high if the drug is hydrophillic...less available in circulation eg atenalol
    d) is equal to 1 – the extraction ratio...ER is liver clearance ÷ liver flow (typically 990L/hr)
    e) **is 70% for orally administered digoxin**...

12. Type 1 biotransformation reactions include...reduction/oxidation/hydration
    a) methylation...phase II
    b) acetylation...phase II
    c) oxidation...correct
    d) glucuronidation...phase II
    e) sulphonation...phase II

13. The half life of narcan is ...naloxone, opiod receptor antagonist (competitive)
    a) 1-2 minutes
    b) 2-4 minutes
    c) 40-60 minutes
    d) **60-90 minutes**...
    e) more than 2 hours

14. 5 ml of 2% wv is equal to
    a) 10 mg
    b) 100 mg
    c) 200 mg
    d) 20 mg
    e) 40 mg

    % wv = g/100ml
    Therefore 2% wv = 2g/100ml
    Therefore 5ml = 2 x 5 ÷ 100 = 0.1 g = 100mg

15. With regard to a drug
    a) LD50 is 50 % of the dose necessary to kill experimental animals...LD50 = lethal dose in 50% population
    b) Efficacy is the maximum response produced by a drug...true
    c) Spare receptors are present if Kc 50 is the same as EC 50 ...EC50 = effect dose in 50% population, KC 50 = kill cell 50?
    d) Potency is the same as affinity...potency is strength of effect, affinity is strength of reception
    e) TD50 is the concentration of a drug necessary to produce toxic effects 50 % of the time...TD50 = toxic dose in 50% population

16. Half life...time for half of drug to be cleared = Log2 x VD ÷ Cl
    a) t1/2 may not be a good indication of clearance...it isn't, but clearance is a good indicator for T ½
    b) does not increase with age...nope
    c) not dependent on Vd...it is, proportionate to!

17. 43. 2ml of 0.5% wv is equal to
    a) 1 mg
    b) 10 mg
    c) 100 mg
    d) 20 mg

    % wv = g/100ml
    Therefore 0.5% wv = 0.5g/100ml
    Therefore 2ml = 2 x 0.5 ÷ 100 = 0.01 g = 10mg

18. 44. What is an example of a phase II biotransformation phase 2...that would be sulphonation, methylation, acetylation, glucuronidation (MAGS)
    a) oxidation...phase I
    b) reduction...phase I
    c) glycolysis...correct

19. What is the half life a drug given: clearance = 8.4l/min; weight = 70 kg; Vd = 5 l/kg
    a) 24 hrs
    b) 12 hrs
    c) 30+ hrs

    T ½ = log2 x VD ÷ Clearance = 0.7 x (5 x 70) ÷ 8.4 = 29

20. Regarding t ½ ... log2 x VD ÷ Clearance
    a) Can be poor predictor of clearance...correct, see above answer
    b) Is not affected by age...nope
    c) Is not related to Vd...proportionate to
    d) Is related to volume of distribution and protein binding...not protein binding (relates to Clearance & VD)

21. Regarding efficacy...maximal effect of a drug
    a) It cannot be zero...it can be inert
    b) **It is regardless of route of administration**...correct
    c) It refers to dose that has effect in 50% of population...ED50 does
    d) It refers to effect at 50% of dose...EC50 does
    e) Relates effect to amount of receptor occupancy...nope

22. 40. Clearance
    a) Is proportional to liver blood flow...if cleared or metabolized by liver!

23. 41. Regarding PK's/PD's...pharmacokinetics & dynamics
    a) Diffusion is inversely proportionate to S.A. and directly proportionate to thickness...fick's law; diffusion ∝ area x permeability co-efficient x Δ Concentration ÷ Thickness
    b) The LD50 is 50% of the dose that kills most people...lethal dose in 50% of population
    c) The LD50 is 50% of the dose at which toxicity occurs...as above
    d) **Efficacy is the maximum response produced by a drug**...true

24. Regarding bioavailability...proportion of drug that reaches systemic circulation
    a) PR drugs have no first pass...mostly don't given vascular drainage bypasses liver
    b) Transdermal drugs have first pass...nope
    c) IV drugs undergo first pass...nope, 100% BioAv

25. 2 ml of 0.5% wv is equal to
    a) 1mg
    b) 10mg
    c) 100mg
    d) 20mg

    % wv = g/100 ml
    Therefore 0.5% wv = 0.5g/100 ml
    Therefore 2 ml = 2 x 0.5 ÷ 100 = 0.01 g = 10 mg

26. 10 ml of 1% wv is equal to
    a) 1 mg
    b) 10 mg
    c) 100 mg
    d) 1000 mg

    % wv = g/100 ml
    Therefore 1% wv = 1 g/100 ml
    Therefore 10ml = 10 x 1 ÷ 100 = 0.1 g = 100 mg

27. Regarding therapeutic index, which is correct...TI = LD50/ED50 therefore higher = more dangerous
    a) It equals ratio ED50/LD50...nope
    b) **It equals LD50/ED50**...correct
    c) High therapeutic index means a drug is dangerous...incorrect, higher TI = higher dose required to reach LD (compared with ED of course)
    d) Potent drugs are more likely to have a high therapeutic index...potency relates to dose to reach E_{MAX}

28. A 70 kg male patient has the following pharmokinetic parameters; VD: 5liter/kg, clearance 8.4 litre per hour
What is the half life of digoxin if the bioavailability is 0.70?
    a) ~1800 minutes
    b) ~2300 minutes
    c) ~2900 minutes
    d) ~3400 minutes

    T ½ = log2 x VD ÷ CL = 0.7 x (5 x 70) ÷ 8.4 = 29.1 hrs = 1750 min

    BioAv is a red herring!

29. Regarding pharmacokinetics
    a) Potency is maximal drug effect...relationship between dose & EMAX
    b) Potency is dose of maximal effect...relationship
    c) **Efficacy is maximal drug effect**...correct
    d) Efficacy is measured by gram-for-gram effect...potency

30. Regarding enzyme induction...molecule inducing production of enzyme on genetic level
    a) It is irreversible...
    b) It takes 4 months to develop...
    c) Causes increase in smooth endoplasmic reticulum...correct
    d) Causes increase in rough endoplasmic reticulum...

Respiratory System

1. Theophylline; which is incorrect...Methylxanthine group, inhibits phosphodiesterase (4) to increase cAMP
    a. **antidiuretic action it has a diuretic action**...

2. Salbutamol; which is correct...beta 2 selective antagonist
    a. **Low pO2 initially**...something to do with oxygen tension
    b. half life of 12 hours...inh 3.8 hrs oral 2.7-5 hrs, highly lipid soluble

3. Which of the following do not possess bronchodilator activity...asthma classes; sympathomimetics, seletice beta agonist, Methylxanthines, antimuscurinics, corticosteroids, leukotriene inhibitors, Cromoglycates, IgE monoclonal antibodies
    a. sodium cromoglycate...correct, mast cell degranulation
    b. theophylline...PDE inhibitor
    c. atropine...antimuscarinic
    d. salbutamol...selective beta agonist
    e. adrenaline...sympathomimetic

4. Theophylline; which is not an overdose effect...important side effects include unheralded seizures, arrythmias (> 40mg/kg ie narrow TI) since it's a PDE (4) inhibitor it has many systemic effects!
    a. seizures
    b. hypokalaemia
    c. hyperglycaemia
    d. **hypocalcaemia**...
    e. tachycardia...+ve inotropic & chronotropic effects due to raised cAMP $\Rightarrow \uparrow$ Ca++

5. Salbutamol...selective beta 2 agonist
    a. **it decreases the PaO2 briefly**...something to do with initial oxygen tension

6. Regarding theophylline...PDE inhibitor = raised cAMP
    a. **it is a diuretic**...weakly
    b. it blocks adenosine receptors...nope

7. Theophylline...PDE inhibitor, raises cAMP to cause bronchodilation, inhibit antigen induced histamine release...
    a. **is a positive chronotrope**...correct
    b. reduces GFR...increases GFR, decreases Na resorbtion
    c. is thought to increase blood viscosity...lowers viscosity
    d. is less potent than aminophlline...not sure, unlikely
    e. has a Vd of 10L/kg...VD 0.5L/Kg (40% protein bound)

8. The Beta 2 sympathomimetic with the longest duration of action is...Salmeterol (12 hrs) > Terbutaline (4-5 hrs) Salbutamol (4 hrs) >
    a. Salbutamol ...4 hrs
    b. **Salmeterol**...12 hrs
    c. Sotalol...non selective
    d. Terbutaline...4-5 hrs
    e. isoproterenol...adrenergic stimulant, vasopressor

9. Which is an effect of Methylxanthines...theophylline etc
    a. weak anti-diuresis...raises GFR, reduces Na resorbtion too
    b. increased strength of muscle contraction...does cause reverse fatigue on the diaphragm
    c. negative inotropic effect...positive inotrope & chronotrope
    d. medullary depression...excitation, can lead to seizures
    e. stimulation of cell surface adenosine receptors...nope

10. All of the following cause DIRECT bronchodilation EXCEPT
    a. atropine
    b. adrenaline
    c. salbutamol
    d. theophylline
    e. **Disodium cromoglycate**...inhibits mast cell degranulation, airway reactivity

11. Salbutamol may cause all except...it's a selective beta 2 agonist
    a. **hyperkalemia**...we use it all the time in hyperkalemia
    b. decreased PO2 initially...increases due to O2 tension
    c. skeletal muscle tremor...beta 2 effect
    d. nervousness...as above
    e. weakness...as above

12. Ipratropium...antimuscarinic
    a. causes miosis...M3 agonists cause this
    b. is well absorbed orally...poorly absorbed in CNS & vasculature
    c. inhibits mast cells...nope
    d. readily enters the CNS...poorly absorbed in CNS & vasculature
    e. **onset of effect within 10 minutes**...but peaks in 10-12 hrs, most respiratory drugs have an onset < 15min

13. Cromolyn reduces bronchial reactivity chiefly by...like sodium cromoglygate
    a. relaxing smooth muscle cells
    b. inhibiting eosinophil chemotactic factor
    c. direct bronchodilation
    d. **inhibiting IgE mediated mast cell degranulation**...bingo
    e. inhibiting basophil mediator release

14. Regarding ipratropium bromide...antimuscurinic
    a. peak onset is 10 mins post inhalation...correct, peak action is 10-12 hrs
    b. gives rise to tolerance...nope
    c. has CNS effects...poorly penetrates the CNS & vasculature
    d. may precipitate narrow angle glaucoma...nope, but the centrally acting antimuscurinics can

15. Regarding theophylline, which is CORRECT...Methylxanthines, PDE (4) inhibitors
    a. causes increased K+...nope
    b. **Seizures may not have warning neurological signs**...yes!
    c. Overdose of slow release tablets will give a peak serum level in 6 hrs...slow release tablets....enough said

16. Regarding theophylline...
    a. Vd is 2L/kg...0.5L/kg, 40% protein bound
    b. Diuretic...correct

17. Which causes bronchodilation?
    a. Cromoglycate...
    b. Propanol...non specific beta ANTagonist
    c. Prednisone...not sure, thought its main use was for anti-inflammatory effects, does potentiate beta effect
    d. **Histamine**...sounds right, is a dilator after all...

18. Salbutamol...selective beta 2 agonist
    a. gives a low PO2 initially...correct, something to do with O2 tension
    b. beta-1 mimetic agent...beta 2 mimetic or agonist as they say
    c. gives bradycardia...tachycardia, skeletal muscle tremor, nervousness, weakness

19. Oxygen toxicity...usually in intubated or neonate, 60% > 16 hrs, after 30hrs impaired gas exchange (probably from absorption atelectasis), 48hrs pulmonary oedema, also causes retinolental fibroplasia so aim for PaO2 < 140 mmHg
    a. Lung effects more related to FiO2 than PiO2...nope
    b. Occurs when breathing 50% oxygen for more than 16 hours...60% > 16 hrs
    c. **Has an effect on the retina in children**...yes, usually through humidicribs not masks
    d. rarely gives central nervous system effects...incorrect

20. Sodium Cromoglycate...inhibits histamine release from mast cells
    a. main route of administration is orally...poor oral absorption, inhalation is best
    b. increases airway sensitivity long term...nope, decreases, also decreases cough
    c. **inhibits IgE mediated mast cell degranulation**...correct

21. Regarding cromolyn, which is incorrect?
    a. **It inhibits IgG mediated mast cell degranulation**...de ja vu

Cardiovascular System: **Thrombosis/coagulation**

1. What drugs do not effect warfarin metabolism...aeiobp have no effect (most Antibiotics, Ethanol, Indomethicin, Opioids, Bzdp, Paracetamol), rbi (Rifampicin, Barbiturates inhibit), CMT (Cephalosporin, Metronidazole, Trimethoprim are main antibiotics that don't follow the rules of aeiobp)
    a. **Phenobarbitone**...inhibits effect
    b. **Rifampicin** ...inhibits effect
    c. **Cimetidine**...potentiates effect by metabolism of both isomers
    d. **benzodiazepines**...correct

2. Which does not interact with warfarin...aeiobp, rbi, cmt
    a. **Phenobarbitone**...inhibits effect
    b. **loop diuretics**...not in the list, probably increases effect
    c. **benzodiazepines**...nothing
    d. **cephalosporins**...kills vit K produces bugs in intestines to potentiate effect

3. Heparin; which is correct...potentiates ATIII effect (ie inactivation of Factors IXa, Xa, IIa) by 1000 times
    a. **causes alopecia**...and osteoporosis in chronic use
    b. **is a homogenous mixture**...nope
    c. **is contraindicated in pregnancy**...indicated in pregnancy, contraindicated in HITS, hypersensitivity, bleeding, IE, active TB, advanced liver/renal disease
    d. **can be given intramuscularly**...S/C or IV
    e. **protamine blocks its receptor effects**...protamine binds to heparin molecule to inhibit action

4. Which of the following statements is correct
    a. **aspirin makes platelets sticky**...inhibits platelet aggregation by irreversibly acetylating COX on TXA2
    b. **Ticlopidine inhibits the ADP pathway**...as does Clopidegral by irreversibly blocking ADP receptors on plts
    c. **aspirin versus diclofenac**...diclofenac has a mild inhibitory role via ADP/collagen inhibition

5. Fibrinolytics; which is correct
    a. **urokinase is cheap**...none of them are
    b. **streptokinase is a human product**...from streptococcus sp, urokinase is from human kidneys...ewww
    c. **aminocaproic acid is an inhibitor of fibrinolysis**...nope, promotes it, an enzyme similar to TXA
    d. **gastrointestinal bleed within 12 months is a contraindication**...6 months, CVA 2 months, 10 days for major surgery, chest or head trauma, CPR > 2 minutes, delivery, organ biopsy, puncture of non compressible vessel (eg subclavian); in general severe liver or kidney disease, aneurysm, hypersensitivity, brain neoplasm or other vascular neoplasm, uncontrolled HTN
    e. **TIMI trial shows that GI hemorrhage is the most common adverse effect**...Thrombolysis in MI trial, not sure what it showed

6. What is true of heparin? ...enhances ATIII function by 1000 (ie inhibition of IXa, Xa, IIa)
    a. **it is a mix of complex mucopolysaccharides?**
    b. **it causes alopecia**...correct

7. Regarding Fibrinolytics
    a. all thrombolytics act to convert free plasminogen to plasmin...Fibrinolytics do this, thrombolytics act on thrombin ie potentiate ATIII (heparin) or directly inhibit (Bivalirudin, Lepirudin)
    b. **urokinase is a human product**...straight from the kidney
    c. tPA and APSAC lack the streptococcal antigen...they certainly do not
    d. tPA does not occur naturally...surely does
    e. reactions to tPA and antistrepalase are preparation related...probably more to it

8. In a patient on warfarin which of the following drugs cause an increased INR...aeiobp, rbi, cmt
    a. **cholestyramine**...inhibits Vit K absorption so I guess it does?
    b. barbituates ...reduced
    c. benzodiazepines...no change
    d. rifampicin...reduced
    e. **amiodorone**...increases (a is for antibiotics)

9. Which is not true of warfarin
    a. it has 100% bioavailability...true
    b. it is reversed by FFP...true
    c. it is 99% protein bound...true
    d. it affects vitamin K synthesis...inhibits
    e. **Half life is 6 hours**...around 36 hrs (daily dosed and continually chasing INR)

10. Streptokinase...fibrinolytic, catalyses formation of plasminogen to plasmin
    a. is a complex lipopolysaccharide...not sure
    b. is synthesised by the human kidney...urokinase is
    c. **binds to the proactivator plasminogen**...yes it does
    d. activates the plasminogen that is bound to fibrin...activates plasminogen at the core of fibrin, tPA activates plasminogen bound to fibrin (can't give plasmin directly because plasma has normal plasmin inhibitors so that we don't end up having spontaneous lysis!)
    e. is more dangerous than tPA in those over 75 years of age...can't find the reference

11. Heparin induced mild thrombocytopenia is caused by...2 types of HITS exist: HIT I is a non-immunological, reversible, asymptomatic, mild thrombocytopenia of idiopathic cause, HIT II is due to Heparin Antibody (IgG) complexing with platelet factor (PF) 4. The tail of this complex activates circulating platelets to form chaotic small clots and leads to consumptive thrombocytopenia. Previous exposure (< 3 months) increases reaction due to already circulating antibodies
    a. release of lipoprotein lipase
    b. **platelet aggregation**...I guess this would be the best answer
    c. thrombosis...not always, HIT is separate to HITT (but often a Sequelae, but not in the mild form)
    d. anti-platelet antibodies...anti heparin antibodies (heparin is produced naturally in humans)
    e. none of the above

12. With respect to the pharmacokinetics of warfarin. All the following cause altered INR EXCEPT...aeiobp, rbi, cmt
    a. cephalosporins...increase in INR from death of vit K producing bacteria
    b. **benzodiazepines**...not altered
    c. barbituates...decrease

13. All of the following are known to potentiate the effects of oral anticoagulants EXCEPT...aeiobp, cmt, rbi
    a. Cimetidine...inhibits both isomers
    b. ceftriaxone...kills vit K producing bacteria
    c. **rifampicin**...decreases effect
    d. metronidazole...one of the antibiotics that does increase effect
    e. trimethoprim...also increases effect

14. Heparin...potentiates ATIII by 1000x (ie inactivates Xia, Xa, IIa)
    a. decrease the rate of conversion of VII to VIIa...nope
    b. decreases the rate of fibrinogen to fibrin...through thrombin (weak effect)
    c. slows the rate of prothrombin to thrombin...yep, prothrombin is "II" and thrombin is "IIa"
    d. inhibits the action of antithrombin III...nope
    e. inhibits the action of protein C...vit K dependent anticoagulant (Va & VIIIa) and prothrombotic (defective inactivation in Factor V def)

15. Regarding heparin...potentiates ATIII (inhibits IXa, Xa, IIa)
    a. dose reduction is necessary in the elderly...nope, reversible and largely predictable kinetics (for LMWH) despite not knowing true metabolic pathway (theoretical pathway involves storage in reticuloendothelial system or metabolized by the liver...it's been observed that a small amount excreted in urine unchanged)
    b. LMW fractions have more effect on thrombin than HMW fractions...same efficacy as UFH though antithrombotic effect is a little less vs UFH
    c. It may cause alopecia...correct
    d. It inhibits antithrombin III...potentiates x1000
    e. Protamine is a competitive antagonist of heparin...binds heparin to inactivate

16. Ticlodipine...same class as Clopidegral – antiplatelet by inhibiting ADP receptors on platelets
    a. inhibits ADP induced platelet aggregation...enough said

17. Warfarin...blocks gamma carboxylation of II, VII, IX, X (vit K dependent factors)
    a. is completely broken down in the duodenum...100% Absorption, BioAv and 99% protein bound
    b. decreases levels of thromboplastin...otherwise known as Factor III ie extrinsic pathway ie not Vit K dependant

18. Regarding fibrinolytics...catalyse plasmin formation from plasminogen
    a. TIMI trial showed increased incidence of GI bleed as the major side effect of administration...nope
    b. Aminocaproic acid inhibits fibrinolysis...correct, its an enzyme not dissimilar in action to TXA, given in bleeding eg after cardiac surgery

19. Regarding fibrinolytics...catalyse plasmin formation from plasminogen
    a. urokinase is cheap but less selective...not cheap, very selective (only activates from within fibrin clot)
    b. streptokinase comes from human cells...urokinase does (the kidney no less)
    c. HIMA says GIT haemorrhage is most common haemorrhagic complication...don't know
    d. GIT haemorrhage within 12 months is a contraindication...not
    e. **Actriylitic acid is a potent fibrinolytic inhibitor**...must work like aminocaproic acid and TXA? Not in book

20. Which is CORRECT regarding warfarin...oral anticoagulant inhibiting Vit K reduction (required for factor gamma-carboxylation and activation)
    a. broken down in GIT...100% absorbed, 100% BioAv, 99% Protein bound therefore low VD
    b. added to transfused blood...heparin usually added
    c. decreases thromboplastin...thromboplastin is Factor II (extrinsic pathway), not related to Vit K

21. Regarding warfarin (terrible question)
    a. **Works by affecting metabolism of Vit K dependant clotting factors**...inhibits Vit K reduction and therefore vit K dependent factor gamma-carboxylation and activation
    b. 75% protein bound...99%
    c. half-life 6 hours ...36 hrs (although daily dosed and forever chasing INR!)
    d. increases levels of protein C early on...Protein C inhibited since it is also Vit K dependent

22. Regarding Ticlopidine...antiplatelet like Clopidegral, irreversibly binding ADP on platelet surface
    a. **Works by antagonising ADP binding of platelets**...irreversibly, plt turnover is 7 days therefore duration of action is the same (and the cause of many cancelled surgery!)
    b. Something about platelet acuity...huh?

23. concerning heparin (UFH)...potentiates action of ATIII (ie inhibits factors IXa, Xa, IIa)
    a. low molecular weight variety work by binding to ATIII...both do
    b. **comes in preparations of standardised units against a bioassay**...true, so we can measure
    c. LWH more potent than heparin...not sure, same efficacy (despite LMWH not being as active on IIa & IXa), but hard to compare since LMWH uses g, UFC uses IU
    d. Nothing about alopecia
    e. Another wordy option

24. Heparin induced severe thrombocytopenia is caused by...HIT I is transient reversible, asymptomatic thrombocytosis, non-immunological in nature. HIT II is due to Heparin antibodies (IgG) complexing with PF (4) whose tail activates circulating platelets to form micro emboli +/- thrombosis
    a. release of lipoprotein lipase...nope
    b. aggregation...not caused by, but can cause thrombosis due to activation of plt
    c. **antiplatelet antibodies**...yes, IgG
    d. all of the above...nope

25. **Heparin**...potentiates ATIII x1000 (inhibits factors IIa, IXa, Xa)
    a. **Inhibits antithrombin III**...otherwise known as thromboplastin – no, part of extrinsic pathway anyway
    b. **Causes alopecia**...yes, and osteoporosis with chronic use
    c. **Decreases rate conversion prothrombin to thrombin** ...by inhibiting Xa I guess it does
    d. **Decreases rate conversion fibrinogen to fibrin**...by inhibiting IIa (thrombin) I guess it does, though not as much (UFH > LMWH)
    e. **Decreases rate conversion VII to VIIa**...no, oral anticoagulants do this

26. The following drugs increase warfarin's action, **except**...aeiobp, cmt, rbi
    a. **metronidazole**...increases INR
    b. **amiodarone**...not the a in aeiobp so probably increases
    c. **Disulfiram**...inhibits acetaldehyde, ethanol relates, so no...e in aeiobp
    d. **Phenobarbitone**...bingo, part of rbi; r= rifampicin, I = inhibits!

27. Regarding heparin, **which is correct**...ATIII catalyst
    a. **causes alopecia**...correct, as well as osteoporosis in chronic use
    b. **is not a racemic mixture**...but it is
    c. **is contra indicated in pregnancy**...very useful in pregnancy, easily reversible, unlike the others...
    d. **can be given IM**...nope IV or S/C , IM risks hematoma formation
    e. **protamine blocks heparin receptors**...binds with heparin making it inert and unable to bind to ATIII to alter its confirmation and potentiate its action

28. **Ticlopidine**...same class as Clopidegral
    a. **Decreases platelet aggregation by inhibiting the ADP pathway of platelets**...correct, irreversibly binds
    b. **Has no GI side effects**...GI irritation, bleeding is often frowned upon and a contraindication
    c. **Inhibits prostaglandin metabolism**...nope, aspirin however irreversibly acetylates COX on TXA2 thereby inhibiting its platelet aggregating function

Cardiovascular System: **Antiarrhythmics**

1. **Which shortens the refractory period in normal cells**...K channels involved in plateau of AP, so drugs that block K channels prolong refractory period
    a. **amiodarone**...Class III ie K ch blocker (with some Na ch blocking action)
    b. **Sotalol**...Class II ie sympathomimetic, nonspecific, slows conduction
    c. **quinidine**...Class Ia ie intermediate Na ch blocker with some K blocking action
    d. **lignocaine**...pure Na blockade (all other class I have some K blockade that prolongs QRS)
    e. **procainamide**

2. **Digoxin; which is correct**...inhibits Na-K ATPase thereby increasing intracellular Ca thereby increasing K conductance
    a. **is a negative inotrope**...more Ca = greater contractility
    b. **has atropine like effects on heart acetylcholine receptors**...atropine is an antimuscarinic not anticholinergic
    c. **inhibits central vagal effects**...stimulation
    d. **increases ventricular excitability**...more intracellular Ca
    e. **increases conduction through Bundle of His**...

3. **Digoxin**...makes lots of intracellular Ca (and therefore K) from blocking Na-K channels on cardiac myocytes
    a. **is a positive inotrope**...correct

4. **All of the following may increase the effect of digoxin EXCEPT**...digoxin isn't extensively metabolised
    a. **amiodarone**...Class III with some Na blocking properties
    b. **Frusemide**...loop diuretic, digoxin is excreted unchanged by the kidneys
    c. **carbamazepine**...anticonvulsant that works via membrane stabilization probably through Na ch blockade activates P450 system
    d. **verapamil**...Class IV
    e. **quinidine**...Class I

5. **Coronary artery dilation occurs with** ...raised cGMP (mostly from NO), reduced Ca, membrane stabilisation, raised cAMP (from beta 2 adrenergics)
    a. **adenosine**...misc antiarrhythmic, IKr activation, Ca inhibition
    b. **high potassium**...membrane stabiliser
    c. **propranolol**...non selective beta antagonist so might have weak beta 2 effects
    d. **Enalapril**...ACE Inhibitor
    e. **none of the above**

6. **Regarding adenosine**...misc antiarrhythmic; activates IKr, inhibits Ca
    a. **its receptors are ion channels**...specific adenosine receptors
    b. **it increases AV nodal conduction**...inhibits conduction, prolongs refraction, lesser effect on SA node
    c. **it enhances potassium conductance**...correct
    d. **it is the drug of choice in VT**...used in SVT principally, or for evaluation of tachyarrythmias
    e. **it has a half-life of 2 minutes**...10 seconds

7. Which does not prolong the refractory period of normal cells
    a. **amiodorone**...class III K ch blocker
    b. **lignocaine**...Class Ib fast Na channel blocker without K or Ca ionic change
    c. **quinidine**...Class I intermediate Na ch blocker with some K ch blocking action
    d. **sotalol**...Class II & III
    e. **procainamide**...used as a cardioplegic agent,

8. Verapamil + diltiazem are l type Ca channel antagonists
    a. **is a positive inotrope**...block calcium so decrease inotropic effect
    b. **inhibits activated and inactivated sodium channels...**blocks both in/activated L-type Ca channels but both also have modest and less marked block on Na channels (Verapamil & Diltiazem consecutively), Dihydropyridines don't do much for Na channels or Ca channels in heart actually
    c. **is a dihydropyridines**...no, they end in "-ipine" eg felodipine, higher affinity for peripheral vs cardiac channels, and have individual specificity for different vascular beds eg Nifedipine for cerebral circulation

9. The calcium channel blocker with the most rapid onset of action when given orally is
    a. **diltiazem**...30-60 minutes oral, 1 - 2 min IV
    b. **nifedipine**...dihydropyridine, 20 minutes oral, 2-3 min SL
    c. **verapamil**...1-2 hrs oral, ½ - 1 min IV
    d. **felodopine**...dihydropyridine, about 2 hrs
    e. **nicardipine**...dihydropyridine, 1-2 minutes IV

10. Adenosine... misc antiarrhythmic; activates IKr, inhibits Ca
    a. **has a half life of only minutes**...seconds
    b. **is drug of choice in VT**...normally used inSVT
    c. **decreases SA nodal conduction**...AV node moreso
    d. **enhances K+ conductance**...it does

11. Digitalis... makes lots of intracellular Ca (and therefore K) from blocking Na-K channels on cardiac myocytes
    a. **is positive inotrope**...more Ca = more contractions!

12. Adenosine...activates IKr, inhibits Na
    a. **opens K+ channel**...correct
    b. **opens Cl- channel**...no effect
    c. **half like of 10 mins** ...seconds
    d. **profoundly blocks SA node**...minimal inhibition of SA, more profound on AV inhibition and prolongation of refractory period
    e. **blocks Ca++ dependant action potential**...blocks Ca channels and therefore current and Ca dep AP

13. Which is an example of a Class IV antiarrhythmic **verapamil/ diltiazem**...Calcium channel blockers

14. **Verapamil**...Class IV non Dihydropyridine
    a. **increases myocardial contractility**...it doesn't, blocks Ca
    b. **is a positive inotrope**...again, blocks Ca, therefore decreases contractility
    c. **causes skeletal muscle weakness**...acts on smooth muscle Ca channels so it can cause bronchospasm (10%)
    d. **blocks active and inactive Ca++ channels**...correct

Cardiovascular System: **Antihypertensives**

1. Coronary artery dilation occurs with
    a. **adenosine**...activates IKr (hyperkalemia dilates) and inhibits Ca channels on smooth muscle and
    b. **high potassium**...correct
    c. propranolol...non selective beta blocker, dilation from beta 2, constriction from beta 1
    d. enalapril...ACE inhibitor therefore vasocosntrictive
    e. none of the above

2. Prazosin; which is correct...alpha 1 antagonist on arteries and veins
    a. it is non-selective...selective for alpha 1 receptors
    b. **reduces afterload and preload**...dilates arteries (afterload) and veins (preload)
    c. half-life is 18 hours...3-4 hrs, 80% BioAv
    d. alters lipid levels...no change
    e. causes lupus like syndrome...hydralazine does this at doses > 400mg

3. Diuretics; which is the correct drug-MOA pairing ...mode of action
    a. thiazides – proximal DCT...inhibit Na=Cl transport in DCT
    b. triamterene – ascending loop of Henle...K sparing inhibit ENaC on CT (so no gradient for K efflux)
    c. spironolactone – loop of Henle...also K sparing, mineralcorticoid receptors antagonist in CT, therefore inhibits ENaC on luminal membrane and also Na=K ATPase on basal membrane to maintain K sparing effect
    d. Frusemide – collecting duct...loop diuretics, mostly ascending loop
    e. acetazolamide – DCT...CA inhibitor - PCT

4. GTN; which is correct...nitrate, activates guanylyl cyclase required for the conversion of GTP to cGMP required for conversion of myosin light chain-PO4 (contraction) to myosin light chain (relaxed form)
    a. **works via NO and cGMP**...correct
    b. moderate incidence of MetHb...does occur but not anywhere near moderate amount, has utility in treating cyanide poisoning
    c. works well to increase coronary blood flow in atherosclerosis...although it activates cGMP which has theoretical benefit with inhibition of plt activation, not actually shown to occur
    d. tolerance is due to ? consumption of sulfhydryl groups...occurs after 1-2 days of use, from decrease in tissue thiol compounds (NO substrate)

5. Calcium channel blockers; which is correct...
    a. **verapamil slows AV conduction**...correct, verapamil and diltiazem inhibit AV, not SA
    b. diltiazem is the prototypical Dihydropyridine...dihydropyridines end in "-ipine", prototypical being Nifedipine
    c. causes postural hypotension...doesn't, acts on both arteries and veins

6. Propranolol; which is correct...non selective beta blocker
    a. **has Na+ blocking activity**...minor membrane stabilising activity
    b. is beta 1 selective...non selective but does block renin release via beta 1
    c. has intrinsic sympathomimetic activity...very little intrinsic activity
    d. is poorly lipid soluble...high volume of distribution

7. Which does not cause vasoconstriction
    a. **Lactate**...raised in septic shock and septic shock is dilatory...
    b. serotonin...don't know mechanism
    c. adrenaline...adrenergics constrict for the most part
    d. angiotensin 2...released in states of Hypovolumia so no
    e. antidiuretic hormone...released in states of hypovolemia so no

8. regarding Simvastatin...HMG-CoA reductase inhibitor
    a. it has a half life of between 5 and 8 hours...1-3 hrs (atorvastatin 14 hrs rovustatin 19 hrs)
    b. bioavailability is…40-75%
    c. NO option about rhabdomyolysis...or CYP drug interactions

9. Ace Inhibitors...inhibits angiotensin converting enzyme = no ATII = no aldosterone or vasoconstriction
    a. **cause angioedema**...and dry cough from bradykinin & substance P activation

10. An old lady has a K+ of 6.7 mmol/L, she was previously stable on Lithium. Which drug is most likely to have done this?
    a. a thiazide

11. Regarding nitrates, which is true? ...form NO which upregulates cGMP to catalyse Myosin Light Chain-PO4 inactivation (to MLC) to cause smooth muscle relaxation
    a. tolerance is due to sulphydral groups in tissue...no I think it's the lack of substrate – tissue thiol compounds
    b. increased collateral flow even if there is a fixed constriction...total flow is unchanged but redistribution explains relief in patients with know CAD
    c. they cause significant Methaemoglobinaemia...insignificant but Sodium Nitrate used in cyanide poisoning
    d. **they relieve spasm**...indicated for vasodilation, spasms reversal and AMI to decrease cardiac work
    e. they cause an increase in LVED volume...increase venous capacitance therefore decrease preload = decrease filling (LVEDV) = decrease CO = decrease O2 demand (useful in angina)

12. Regarding Calcium channel blockers, all are true EXCEPT:
    a. **they have low protein binding**...high
    b. verapamil blocks sodium channels...a little
    c. they have a high first pass metabolism...correct

13. Diazoxide. Which of the following is NOT true ? ...peripheral arteriole dilator, long acting, similar to thiazides (without the diuretic effect)
    a. is used to treat severe hypertension...used in malignant hypertension and prophylaxis in already hypertensive patients undergoing stimulating procedures eg renal biopsy, nitroprusside is drug of choice for malignant HTN
    b. **acts by direct smooth muscle relaxation**...correct
    c. causes salt and water retention...nope, inhibits insulin secretion, no other direct systemic effects
    d. is a thiazide derivative...chemically similar but not a derivative

14. Hydralazine...direct vasodilatory effect on arteriolar smooth muscle
    a. Causes an abrupt but transient fall in blood pressure...effects last longer than drug concentration due to avid binding of vascular tissue
    b. Displays a biphasic blood pressure response...no, 5HT2 receptor agonists do...

15. The most lipid soluble beta blocker is
    a. **propranolol**...
    b. atenolol...
    c. metopralol...
    d. pindolol...
    e. sotalol...

16. Propranolol
    a. is a highly selective beta receptor antagonist...non selective, beta 1 blockade on adrenals to prevent renin release
    b. is poorly lipid soluble...highly soluble, large VD
    c. **has sodium channel blocking action**...minor role
    d. has intrinsic sympathomimetic activity...no intrinsic activity
    e. has an oral bioavailability of > 50 %...25%

17. Nitrates
    a. increase collateral blood flow...overall flow same but redistribute in order to have a symptomatic effect
    b. **demonstrate tolerance**...probably through lack of precursor tissue thiol compounds
    c. Demonstrate physical dependence...ha ha no!

18. The CAST trial highlighted the adverse effects of ...cardiac arrythmias suppression trial in particular of ventricular premature contractions using flecanide or encainide – proven to have worse outcome
    a. metoprolol...class II but little effect
    b. verapamil...Class IV
    c. sotalol...Class II & III antiarrhythmic
    d. **flecanide**...class IC long acting Na blocker
    e. bretylium...rarely used class III with +ve catecholamine releasing effects

19. Losartan differs from Enalapril in: ...Enalapril is an ACE inhibitor, losartan is a AT II receptor antagonist (AT1)
    a. **its selective action on angiotensin type one receptors**...correct
    b. its enhanced effect on bradykinin metabolism...no effect, enalalpril inhibits bradykinin breakdown
    c. its prolonged half life...not sure about losartan but Enalapril is 2 hrs,
    d. its higher incidence of drug related angioedema...less angioedema since it has no effect on bradykinin
    e. its increased incidence of cough...as per answer d

20. All of the following anti-hypertensives act directly on vascular smooth muscle EXCEPT
    a. felodipine...calcium channel blocker (selective for peripheral vascular smooth muscle)
    b. nitroprusside...does, 1st line for malignant HTN
    c. indapamide...as well as Na & water excretion
    d. **prazosin**...alpha blocker (on smooth muscle) ie antagonist not agonist!
    e. hydralazine...does

21. Which of the following is an aldosterone antagonist...inhibits ENaC on luminal membrane of collecting duct and Na-K ATPase on basolateral membrane
    a. **spironolactone**...correct

22. An example of an ADH antagonist is...antagonists to this would include anything that caused a diuresis through inhibition of aquaporins in the collecting duct, indicated in SIADH or CHF; Conivaptan and Demeclocycline
    a. ethanol...like caffeine, probably due to ADH suppression (not receptor antagonism)
    b. Amiloride...K sparing diuretic, acts on NCC transporter in DCT (cotransport of Na & Cl on luminal membrane into the cell)
    c. **lithium**...correct but not used due to risk of nephritis
    d. aldosterone...promotes anti diuresis through activation of ENaC on luminal membrane & NA-K ATPase on basolateral surface
    e. triamterene...K sparing/Thiazide diuretic combination so acts on NCC transporter in DCT and antagonism of aldosterone

23. Carbonic anhydrase inhibitors...act on PCT to inhibit CA which catalyses luminal formation of H2O & CO2 in lumen in order to diffuse across luminal membrane and intracellular transformation back into HCO_3^- & H^+, passive Cl channel moves into the cell in exchange for a base to neutralize luminal fluid
    a. were developed from early antibiotics...from noting the diuretic action of sulphonamides
    b. are closely related to thiazide diuretics...thiazides act on NCC transporters in DCT...cant find reference
    c. cause metabolic acidosis...it inhibits HCO3 resorbtion thereby causing a (hyperchloremic) metabolic acidosis
    d. decrease the pH of CSF...CA is also inhibited in the CSF thereby inhibiting HCO3 resorbtion
    e. all of the above

24. Which is NOT true of diuretics
    a. loop diuretics can be used to treat hypercalcemia...true, NKCC2 sets up electrical gradient for paracellular diffusion of Mg & Ca into the interstitium
    b. **Frusemide is used in the prophylaxis of acute mountain sickness...**acetazolamide decreases CSF production and pH to treat cerebral oedema of mountain sickness (> 3 km above sea level quickly)
    c. Cirrhotic patients respond to spironolactone...cirrhosis = reduced renal perfusion / plasma volume (from ascites) / oncotic pressure all of which increase aldosterone secretion! Loop diuretics are hepatotoxic
    d. they may enhance the effect of ACE inhibitors...ACE inhibitors inhibit aldosterone secretion so acts like spironolactone I guess
    e. hydrochlorothiazide is useful in treating diabetes insipidus...nephrogenic diabetes insipidus

25. Which is not the correct site of action
    a. Spironolactone and the collecting duct...correct, antagonist to aldosterone mediated ENaC (on luminal surface) and Na-K ATPase on basolateral surface
    b. **Triamterene and the ascending loop of Henle**...Triamterene is a combination K sparing/thiazide therefore chief sites of action are CD (K sparing) and DCT (thiazide) NB thiazides probably work on descending loop
    c. Thiazides and the proximal part of the distal tubule...correct, target transporter is NCC on luminal membrane
    d. **Acetazolamide and the collecting tubule**...acetazolamide is a CAI with chief action on PCT but also throughout the renal tubule
    e. Frusemide and the ascending loop of Henle...true, mainly inhibits NKCC2 transporter on luminal surface

26. Sodium nitroprusside...acts directly on vascular smooth muscle, both venous and arterial
    a. **increases cGMP by release of nitric oxide**...correct and also direct effect on smooth muscle
    b. decreases vascular resistance but increases blood pressure...no, used in malignant hypertension as 1st line, NB no change in CO though so reflex tachycardia prominent (use beta blockers concurrently)
    c. is a complex of calcium and cyanide groups...iron, cyanide and nitrous moieties
    d. is predominantly an arteriodilator...both
    e. has its onset of action in 10-15 minutes...onset more likely < 1 minute (offset 1-10min after stopped)

27. Methyldopa...centrally acting antihypertensive, false transmitter acting on alpha (2 > 1) receptors in medulla
    a. is a potent vasoconstrictor...decrease sympathetic and accentuates parasympathetic outflow tracts= negative inotropic/chronotropic effect and peripheral vasodilation
    b. can cause Coombs positive test after prolonged use...seen in 10-20% if used > 12 months

28. ACE inhibitors...inhibit conversion of ATI to ATII thereby inhibiting its effects (vasoconstriction and aldosterone release)
    a. cause a concomitant reduction in bradykinin...upregulates bradykinin (and substance P) which is why they develop a dry cough and angioedema
    b. directly inhibit angiotensin receptors...inhibits conversion ATII receptor blockers (eg candesartan) do this
    c. work predominantly by venodilation...both I think
    d. **can cause angioneurotic oedema**...correct, due to upregulation of bradykinin and substance P
    e. are only available intravenously...oral formulations

29. Hydralazine...direct inhibition of vascular smooth muscle (mainly arteriole)
    a. classically has a biphasic response in BP control...no,
    b. should not be used in eclampsia...incorrect, ACE I are contraindicated in 3rd trimester (foetal hypotension, anuria, renal failure),
    c. causes significant post hypotension...nope, reflex tachycardia maintained, no adrenergic blocking activity
    d. **predominantly a vasodilator**...arteriolar

30. Diazoxide...direct acting vasodilator
    a. **can be used in a hypertensive emergency**...correct
    b. structurally related to thiazide...not sure, it's not a diuretic

31. ACE inhibitors...inhibit production ATII therefore inhibits aldosterone release and vasoconstriction (and upregulates bradykinin and substance P ie "the cough & angioedema")
    a. can be used in second and third trimesters...nope, foetal hypotension, anuria, renal failure, malformation
    b. have been associated with angio oedema...correct as above

32. Regarding hydralazine...direct acting arteriolar constriction
    a. **Works by direct vasodilation**...correct
    b. Shows biphasic blood pressure response...not sure
    c. Causes postural hypotension...no, reflexes maintained

33. Regarding simvastatin...HMG-CoA reductase inhibitor
    a. **Low bioavailability**...40-70% absorbed
    b. Half life 5 – 8 hours...1-3 hrs (14 hrs for atorvastatin, 19 hrs for rosvustatin)

34. Adenosine...Misc antiarrhythmic, activates IKr, inhibits Na to a lesser extent , used in SVT
    a. Half life 10 mins...faster – 10 seconds

35. Which is an inhibitor of aldosterone...aldosterone receptor antagonist; spironolactone, Eplerenone, aldosterone synthesis antagonists; ACE Inhibitors or AT receptor antagonists (AT2)

36. Regarding Frusemide...loop diuretic, think NKCC2 in DCT
    a. **Is more potent than triamterene**...triamterene is a combination K sparing/Thiazide diuretic
    b. Has no effect on digoxin function...digoxin inhibits Na-K ATPase
    c. Causes hyperkalaemia...inhibits K resorbtion (which is why we have a "K sparing" class of diuretics)
    d. Causes hypercalcemia...inhibits electrical gradient for Ca & Mg paracellular reabsorbtion

37. Regarding nitrates...up regulate guanylyl cyclase to convert GTP to cGMP to increase conversion of (active) myosin light chain-phosphate to (relaxed) MLC only
    a. **Direct activity is coronary artery vasodilation**...higher affinity for peripheral veins but does dilate epicardial vessels, especially those in spasm.
    b. Cause water and sodium retention...not sure

38. Regarding nitrates, they do not...
    a. **Increase collateral coronary blood flow**...they don't, they redistribute coronary circulation to relieve symptoms but net flow is unchanged
    b. Demonstrate tachyphylaxis/tolerance...tachyphylaxis not documented, but some tolerance due to down regulation of tissue thiols
    c. **Demonstrate physical dependence**...no dependence

39. Regarding propranolol...non specific beta blocker
    a. Is a highly selective B receptor antagonist...nope
    b. Is poorly lipid soluble...high VD
    c. **Has sodium channel blocking activity**...some

40. A 42 year old male with typical ischemic chest pain. Further investigation leads to diagnosis of "vasospasm". Which is most likely to cause this? ...due to vascular smooth muscle hypercontraction (not local vasodilation), probably something to do with lack of Mg. Autonomic control of spasm is controversial
    a. Adrenaline

41. Prazosin...alpha 1 blocker
    a. is non-selective...alpha 1
    b. worsens lipid levels...worsens
    c. causes SLE like syndrome...hydralazine does this
    d. **reduces BP by affecting both resistance + capacitance vessels**...being alpha 1 it has receptors on both venous and arterial circulation

42. Regarding nitrates...enhance formation of guanylyl cyclase which enhances GTP to cGMP which converts MLC-PO4 into its resting state, MLC
    a. increase coronary blood flow...no, redistributes flow
    b. rarely demonstrate tolerance...does demonstrate due to lack of substrate- tissue thiols
    c. decrease myocardial contractility...acts on smooth muscle and decreases O2 requirement but not sure about any reflexive effect on contractility
    d. **give relief of coronary spasm**...correct

43. ACE inhibitors...inhibit formation of ATII therefore inhibits vasoconstriction, aldosterone release and enhances formation of bradykinin and substance p (causing dry cough and angio oedema)
    a. are safe in pregnancy...cause foetal hypotension, anuria, renal failure and malformation in 2^{nd} & 3^{rd} trimester
    b. can cause angioedema...correct, from bradykinin and substance p
    c. do not interact with NSAID...NSAIDs inhibit bradykinin and therefore inhibits vasodilation from upregulated bradykinin
    d. have no effect on bradykinin...enhance (well, decrease breakdown)

44. Mannitol...osmotic diuretic
    a. **Inhibits H2O absorption in proximal tubule, loop of henle and collecting tubule**...yup through a greater luminal osmotic pressure
    b. Is metabolised to glycerol...poorly absorbed, not metabolised
    c. Decreases TBW and total body cation content equally...no, just water so higher cation content (although Na resorbtion is less as well)
    d. Is of no value when renal haemodynamics are compromised...prevents anuria from large pigment loads eg Rhabdomyolysis, hemodialysis (without heparin)

45. Female patient on ACE inhibitor, which is most likely to impair hypotensive effects
    a. **Prostaglandin inhibitor**...inhibit Bradykinin substance P formation that contributes to vasodilation

46. Prazosin...alpha 1 blocker
    a. Has a half life of 18 hours...3-4 hrs
    b. Adversely affects lipid profiles...no change
    c. Produces a reflex bradycardia...reflex tachycardia (not as marked as non selectives)
    d. **Has a first dose hypotensive effect**...initial postural drop
    e. Can increase CO by decreasing preload and leaving afterload unchanged...works on pre and afterload so no change

Nervous System

1. Dantrolene in malignant hyperthermia; which is the correct MOA...binds RyR ch thereby inhibiting Ca release from SR
    a. it antagonises the effects of suxamethonium...sux is a depolarizing relaxant meaning that it binds to Ach receptors on terminal membranes to cause permanent activation and opening of Na channels that creates and AP that subsequent releases Ca from SR via local release of Ca from voltage gated dystrophin channels. It can interact with anesthetics to induce malignant hyperthermia. Dantrolene doesn't reverse this effect
    b. it inhibits prostaglandin formation...binds RyR channels which are ion channels in the SR
    c. **it decreases calcium release from skeletal muscle sarcoplasmic reticulum**...correct

2. Which agent has a pure beta agonist effect in the circulation
    a. adrenaline...has predominantly alpha effects at high enough doses ie vasoconstriction and beta 2 vasodilation in skeletal beds
    b. noradrenaline...predominantly alpha effects peripherally without beta 2 effects like adrenaline
    c. **isoprenaline**...mostly peripheral beta effects (vasodilation) with minor alpha effect

3. Methyldopa; which is correct...centrally acting false neurotransmitter stimulating alpha cholinergics in the medulla (alpha 2 > 1)
    a. causes a positive Coombs test with prolonged use...correct, 10-20% after 12 months of therapy

4. Propofol; which is correct...centrally acting GABA receptor agonist IV anesthetic
    a. accumulates in the body...short acting, used in procedural sedation
    b. **can produce abnormal muscle movements**...it can
    c. has minimal effects on the CVS...profound peripheral vasodilation and marked negative inotropic effect

5. Carbamazepine; which is correct...CBZP is an antipsychotic inhibiting presynaptic nerve terminal through competitive inhibition of voltage gated Na channels to inhibit glutamate release centrally
    a. **overdose causes seizures**...not documented but makes sense
    b. is an enzyme inhibitor...no, is a presynaptic voltage gates Na channel inhibitor
    c. metabolises to non-active metabolites...metabolites also have anticonvulsant properties
    d. has antihistamine properties...not aware

6. L-dopa; which is correct...levodopa, madapar, Dopamine precursor targeted centrally in the treatment of Parkinson's disease manifestations (crosses BBB and converted to dopamine by DOPA decarboxylase whereas dopamine cannot)
    a. Abrupt stop can increase tremor...
    b. **precursor to dopamine**...correct
    c. ? 25% reaches the brain...most of it does given

7. Ergot...adrenoceptor agonist targeting dopamine, 5HT & alpha centrally
    a. In overdose produces hypertension and severe vasospasm which is treated with an alpha antagonist

8. Ergotamine; which is incorrect...grown from fungus, adrenoceptor agonist targeting dopamine, 5HT & alpha centrally
    a. can be given parenterally...PO, S/L, PR...or IM in PPH (x10 absorption PO vs IM)
    b. causes vasoconstriction...through alpha agonism
    c. **Causes GI haemorrhage**...gastric irritation as adverse reaction only
    d. good early in acute migraine...usually administered during prodrome
    e. can cause nausea and vomiting...can do via gastric 5HT receptor agonism

9. Drugs used to treat glaucoma; which is correct drug-MOA pairing
    a. **Pilocarpine – ciliary muscle contraction**...direct acting cholinomimetics therefore ciliary (accommodation) & iris contraction (meiosis)
    b. Timolol – ciliary muscle contraction...beta 1 & 2 blocker on ciliary epithelium = reduced aqu humour production = ocular hypotension
    c. acetazolamide – increased aqueous production...Carbonic Anhydrase Inhibitor, inhibits production
    d. Latanoprost – increased aqueous production...prostaglandin analogue, increase outflow tract to decrease IOP
    e. dipivefrine – decreased outflow...epinephrine Prodrug, converted on penetration of cornea to vasoconstrict thereby decreased aqu humour production and thereby decrease IOP

10. Neuromuscular junction blockers; which is incorrect
    a. **vecuronium is predominantly kidney excreted**...75-90% liver, rest kidney, 95% unchanged
    b. atracurium is inactivated by Hofmann elimination...correct, Hoffman elimination (spont organic transformation from amide to amine with one less carbon atom)
    c. pancuronium has a longer duration of action than vecuronium...pan; off 35-45min, vec; 20-35 min
    d. pancuronium and vecuronium have the same structure...both are non-depolarizing steroid NMJ blockers

11. Which is true of local anaesthetics? ...Na channel blockers
    a. **they act on the most rapidly firing neurons**...correct namely A delta and C fibres (pain & temperature)
    b. they act on th biggest diameter neurons first...more sensitivity to small diameter of B & C fibres
    c. **they work from the outside fibres to the inside ones**...I guess so, nerve trunks have motor fibres to periphery, peripheral sensory fibres have distal parts inside and proximal parts outside

12. Carbamazepine... CBZP is an antipsychotic inhibiting presynaptic nerve terminal through competitive inhibition of voltage gated Na channels to inhibit glutamate release centrally
    a. induces enzymes...inhibits Na channels
    b. **has active metabolites**...correct

13. Match these eye drugs with their mechanism of action
    a. Pilocarpine and ciliary contraction...direct acting cholinomimetics therefore has both ciliary constricting (accommodation) and iris constricting (meiosis) properties
    b. prostaglandins and decreased aqueous production...eg Latanoprost, increase outflow track to decrease IOP
    c. b-blockers and increased outflow...eg Timolol, act on beta 1 & 2 receptors to decrease aqu production

14. Which drug decreases the effect of neuromuscular blockade?
    a. Atropine...muscurinic receptor antagonist (neuromuscular junction are nicotinic)
    b. **tubocuraine**...nicotinic cholinergic receptor antagonist (previously used to stop post sux pain)
    c. gentamicin...aminoglycoside

15. Which statement is true regarding recovery from irreversible neuromuscular blockade?
    a. it relies on receptor turnover...correct, for reversible it depends on breakdown (usually by AChE)

16. Ergotamine...dopamine, 5HT, alpha receptor agonist
    a. overdose can be treated with alpha blockers...this would only block one of 3 target receptors
    b. **is a partial alpha 1 agonist**...correct

17. Regarding flumazenil, which is INCORRECT? ...BZDP receptor antagonist (competitive) on GABA
    a. it can cause hypertension...correct
    b. it has a half-life of 4 hours...rapid hepatic clearance (T ½ 0.7-1.3 hrs)

18. A young male punter comes in with a high blood pressure, mydriasis and a high temperature. Which drug has he most likely taken? ...blood pressure = cholinergic, mydriasis = alpha agonism on radial pupillary muscles, high temp?
    a. Atropine...antimuscarinic
    b. adrenaline...adrenergic (mostly beta 1 & 2 and alpha)
    c. aspirin...platelet aggregation inhibitor through prostaglandin inhibition
    d. naloxone...opiod receptor antagonist
    e. **cocaine**...amphetamine, sympathomimetic (adrenoceptive)

19. Regarding Valproate, what is true? ...anticonvulsant, similar to CBZP & phenytoin ie Na channel blockade on GABA receptors centrally
    a. it's VD is…..a number...0.15L/kg
    b. it is lipid soluble...correct otherwise would be a poor CNS acting drug
    c. it has high FPM...

20. What is true of L-Dopa? ...dopamine precursor that can cross BBB, used in Parkinson's disease
    a. 33% reaches the CNS...most of it does
    b. it is the precursor of dopamine...correct
    c. suddenly stopping it will cause tremor...no, not sure why
    d. it's half life is about 5 hours...1 – 3 hrs
    e. 40% less is required if it is given with a peripheral carboxylase inhibitor...

21. Regarding Phenytoin, what is true? ...anticonvulsant similar to CBZP & valproate (ie inhibit Na ch on GABA receptors)
    a. it demonstrates auto induction...controversial
    b. low doses exhibit 1st order kinetics...true, zero order kinetics in high doses, like ethanol and aspirin

22. The most common adverse effect of procainamide is...class Ia antiarrhythmic, so Na channel intermediate inhibition, has pronounced (1/3) antiarrhythmic effects!
    a. bradycardia...inhibits SA & AV so maybe
    b. pulmonary infiltrates...no
    c. fever...no
    d. **hypotension**...probably
    e. anaphylaxis...not likely/common

23. A patient complains of pain post-operatively. This is most likely to be due to
    a. propfol
    b. isoflurane
    c. suxamethonium...
    d. atracurium
    e. ketamine

24. The muscle relaxant with the longest duration of action is
    a. atracurium
    b. mivacurium
    c. **pancuronium**...
    d. vecuronium
    e. rocuronium

25. The MAC is greatest for...MAC = medium concentration for 50% patients immobile when exposed at ED50 therefore MAC = 1 means 50% of patients at that concentration will not be immobile
    a. **nitrous oxide**...> 100
    b. halothane...0.75
    c. isoflurane...1.7
    d. methoxyflurane...0.16
    e. ketamine...IV so no MAC

26. All the following are anaesthetic agents EXCEPT
    a. midazolam
    b. **glycopyrolate**...antimuscurinic used in overwhelming secretions (like atropine)
    c. propofol
    d. fentanyl...opiod agonist
    e. etomidate...used in US

27. Prochlorperazine...stemetil, anti-dopamine, anti-alpha adrenergic, norad reuptake inhibition, weak anticholinergic/serotonin/antihistamine
    a. **can cause neuroleptic malignant syndrome**...

28. Local anaesthetics...Na channel blockers
    a. **act on the most rapidly firing neurones**...A delta and C (pain)
    b. have an increased effect on large fibre diameter

29. The muscle relaxant most commonly associated with tachycardia is low dose
    a. Suxamethonium
    b. Atracurium
    c. Vecuronium
    d. **Pancuronium**...through vagal block
    e. Tubocurare

30. All of the following are amide local anaesthetics EXCEPT...amides have "-I" before "-caine" (somewhere before)
    a. lignocaine
    b. bupivicaine
    c. benzocaine
    d. prilocaine
    e. etidocaine

31. Which is an ester local anaesthetic
    a. **tetracaine**...
    b. lignocaine
    c. bupivicaine
    d. etidocaine
    e. prilocaine

32. Which of the following statements are FALSE regarding vecuronium
    a. it has minimal cardiovascular effects
    b. it is predominantly renally excreted
    c. it has a significantly longer duration of action than pancuronium

33. Which is true of neuromuscular blockers
    a. atracurium causes hypotension in volume depleted patients
    b. pancuronium causes histamine release
    c. vecuronium is an isoquinolone derivative
    d. gallium is eliminated by the liver
    e. gentamicin increases their efficacy

34. The cholinesterase inhibitor with the shortest duration of action is
    a. physostigmine
    b. edrophonium
    c. neostigmine
    d. parathion
    e. malathion

35. Which of the following is a direct serotonin agonist
    a. fluoxeteine
    b. amitryptiline
    c. moclobemide
    d. ondansotron
    e. sumatriptan

36. Regarding SSRI's
    a. they are preferred in the treatment of obsessive compulsive disorders over TCA's

37. Barbituates act by
    a. opening GABA chloride ion channels

38. Which of the following regarding carbemazepine is FALSE
    a. it is greater than 50 % protein bound
    b. it has active metabolites
    c. it induces p450 liver cytochromes

39. Carbemazepine is closely related to
    a. vigabatrin
    b. quinidine
    c. sodium valproate
    d. metoprolol
    e. imipramine

40. The drug that acts by MAO inhibition is
    a. paroxetine
    b. sertraline
    c. trazodone
    d. moclobemide
    e. clomipramine

41. The most dangerous drug in overdose is
    a. imipramine
    b. moclobenide
    c. sertraline
    d. trazodone
    e. paroxeteine

42. Fluoxeteine
    a. has minimal drug interactions
    b. is associated with seretonin syndrome with muscle weakness, hyperpyrexia and confusion
    c. induces hepatic p450 enzymes

43. Patient on phenytoin is found to have a low blood phenytoin level. Which of the following is LEAST likely to cause this
    a. carbemazepime
    b. non-compliance
    c. disulfiram
    d. erythromycin
    e. hypoalbuminemia

44. Carbemazepime
    a. enhances sodium channel conductance
    b. causes seizures in overdose
    c. inhibits cytochrome p450
    d. has active metabolites
    e. is not a tricyclic

45. Regarding SSRI
    a. They are safe in OD due to minimal drug interactions
    b. Can cause malignant hyperpyrexia
    c. Are readily removed by dialysis
    d. May cause seizures in OD
    e. May be associated with seretonin syndrome with muscle weakness, hyperpyrexia and confusion

46. The opiate associated with seizures when given in high dose to patients with renal failure is
    a. morphine
    b. pethidine
    c. methadone
    d. fentanyl
    e. codeine

47. Regarding neurotransmitters in the brain
    a. strychnine stimulates glycine receptors
    b. atropine antagonises GABA receptors
    c. butyrophenones stimulate dopamine receptors
    d. ondansotron antagonises seretonin receptors
    e. atenolol stimulates noradrenaline receptors

48. Buspirone relieves anxiety without sedation by:
    a. direct GABA stimulation
    b. indirect GABA stimulation
    c. direct noradrenaline receptor stimulation
    d. indirect noradrenaline stimulation
    e. none of the above

49. The most potent sedative is
    a. diazepam
    b. midazolam
    c. temazepam
    d. phenobarbitone
    e. chloral hydrate

50. The drug used as an antipsychotic most likely to cause extrapyramidal effects is
    a. chlorpromazine
    b. lorazepam
    c. risperidone
    d. haloperidol
    e. clozapine

51. A man presents with dilated pupils, confusion, hyperpyrexia. Which of the following drugs would not account for this
    a. atropine OD
    b. morphine
    c. datura

52. A healthy young man receives a normal dose of a drug which induces midriasis and increased systolic blood pressure . The drug could be
    a. adrenaline
    b. acetylcholine

53. Characteristics of propranolol include all EXCEPT
    a. lipid solubility
    b. local anaesthetic action
    c. half life of 3-6 hours
    d. bioavaliability of 30 %
    e. beta sympathetic selectivity

54. A patient arrives in the DEM staggering, agitated, hyperthermic with dilated pupils. Which is least likely to produce this effect
    a. atropine OD
    b. amphetamine OD
    c. aspirin OD
    d. tricyclic OD
    e. angels trumpet

55. A young man is injected with an iv drug. He shows a resultant tachycardia, midriasis, normal blood pressure and reduced sweating. The most likely drug is
    a. nicotinic antagonist
    b. muscarinic antagonist
    c. cholinomimitic
    d. adrenergic agonist
    e. adrenergic antagonist

56. A woman is hypertensive with a potassium of 6.7. which of the following is LEAST likely to cause this
    a. potassium supplements
    b. frusemide
    c. ACE inhibitor
    d. Suxamethonium
    e. Spironalactone

57. The major side effect of benztropine is
    a. miosis
    b. confusion
    c. diarrohea
    d. GIT haemorrhage
    e. Bronchorrhea

58. Stemetil
    a. useful in tardive dyskinesia
    b. can cause neuroleptic malignant syndrome
    c. has antiemetic effect via 5-HT antagonist activity

59. Alpha –methly- dopa
    a. can cause a positive Coombes test

60. Termination of irreversible neuromuscular block involves
    a. regeneration of receptors
    b. increase in end plate Ach

61. Regarding antidepressants
    a. fluoxetine is more sedating than tricyclics
    b. SSRI's are more effective in OCD

62. Carbamazepine
    a. is metabolised to active metabolites
    b. in overdose causes seizures
    c. is an enzyme inhibitor

63. What has pure beta agonist effect in the circulation
    a. adrenalin
    b. noradrenalin
    c. isoprenalin

64. Regarding the treatment of Parkinsons, which is INCORRECT
    a. L-dopa is contraindicated in acute psychoses
    b. Bromocriptine has less CNS effects than L-dopa
    c. Administration of L-dopa with a dopa decarboxylase inhibitor decreases side effects

65. GABA receptor
    a. barbituates increase the time GABA opens
    b. barbituates do not effect warfarin metabolism

66. In TCA overdose

67. Regarding the treatment of glaucoma, which of these decreases aqueous outflow?
    a. Timolol
    b. Lantanoprost
    c. Carbechol
    d. Adrenaline
    e. Acetazolamide

68. Regarding sedatives
    a. Barbiturates increased the time of GABA channel opening
    b. Carbamazepine has no active metabolites
    c. Phenytoin has low plasma protein binding

69. Which causes methaemaglobinaemia (repeat)
    a. Prilocaine

70. How does pralidoxime work? (repeat)

71. Regarding St Johns Wort
    a. It is more effective than placebo
    b. It has a side effect profile comparable/same as placebo
    c. Can cause hyperthermic/hypertensive reaction
    d. It has more side effects than placebo

72. What is the correct order of catecholamine synthesis?
    a. Tryptophan – dopa – dopamine – adrenaline – noradrenaline
    b. Tysosine - dopa- dopamine – adrenaline – noradrenaine
    c. Tyrosine – dopa – dopamine – noradrenaline – adrenaline
    d. Tyrosine – dopamine – dopa – noradrenaline – adrenaline
    e. Tyrosine – dopamine – dopa – adrenaline – noradrenaline

73. A young man presents with dilated pupils, confusion and hyperpyrexia. Which of the following could not account for these effects.
    a. Atropine
    b. Datura
    c. Morphine

74. Pralidoxime acts to
    a. Inhibit presynaptic ACh release
    b. Cleave acetylcholinesterase
    c. Regenerate ACh

75. Vecuronium, all of the following are true except
    a. Has minimal CVS effects
    b. Is predominantly renally excreted
    c. Has a significantly longer duration of action than pancuronium

76. In the treatment of parkinsons disease
    a. Antimuscarinics are better for the treatment of (?) tremor than dopamine agonists
    b. Administration of L-dopa with a dopa decarboxylase inhibitor decreases side effects

77. Dantrolene is a good choice in treatment of malignant hyperpyrexia because
    a. It antagonises the effects of suxemethonium
    b. It inhibits prostaglandin formation
    c. It decreases calcium release from sarcoplasmic reticulum in skeletal muscle

78. Atracurium
    a. Has a longer duration of action than vecuronium
    b. Is not associated with histamine release
    c. Is a steroid derivative
    d. Is eliminated by non renal/liver dependant mechanisms

79. Regarding pancuronium - which is incorrect?
    a. It is a steroid
    b. It does not release histamine
    c. It is renally excreted
    d. It has a shorter duration of action than vecuronium

80. Phenytoin
    a. Is lowly protein bound
    b. Causes agranulocytosis in 5% of patients
    c. Can cause abnormalities of vitamin D metabolism

81. Match the drug and effect - which is wrong?
    a. Phenytoin - gum hypertrophy
    b. Carbamazepine - blood dyscrasias
    c. Phenobarbitone -
    d. Ethosuximate - hirsutism

82. Which local anaesthetic causes methaemaglobinaemia?
    a. Lignocaine
    b. Tetracaine
    c. Bupivacaine
    d. Procaine
    e. Prilocaine

83. Benztropine causes
    a. Miosis
    b. Diarrhoea
    c. Confusion
    d. Bronchorroea
    e. GIT haemorrhage

84. A patient on phenytoin has a seizure and is found to have a low level, which is least likely to cause this?
    a. Phenobarbitone
    b. Non-compliance
    c. Hypoalbuminaemia
    d. Disulfiram
    e. Erythromycin

85. Diazepam
    a. Does not engender psychological dependance
    b. Is metabolized to oxazepam

86. Regarding fluoxetine
    a. Seretonin syndrome = muscle weakness,hyperpyrexia and confusion
    b. It is removed by dialysis
    c. Can cause malignant hyperpyrexia
    d. Is an enzyme inhibitor
    e. Is safe in overdose due to minimal drug interactions

87. Dobutamine
    a. Results in ATP -> AMP
    b. Can decrease systemic vascular resistance / afterload

88. All prolong refractory period in normal cells, except
    a. amiodarone
    b. lignocaine
    c. quinine
    d. pracainamide
    e. sotalol

89. Propofol
    a. Does accumulate
    b. Can produce abnormal muscle movements
    c. Has minimal effects on the CVS

90. Benztropin
    a. causes confusion
    b. causes diarrhoea
    c. causes GI hemorrhage
    d. causes miosis

91. Barbiturates
    a. Only Phenobarbital is excreted unchanged by the kidney
    b. stimulates the medullary vasomotor center
    c. have more benign side-effect spectrum than benzodiazepine

92. L-Dopa
    a. 1-3% reaches the brain
    b. Precursor to tyrosine
    c. abrupt stop can increase tremor
    d. rarely needs increase in dose once effective

93. Stemetil
    a. can cause neuroleptic malignant syndrome
    b. can cause malignant hyperthermia
    c. can cause serotonin syndrome
    d. never causes tardive dyskinesia
    e. has anti-emetic effect through serotonin antagonism

94. Treatment of glaucoma does not include
    a. alpha blocker
    b. beta blocker
    c. carbonic anhydrase inhibitor
    d. cholino-mimetic agents

95. Praloxidime
    a. regenerates acetylcholine
    b. regenerates acetylcholine receptors
    c. regenerates acetylcholinesterase
    d. regenerates succinylcholine

96. SSRI's
    a. Have more pronounced side effects than TCA's
    b. are the treatment of choice in bipolar disease
    c. usually have short half-lives
    d. are effective in obsessive compulsive disorders

97. Diazepam
    a. is metabolised to lorazepam
    b. is metabolised to oxazepam
    c. has a half life of 4 hours
    d. should not be used in convulsions of unknown origin

98. Which local anaesthetic causes methemoglobinemia?
    a. lignocaine
    b. prilocaine
    c. bupivacaine
    d. procaine

99. Cisapride
    a. Has a half life of 6-8 hours
    b. Decreases lower oesophageal sphincter pressure
    c. Is well absorbed orally

100. Sumatriptan
    a. Is a partial alpha 1 agonist

101. A young patient is given a normal dose of a drug in the emergency department. They develop tachycardia, increase BP and dilated pupils. The drug is most likely to be
    a. Adrenaline
    b. Atropine

102. Dantrolene is used in malignant hyperthermia. It's mechanism of action is:
    a. Succinylcholine antagonist
    b. decrease in calcium release from sarcoplasmatic reticulum
    c. hypothermia through muscle relaxation
    d. antipyretic through prostaglandin inhibition

Antimicrobial Agents

1. Sulphonamides are a structural analogue of
    a. PABA
    b. Dihydrofolate
    c. Tetrahydrofolate
    d. Folic acid

2. Interferons; which is incorrect
    a. has virus specific antiviral activity
    b. antiviral to all viruses

3. Amphotericin B; which is correct
    a. can be given orally to treat systemic illness
    b. can cause fever, headache and confusion
    c. dose needs to be reduced in renal impairment
    d. can cause liver toxicity/damage/problems (unsure of exact statement)

4. Antibiotic resistance; which pair is incorrect
    a. vancomycin – alteration in D-ALA-D-ALA
    b. penicillin – beta lactamase
    c. gentamicin - ? penetration into cell
    d. erythromycin - ? esterase
    e. fluoroquinolones - ? binding sites

5. Zidovudine (AZT); which is correct
    a. has a short half life
    b. blocks thymidine kinase
    c. not used to treat retroviruses
    d. similar mechanism of action to amantadine

6. Cephalosporins; which is incorrect
    a. ceftazadime has activity against pseudomonas
    b. cefaclor is second generation
    c. third generation have greater gram negative spectrum than first generation
    d. not as sensitive to beta-lactamase as penicillins (giving a wider spectrum)

7. Norfloxacin
    a. has increased concentration in tubular fluid when given with probenecid
    b. something to do with nucleic acid synthesis

8. Sulphonamides
    a. are structurally related to PABA

9. Gentamicin
    a. is an oxygen dependant antibiotic

10. Which is true of penicillin-V?
    a. it can be used for eyes
    b. it should be given on an empty stomach

11. regarding AZT
    a. it has a short half life

12. Regarding metronidazole
    a. it is indicated for trichomonas
    b. it is NOT indicated for gardnerella
    c. it inhibits aldehyde dehydrogenase

13. Which is the correct combo of AB and mechanism of resistance?
    a. Gentamicin and ?cell entry
    b. erythromycin and esterase production
    c. quinolones and point mutation
    d. vancomycin and ALA-ALA-ALA repeat
    e. penicillin and esterase production

14. A patient with impetigo would be most likely to respond to
    a. streptomycin
    b. kanamycin
    c. metronidazole
    d. cephalexin
    e. phenoxymethylpenicillin

15. Which of the following is a live virus vaccine
    a. typhoid
    b. tetanus
    c. HBV
    d. Rabies
    e. Measles

16. Which skin antiseptic is commonly used
    a. ethyl alcohol 70%
    b. ethanol 30%
    c. isopropyl alcohol 10%
    d. formaldehyde
    e. boric acid

17. Macrolide antibiotics
    a. are usually active against neisseria species
    b. are bacteriostatic but not bactericidal
    c. bind at the 30 s ribosome sub-unit
    d. are unaffected by plasmid mediated resistance
    e. enhance metabolism by cytochrome pathways

18. Which of the following is a second generation cephalosporin
    a. cefaclor
    b. ceftazidime
    c. cephalexin
    d. cefotaxime
    e. cephalothin

19. The cephalosporin with the highest activity against G +ve bacteria is:
    a. cefuroxime
    b. cefotaxime
    c. cefaclor
    d. cefipime
    e. cephalothin

20. Which of the following antibiotics does not possess a beta-lactam ring
    a. penicillins
    b. cephalosporins
    c. fluoroquinolones
    d. carbapenams
    e. monobactams

21. Which of the following drugs does not exert its action by inhibiting cell wall synthesis
    a. vancomycin
    b. erythromycin
    c. penicillin
    d. ceftriaxone
    e. imipenem

22. Erythromycin
    a. has a large cross-reactivity with the penicillins
    b. is bacteriostatic only
    c. is ineffective against G +ve organisms
    d. is inactivated by beta-lactamases
    e. binds to the 50 s sub-unit of the bacterial ribosome

23. Erythromycin
    a. is effective against campylobacter jejuni

24. Metronidazole
    a. inhibits alcohol dehydrogenase
    b. is effective for vaginal trichomoniasis
    c. does not cause a metallic taste in th emouth
    d. turns urine green

25. Penicillins reach high concentrations in
    a. vitreous humour
    b. CSF with normal meninges
    c. Proximal tubular fluid in kidneys

26. Zidovudine (AZT)
    a. has a short half life
    b. inhibits viral thymidine kinase
    c. has no activity against retroviruses

27. The antiviral drug which acts on reverse transcriptase is:
    a. Acyclovir
    b. zidovudine
    c. ganciclovir
    d. vidarabine
    e. all of the above

28. Regarding metronidazole which is not true
    a. it is used to trae giardiasis
    b. it inhibits alcohol dehydrogenase
    c. it causes a metallic taste in the mouth
    d. it is used to treat gardenella
    e. it is useful against trichomonas vaginalis

29. Acyclovir is active against all the following EXCEPT
    a. HSV
    b. CMV
    c. HZV
    d. Varicella
    e. None of the above

30. Acyclovir
    a. is commonly given in doses of 10-20 mg TDS
    b. si used to treat CMV
    c. is a guanosine analogue
    d. acts to inhibit viral entry into cells
    e. is only available intravenously

31. Amantadine
    a. is an antiviral drug
    b. produces insomnia not sedation
    c. causes acute psychosis
    d. potentiates dopaminergic function
    e. all of the above

32. Doxycycline
    a. acts to inhibit nucleic acid synthesis
    b. may cause photosensitivity

33. Metronidazole
    a. may cause a disulfiram-like reaction
    b. is only available intravenously

34. All of the following inhibit nucleic acid synthesis except
    a. norfloxacin
    b. trimethoprim
    c. rifampicin
    d. sulfasalazine
    e. chloramphenicol

35. Gentamicin
    a. is not nephrotoxic
    b. increases the effect of neuromuscular junction blocking drugs

36. Gentamicin
    a. may be given orally
    b. enters cells by an oxygen dependent influx
    c. has a large theraputic index

37. Which of the following is not true of trimethoprim
    a. it is useful in the treatment of UTI
    b. it is bactericidal
    c. it is an anti-folate anti-metabolite drug

38. Regarding trimethoprim, which is INCORRECT
    a. synergistic with sulphonamides
    b. folate synthesis disruption
    c. less toxic to humans than bacteria
    d. is bacteriocidal

39. Aminoglycosides
    a. resistance is plasmid mediated
    b. does not cross species

40. Which is INCORRECT
    a. disinfectants clean non-living fields
    b. antiseptics clean living fields
    c. antiseptics in low dose can promote bacterial growth
    d. alcohol kills all bacteria and spores

41. Aciclovir
    a. dose is 10-20 mg five times daily
    b. does not work on viruses with thymidine kinase
    c. does not work on CMV
    d. is a guanasine analogue

42. Metronidazole
    a. shown to be teratogenic in humans
    b. causes a disulfram like reaction
    c. inhibits alcohol dehydrogenase
    d. is recommended as a single dose for Giardiasis

43. Which of the following is a cell wall inhibitor
    a. cephalosporin
    b. tetracyclin
    c. ciprofloxacin

44. Tetracyclin
    a. may cause photosensitivity
    b. does not cause enamel discolouration

45. Gentamicin
    a. is water soluble but unstable in solution
    b. is an antibiotic which is O2 dependant

46. Which antibiotic is resistant to beta – lactamase
    a. piperacillin
    b. cloxacillin
    c. amoxicillin
    d. penicillin

47. Regarding penicillins
    a. Doesn't cause hypernatremia
    b. Can cause seizures
    c. 50% of people with previous reaction will have another reaction
    d. foods treated with tetracycline can cause reaction

48. Erythromicin
    a. Treats campylobacter jejuni

49. Which of these is INCORRECT?
    a. Disinfectants clean non-living fields
    b. Antiseptics clean tissue
    c. Alcohol kills fungi and spores

50. Which of these inhibit cell membrane function?
    a. Amikicin
    b. Erythromycin
    c. Vancomycin
    d. Amphotericin B

51. Regarding cephalosporins, which is INCORRECT
    a. Cefaclor is a second generation
    b. 2nd generation have greater gram negative activity than first
    c. ceftriaxone has anti-pseudomonal activity
    d. 3rd generation has good cover for penicillin resistant strep
    e. Generally have wider spectrum of activity compared to pencillins due to beta-lactmase resistance

52. Regarding erythromycin (repeat)
    a. Affects 30S subunit
    b. Is bactericidal
    c. Effective against Campylobacter jejuni

53. Penicillins reach high concentrations in
    a. Vitreous humour
    b. CSF with normal meninges
    c. Proximal tubular fluid in kidneys

54. Which antibiotic is a cell wall inhibitor?
    a. erythromycin
    b. streptomycin
    c. vancomycin
    d. gentamycin

55. Pentamidine
    a. Is an antiretroviral agent
    b. is a protease inhibitor
    c. can cause iatrogenic diabetes
    d. should be avoided in HIV patients

56. Pentamidine
    a. Is toxic to pancreatic B cells

57. Interferons;
    a. Are directly antiviral
    b. Exert virus-specific anti-viral activities
    c. Can be used to treat Kaposi"s sarcoma

58. Zidovudine;
    a. Is a protease inhibitor
    b. Has a short serum half life
    c. Has no activity against retroviruses
    d. Inhibits viral thymidine kinase

59. Penicillin G
    a. Hypernatraemia is not reported
    b. Has good penetration to the eye
    c. 100 000u intrathecally can cause seizures
    d. 50% of people who claim allergy will have an allergic reaction on further exposure

60. Which causes hypoprothrombinaemia & bleeding disorders?
    a. Cefuroxime
    b. Cephalexin
    c. Cefaclor
    d. Cefotetan
    e. Ceftazidime

61. Which antiseptic is commonly used in medical practice/
    a. Ethyl alcohol 70%
    b. Ethanol 30%
    c. Formaldehyde
    d. Isopropyl alcohol 10%
    e. All of the above

62. Metronidazole
    a. Commonly causes constipation
    b. Inhibits alcohol dehydrogenase
    c. Is useful in treatment of urogenital trichomonas

63. Erythromycin
    d. Is predominantly renally excreted
    e. Is a cell wall inhibitor
    f. Is bacteriostatic only
    g. Is effective against Campylobacter jejuni

64. sulphonamides are a structural analogue of
    h. Folate
    i. Vit B12
    j. PABA
    k. penicillin

65. Acyclovir is active against all except;
    a. CMV
    b. VZV
    c. HSV
    d. EBV

Autocoids

1. On administration of an anti-histamine which of the following effects are caused by receptors other than histamine receptors
    a. sedation
    b. postural hypotension
    c. nausea and vomiting
    d. LA
    e. All of the above

2. Antihistamines have significant effects at which other receptors? (only definite option I could remember was alpha and probably dopamine. The other ones may be confabulatory)
    a. Dopamine
    b. Alpha adrenergic
    c. Muscurinie
    d. Nicotinic
    e. Serotonin

3. Histamine
    a. decreases smooth muscle spasm
    b. gives vasoconstriction and therefore hypertension
    c. increase myocardial contractility
    d. has no effect on local edema

4. Histamine when injected locally could be expected to produce all of the following except
    a. Increase contractility of GI smooth muscle
    b. Decrease systemic vascular resistance
    c. Decrease myocardial contractility

Endocrine System

1. Which of these has a different mode of action
    a. insulin
    b. glucagon
    c. ACTH
    d. PTH
    e. All of the above

2. Glucocorticoids; which is correct
    a. prednisolone is 5 times more potent than hydrocortisone
    b. fludrocortisone can only be given intravenously
    c. methylprednisolone has mineralocorticoid effects
    d. dexamethasone has a short half life

3. With regard to the mechanism of action of steroids
    a. they cause bronchodilation
    b. something to do with interferons

4. Regarding thyroid hormones
    a. the half life of T3 is greater than that of T4
    b. other options to do with endogenous vs man-made hormones

5. With regard to oral hypoglycaemics
    a. tolbutamide and glipizide are sulphonylureas
    b. chlorpropramide has a half life of 4-6 hours
    c. metformin is more effective once weight is controlled
    d. glipizide has one of the longest half lives
    e. lactic acidosis is more common with metformin than phenformin

6. The most potent mineralocorticoid is
    a. hydrocortisone
    b. prednisolone
    c. methylprednisolone
    d. dexamethasone
    e. betamethasone

7. Metformin
    a. does not require functioning pancreatic beta cells for its action

8. Which is most potent
    a. cortisol
    b. cortisone
    c. aldosterone
    d. corticosterone
    e. deoxycorticosterone

9. Which action of glucagon is INCORRECT
    a. Smooth muscle relaxant
    b. Positive inotrope
    c. Positive chronotrope
    d. Stimulates gluconeogenesis

10. Insulin does not cause
    a. Decrease glycogenolysis in the liver
    b. Increase glycogen synthesis in the liver
    c. Increase lipolysis in the liver

11. Metformin
    a. Is a sulphonylurea
    b. Can cause a significant lactic acidosis (?)
    c. Is similar to chlorpropamide
    d. Their action is (or is not - can't remember exact option) dependant on insulin
    e. Does not require functioning pancreatic B cells for its action

12. Insulin causes
    a. Decrease lipolysis in liver
    b. Decrease glycogenesis in liver
    c. Increase glycogen synthesis in liver
    d. Decrease lipolysis in skeletal muscle

Gastrointestinal Tract

1. Cisapride; which is correct
    a. is a serotonin antagonist
    b. is a dopamine antagonist
    c. slows colonic motility
    d. atropine opposes its effects

2. Antiemetics; which is incorrect
    a. diphenoxylate
    b. dexamethasone
    c. THC
    d. Ondansetron
    e. Diphenhydramine

3. Metoclopramide; which is correct
    a. decreases lower oesophageal sphincter tone
    b. increases antral contractility
    c. decreases ileal peristalsis
    d. is a dopamine agonist

4. Regarding Cisapride, what is true?
    a. it makes Parkinson's disease worse

5. Cisapride
    a. slows gastric emptying
    b. delays oesophageal clearance
    c. raises lower oesophageal sphincter pressure
    d. increases pancreatic secretions
    e. increases gastric secretions

6. Regarding cisapride, which is CORRECT
    a. 80% oral bioavailability
    b. potent anti-dopamine agent
    c. needs to be reduced in renal failure
    d. decreases colonic motility

7. Regarding antiulcer/antireflux drugs
    a. Oral antiacids completely safe in people with renal failure

8. Metoclopramide
    a. Increases antral contractility

9. Cimitidine
    a. blocks both H1 and H2 receptors
    b. t1/2 is 22 hours
    c. inhibits cytochrome P450
    d. never causes gynaecomastia

10. regarding antiemetics
    a. metoclopramide increased lower oesophageal sphincter tone
    b. metoclopramide is a dopamine agonist
    c. THC works at the chemoceptor trigger zone

Analgesics & NSAIDs

1. Which pathway produces the toxic metabolite in paracetamol overdose
    a. N-hydroxylation
    b. Glucoronidation
    c. Sulfation
    d. Conjugation with glutathione

2. Opiates; which is correct
    a. morphine acts as a mu, kappa and delta agonist

3. Aspirin; which is correct
    a. has a pKa of 6.5
    b. moderate doses increase respiratory rate
    c. high doses cause alkalosis
    d. reversible inhibitor of cyclo-oxygenase
    e. alkalinising the urine will decrease excretion

4. Ketamine; which is correct out of the following options
    a. cardiovascular stimulant via a central mechanism
    b. increases respiratory rate initially

5. Ketamine
    a. has a brief period of increased resp rate
    b. decreases the brains oxygen use/requirement
    c. is a negative ionotrope

6. Tolerance to morphine involves all of these features EXCEPT
    a. miosis and resp depression
    b. euphoria
    c. analgesia
    d. cough suppression

7. Which is true of aspirin?
    a. it has a pKa of 6.5
    b. causes cutaneous vasodilation

8. what is correct regarding salicylates?
    a. they demonstrate capacity limited clearance at low doses
    b. they have a pKa of 6.5
    c. they cause platelets to have a half life of 2 days

9. In an overdose of paracetamol
    a. metabolism of paracetamol requires glutathione

10. Paracetamol
    a. has anti-inflammatory properties
    b. is highly protein bound

11. Dextropropoxyphene
    a. is structurally related to methadone

12. Ketamine is closely chemically related to
    a. phencyclidine
    b. LSD
    c. Propofol
    d. Thiopentone
    e. Enflurane

13. A high degree of tolerance can be expected to all these effects of morphine EXCEPT
    a. miosis
    b. nausea
    c. cough supression
    d. analgesia
    e. respiratory depression

14. Methadone is used in the treatment of narcotic addiction because
    a. it does not produce constipation
    b. it is a phenylpiperadine class narcotic agonist
    c. it produces a short withdrawl when ceased
    d. it produces predictable effects when given orally
    e. it is a less efficacious analgesic than morphine

15. What do kappa receptors mediate
    a. supraspinal analgesia and euphoria
    b. truncal rigidity
    c. hallucinations and dysphoria
    d. respiratory depression and dependence
    e. spinal analgesia and miosis

16. Allopurinol
    a. metabolised by xanthine oxidase
    b. has no side effects
    c. useful in acute gout
    d. low oral bioavailability

17. Regarding paracetamol toxicity
    a. toxicity is related to glutothione consumption
    b. enhanced with cimetidine
    c. toxic metabolite is due to sulphanation

18. Paracetamol
    a. is only given orally
    b. highly protein bound
    c. doesn't cause hyperuricaemia

19. Dextropropoxyphene
    a. when combined with paracetamol is a strong anti inflammatory
    b. overdose causes death from hepatotoxicity
    c. structurally related to methadone

20. Regarding paracetamol
    a. It has significant anti-inflammatory effects
    b. No effect on uric acid levels

21. Regarding Aspirin
    a. Low doses causes hypoventilation
    b. High does cause metabolic alkalosis
    c. Reversibly inhibits COX

22. Regarding ibuprofen
    a. More gastric side effects than aspirin
    b. Low bioavailability
    c. Irreversibly inhibits COX

23. Naloxone
    a. Has a half life of over 4 hours
    b. Has a half life of less than one hour
    c. Has a half life of between 2 and 3 hours
    d. Has a half life of between 1 and 2 hours
    e. Has a half life of between 3 and 4 hours

24. Pethidine
    a. Causes raised CSF pressure

25. Dextropropoxyphene
    a. should never be used in combination with paracetamol
    b. should be avoided in renal failure
    c. is structurally similar to methadone

26. Allopurinol
    a. metabolised by xanthine oxidase
    b. used in acute gout
    c. low bioavailability

27. Ketamine
    d. is a bronchoconstrictor
    e. increases respiratory rate initially
    f. has no cardiovascular effects
    g. can cause agitation and ‘emergence’ in children

Toxicology

1. Ethylene glycol overdose; which is correct
    a. toxicity is due to polycyclic hydrocarbon ring structure
    b. causes formic acid crystals in urine
    c. causes metabolic alkalosis
    d. …… (some drug) is the antidote (NOT ethanol, may have been fomepizole?)

2. Cocaine; which is incorrect
    a. inhibits monoamine oxidase
    b. blocks uptake of catecholamines
    c. enhances dopamine activity
    d. has central and peripheral effects
    e. has local anaesthetic effects

3. Yet another overdose rocks up to your ED. You examine them and find them to have: blurred vision, urinary retention, dilated pupils and to be very agitated. What have they taken?
    a. cocaine
    b. TCAs
    c. morphine

4. Another dodgy young male has had an overdose of a drug….he is hyperthermic, agitated and has rhabdomyolsis…which drug has he taken to excess?
    a. cocaine
    b. MDMA
    c. Aspirin

5. repeat question regarding ethyl alcohol PhK and PhD
    a. is excreted unchanged by the lungs

6. Methanol intoxication
    a. is partly due to inhibition of aldehyde dehydrogenase
    b. is due to formation of oxalic acid
    c. is treated in part with activated charcoal
    d. produces renal damage due to crystal formation
    e. can be treated with 4 methylpyrazole

7. Cannabinoids
    a. produce tachycardia
    b. have an antipsychotic action
    c. act on a number of non-specific receptors
    d. constrict the pupils
    e. all of the above

8. Regarding ethyl-alcohol
    a. excreted unchanged in the lungs
    b. causes CNS excitation then depression

9. regarding marijuana
    a. it causes miosis
    b. hydroponic indoor-grown varieties are no more potent than soil grown
    c. it causes conjunctival hyperaemia and tachycardia

10. A 30 year old male patient presents with an acute myocardial infarction. Which drug has most likely caused this?
    a. alpha-1 effect of cocaine
    b. increased adrenalin production due to heroin
    c. increased serotonin due to fluoxetine
    d. monoamineoxidase inhibition by amphetamine derivative

11. Regarding ethanol metabolism
    a. The MEOS system is the main pathway
    b. The alcohol dehydrogenase pathway is inducible
    c. Obeys first order kinetics
    d. Most alcohol dehydrogenase is found in the stomach

12. The metabolism of paracetamol to its toxic metabolite is via which reaction
    a. Glucuronidation
    b. Sulphation
    c. Hydroxylation

Extremes of Age & Pregnancy

1. Drug toxicity and the foetus; which is correct
    a. ACE inhibitors – renal failure/damage
    b. Thalidomide – neural tube defects
    c. Alcohol – Ebstein's anomaly

2. Which of the following drugs is safest in pregnancy?
    a. heparin
    b. warfarin
    c. enoxaparin

3. Which is the correct combo of agent and teratogenic effect?
    a. Lithium – Epstein Barr anomaly
    b. ACE inhibitors – hydronephrosis

4. Which of the following drugs is the most safe to give in pregnancy
    a. heparin
    b. lithium
    c. phenytoin
    d. captopril
    e. gentamicin

5. Regarding drugs in the elderly
    a. the dose of lithium should be increased
    b. phase II biotransformation is much poorer
    c. they have an increased lean body mass
    d. side effects are proportional to the amount of medication
    e. they have higher serum albumin

6. Which is safest to give in pregnancy
    a. Lithium
    b. Phenytoin
    c. Warfarin
    d. ACE inhibitor
    e. Heparin

7. Neonates have
    a. increased total body water
    b. decreased bioavailability
    c. increased clearance of drugs by glomerular filtration
    d. increased hepatic enzymes
    e. increased protein binding

8. Elderly people have reduced hepatic clearance of
    a. ethanol
    b. warfarin
    c. prazosin
    d. tolbutamide
    e. salicylate

Miscellaneous Agents

1. Which agent does not cause constipation
    a. verapamil
    b. digoxin
    c. warfarin

2. Allopurinol; which is correct
    a. metabolised by xanthine oxidase
    b. has no side effects
    c. useful in acute gout
    d. low oral bioavailability

3. Hyperkalaemia; which drug is unlikely to have caused
    a. methyldopa
    b. potassium supplement
    c. spironolactone
    d. ACE inhibitor
    e. Naproxen

4. Drug interactions; which pairing is correct
    a. Rifampicin induces warfarin metabolism
    b. Carbamazepine inhibits ……..

5. Which drug has a half life of 6 hours?
    a. Atenolol
    b. aspirin
    c. lignocaine
    d. adenosine

6. Regarding drugs that affect thyroid function, which is true?
    a. amiodarone…..mech
    b. Lithium inhibits T4 absorption
    c. Iodide decreases the amount of TBG
    d. phenytoin alters T3 and T4 metabolism

7. With regard to the side effects of N-Acetyl Cysteine, all are true EXCEPT:
    a. bronchoconstriction
    b. increased endogenous histamine production and release
    c. it causes glutathione regeneration
    d. it inhibits P450 enzymes
    e. cimetidine increases its toxicity

8. Which of the following has its metabolism inhibited by limiting liver blood flow
    a. verapamil
    b. lignocaine
    c. labetalol
    d. trimethoprim
    e. propoxyphene

9. Allopurinol
    a. is metabolised by xanthine oxidase

10. Which of the following drugs causes methaemaglobinemia
    a. lignocaine
    b. prilocaine
    c. bupivicaine
    d. benzocaine
    e. cocaine

11. Which of the following drugs can cause alopecia
    a. warfarin
    b. heparin
    c. verapamil
    d. ticlodopine
    e. digoxin

12. Which of the following drugs DOES NOT cause constipation
    a. verapamil
    b. digoxin
    c. imipramine
    d. codeine
    e. chlorpromazine

13. Which of the following drugs can cause hypothrombinemia
    a. cefuroxime
    b. cefotetan
    c. cefazolin
    d. cefaclor
    e. ceftriaxone

14. Which of the following drugs does not cause the same effect
    a. muscarine
    b. acetylcholine
    c. hyoscine
    d. carbachol
    e. methacholine

15. Which of the following side effects for given drugs is wrong
    a. phenytoin and gum hypertrophy
    b. phenobarbitol and enzyme induction
    c. carbemazepine and ataxia
    d. ethosuximate and hirsutism
    e. valpraote and idiosyncratic hepatic toxicity

16. Which of these has a different mode of action
    a. insulin
    b. glucagon
    c. ACTH
    d. PTH
    e. All of the above

17. Chose the odd one out
    a. muscarine
    b. Ach
    c. Hyoscine
    d. Bethanachol

18. Which drug does not interact with warfarin
    a. phenobarbitone
    b. loop diuretic
    c. benzodiazepine
    d. cepholosporins

19. Which agent does not cause constipation
    a. verapamil
    b. digoxin
    c. warfarin

20. Fosamax working mechanism:
    a. increasing hydroxyappatit
    b. increasing calcium resorbtion
    c. decrease in phosphate excretion

21. Which applies to Simvastatin
    a. half life is 5-8 hours
    b. has a low bioavailability
    c. is associated with peptic ulcer disease
    d. is not known to give rhabdomyolysis

Genito-urinary Agents

1. Which raises the pH of the urine the most
    a. frusemide
    b. acetazolamide
    c. chlorothiazide
    d. phenobarbitone

2. Ph of urine is increased mostly by
    a. acetazolamide
    b. furesemide
    c. chloorthiazide
    d. spironolacton

3. Which raises the pH of the urine the most
    a. Acetazolamide
    b. Frusemide
    c. Chlorthiaziade