1) **What does gram positive mean?**
   Very thick peptidoglycan layer, color is purple because of their thick peptidoglycan layer. Do not have endotoxins, they can release exotoxins.

2) **How many medically important gram positive bacteria are there?**
   a) 2
   b) 3
   c) 6
   d) 8

- There are 6 medically important gram positive bacteria
  - 2 cocci (staphylococci and streptococci); 4 are rods (2 spore formers and 2 non-spore formers)

3) **The two types of of spore forming gram positive rods are**
   a) Listeria monocytogenes and corynebacterium diphtheriae
   b) Clostridium and Listeria monocytogenes
   c) Bacillus and corynebacterium diphtheriae
   d) Bacillus and clostridium

- Bacillus and clostridium are gram positive rods that are spore forming
  - Listeria monocytogenes and corynebacterium diphtheriae are non spore forming

4) **How do spore forming rods cause disease?**
   They causes disease by the release of potent exotoxins.

5) **How does Bacillus and Clostridium differ from each other?**
   They differ from each other biochemically. Bacillus likes oxygen, it is aerobic and it will grow in the presence of oxygen. Clostridium is anaerobic, meaning it grows in the absence of oxygen.

6) **What are the two types of Bacillus species? What disease do the cause?**
   Bacillus anthracis and *Bacillus cereus* are the two pathogenic species of bacillus.
   Bacillus anthracis causes **anthrax** disease; ***Bacillus cereus*** causes **gastroenteritis**

7) **What makes *Bacillus anthracis* unique?**
   a) It is the only spore forming rod
   b) It is the only bacteria with a capsule made of protein
   c) It can complete phagocytosis
   d) It is the only pathogen species of Bacillus

- Bacillus anthracis is unique because it is the only bacteria with a capsule made of protein (poly-D-glutamic acid). This capsule **prevents phagocytosis**. Normally capsules are made of sugar (polysaccharide).

8) **How does one get exposed to Bacillus anthracis?**
   Bacillus anthracis normally causes anthrax disease in herbivores such as cows and sheep; humans are exposed to spores from direct contact with infected animals or soil.

9) **Which of these is FALSE about Bacillus anthracis?**
   a) B. anthracis is very stable
   b) B. anthracis is resistant to drying, heat, UV light and disinfectants
   c) Spores germinate and makes toxins
   d) B. anthracis is a non spore former

- Bacillus anthracis is very stable, resistant to drying, heat, ultraviolet light and disinfectants.
- When spores germinate, they make toxins

10) **What is Plasmid?**
   Plasmid is an extra portion of DNA found in bacteria. This allows the bacteria the ability to complete something important.
11) **Germination and expression of plasmid encoded virulence factors on plasmids pXO1 and PXO2 is regulated by what?**
   a) Increase in temperature to 37ºC
   b) Carbon dioxide increases
   c) Serum protein
   d) All of the above
   e) None of the above

12) **What was the spores used for?**
   a) Biological terrorism
   b) Massacre of herbivores such as cows and sheeps
   c) Warfare (i.e. Japanese army in Manchuria in 1940)
   d) A & C

- The spores were used in bio-terrorism and warfare

13) **How many plasmids are in Bacillus anthracis?**
   a) 2
   b) 4
   c) 5
   d) 1
- There are 2 plasmids in Bacillus anthracis; this is known as pXO1 and pXO2

14) What is TRUE about pXO1?

a) The 3 proteins of endotoxin do not cause any problem alone
b) The 3 proteins of exotoxin do not cause any problem alone
c) If 3 proteins of exotoxin combine, they will form exotoxin that can kill
d) B & C are correct

- In Anthracis exotoxin, pXO1 is encoded on the plasmid; the exotoxins contains 3 separate proteins which are not toxic on their own, but will be lethal if combined

15) What is the edema factor of anthrax? What does the protective agents do? Lethal factor?

The EF of anthrax is that it disrupts water homeostasis. The protective antigen promotes entry of EF into phagocytic cells. The lethal factor is zinc metalloprotease that inactivates protein kinase

16) What does plasmid pXO2 do? Are both plasmids pXO1 and pXO2 important?

It encodes three genes required for synthesis of the unique poly-glutamyl capsule. Both plasmids are needed for bacterial.

17) How can you prevent high mortality of anthrax?

With rapid identification and prompt use of penicillin, doxycycline, ciprofloxacin or levofloxacin are critical of prevention of high mortality rate. Vaccines against PA are available for humans; animals sometimes are vaccinated with live cultures that have had their capsules removed

18) Where does the Bacillus cereus affect?

a) GI tract
b) Lungs
c) Brain
d) Heart

- The Bacillus cereus is an enterotoxin that affects the GI tract, this will cause food poisoning and **gastroenteritis**

19) What is the difference between B. cereus and B. anthracis?

B. cereus is different from B. anthracis in that is it motile, non-encapsulated and resistant to penicillin.

20) What are the two types of enterotoxin?

Heat labile: nausea, abdominal pain, diarrhea. Last 12-24 hours
Heat Stable: Severe nausea and vomiting, short incubation.

21) If a patient is suffering from food poisoning by B. cereus, will antibiotic therapy help and why?

No, it will not help alter the course of symptoms in the patient because the pre-formed toxins are what causes the food poisoning

22) Which of the following is TRUE about Clostridium species?

a) They are gram positive
b) They are spore forming rods but are anaerobic
c) Famous for causing botulism, tetanus, gas gangrene and pseudomembranous colitis
d) The exotoxins are extremely powerful and lethal
e) All the above is TRUE

- Clostridium is a gram positive, spore forming rod, but are anaerobic. Anaerobic cultures helps to differentiate them from Bacillus. They are extremely lethal if not rapidly diagnosed and cause botulism, tetanus, gas gangrene and pseudomembranous colitis

23) Which of the following is TRUE about Clostridium botulinum?

a) It does not produce lethal neurotoxins that cause rapidly fatal food poisoning
b) Neurotoxins blocks release norepinephrine from nerve terminals in the autonomic nervous system
c) It does not cause any flaccid muscle paralysis
d) Flaccid muscle paralysis results can lead to sudden respiratory paralysis and death

- Clostridium botulinum produces lethal neurotoxins that causes rapidly fatal food poisoning. The neurotoxin blocks the release of ***acetylcholine*** from nerve terminals and will cause flaccid muscle paralysis.

24) True or False, proper cooking helps to destroy spores.

True, proper cooking helps to destroy spores; however, if improper cooking or canning results in anaerobic conditions that allow for growth and synthesis of neurotoxin.

25) Why are infants told not to eat honey until 12 months of age?

Honey might contain spores that cause infant botulism associated with fresh honey contamination. The spores germinate and bacteria colonize infant intestinal tract. Neurotoxins will be released and the baby will suffer for constipation for 2-3 days and have difficulty swallowing and muscle weakness. This is also known as a floppy baby."

26) What is treatment for Botulinum?

The treatment for botulinum will be antitoxins that help neutralize the unbound free neurotoxins in the bloodstream. However, because this is a slow process, intubation and ventilatory support until respiratory muscle resumes activity.

27) Are there any benefits of Botulinum neurotoxin?

There is type A botox that helps treat two eye muscles disorders: uncontrollable blinking and misaligned eyes. It can also help excessive sweating when paralyze the muscles. Another benefit is that it is used or chronic pain and jaw tension. You can also use in forehead to make no wrinkles appear but that lessens eyebrow movements.

28) How does one get contaminated by Clostridium tetani?

This is caused by a classic puncture wound by a rusty nail or and skin trauma by any object contaminated with spores. Spores are found in soil and animal feces. When Clostridium tetani gets into the wound, it can ***germinate*** as long as there is a localized anaerobic environment

29) What are the exotoxins called in Clostridium tetani?

a) Exotetani
b) Tetanospasmin
c) Clostridium tetani
d) Tetani

- Tetanospasmin - this causes sustained contractions of skeletal muscles (tetany)

30) What does tetanospasmin do?

a) Tetanus toxins take up at neuromuscular junction and transport it to CNS
b) Toxin acts on the inhibitory Renshaw cell interneurons and prevents the release of inhibitory neurotransmitters of GABA and glycine
c) Severe muscle spasms(trismus, aka, lockjaw) and grotesque grinning expression.
d) All the above is an effect of tetanospasmin.

31) How is tetanospasmin prevented?

Formalin-inactivated toxins (tetanus toxoid) given every 10 years as boosters and is part of DPT shot. Since it is given every 10 years, this allows for the secondary immune response to be faster.

32) Clostridium perfringens are classified as what kinds of infections? How are they treated?

i) Wound infection/cellulitis: Physical barrier is broken
ii) Clostridial myonecrosis: Bacteria inoculated from trauma to muscles

They are treated with oxygen and antibiotics (penicillin) and removal of damaged tissues.

33) What is the difficulty with treating Clostridium difficile?

The difficult with C. difficile is that it cannot be treated with antibiotics. Clostridium difficile also arises from overuse of broad spectrum of antibiotics which destroy normal intestinal flora. If affects the colon where it releases exotoxins. (Toxin A = diarrhea and Toxin B = cytotoxic to colonic cells)

34) How is Clostridium difficile treated?

The treatment consists with discontinuing the antibiotic treatment that patient was originally on and then administration of ***metronidazole or vancomycin*** by mouth. What makes this different from other antibiotics is that these are not absorbed orally into the bloodstream.

35) What are the two non spore forming rods?

a) Listeria monocytogenes and corynebacterium diphtheriae
b) Clostridium and Listeria monocytogenes
c) Bacillus and corynebacterium diphtheriae
d) Bacillus and clostridium

- Listeria monocytogenes and corynebacterium diphtheriae are gram positive non spore forming bacteria

36) What is FALSE about Listeria monocytogenes?

a) One of the few bacteria that can cross the three barriers (blood-brain, gastrointestinal and feto-placental)
b) Found in foods such as soft cheeses, unpasteurized milk and cold cuts. It cause cause variety of symptoms, ranging from general malaise, to meningitis to spontaneous abortions (stillbirths) to death
c) Is considered a facultative intracellular organism (can live outside of within cells)
d) Antimicrobial resistance is an issue with L.monocytogenes

- Oddly enough, antimicrobial resistance is not an issue with L. monocytogenes

37) What is the effects of corynebacterium diphtheriae?

a) Colonizes the pharynx and releases exotoxins into bloodstream.
b) Paralysis of muscles
c) Food poisoning
d) Blocks the Ach release in autonomic system

- It colonizes the pharynx and releases exotoxins into bloodstream. It forms a grayish pseudomembrane composed of fibrin , leukocytes, necrotic epithelial cells and C. diphtheriae cells
- Bacteriophage will give bacteria ability to make exotoxins which contains two subunits.
- B subunit binds to target cells and allows A subunit to enter, and the A subunit blocks protein synthesis (inactivates elongation factor EF2)

38) **What is the order of the three steps for treatment of Corynebacterium diphtheriae?**

1) Antoxin to inactivate circulating toxin
2) DPT vaccine (D= diphtheria)
3) penicillin or erythromycin to kill the bacteria

a) 2-3-1
b) 1-3-2
c) 1-2-3
d) 3-2-1

39) What is TRUE about Gram - negative bacilli

a) The enterics are gram negative bacilli part of the normal flora found in the intestine
b) Very thick peptidoglycan layer
c) Staphylococci and streptococci are gram negative
d) Bacillus and Clostridium species are gram negative

- The enterics are gram negative bacilli part of the normal flora found in the intestine **BUT can also cause disease**

40) What are the 4 major groups of Enterics? How are they divided?

The organisms are divided into groups based on biochemical and antigenic properties. The four major groups are:

1) Enterobacteriaceae
2) Vibrionaceae
3) Pseudomonadaceae
4) Bacteroidaceae

41) If an organism has the ability to ferment lactose and are dark purple/black, what are they?

a) They are EMB media
b) They are MacConkey media
c) They are listeria monocytogenes
d) They are bacillus cereus

- They are EMB media and inhibits Gram positive bacteria, it is not Macconkey media because the lactose fermenters are pink-purple. These are selective media.

42) For classification using surface antigens, which ones are correctly matched?

a) Cell wall: O- antigen
b) Capsule: K- antigen
c) Flagella: H- antigen
d) All are correctly matched

43) Which of the following is FALSE about Salmonellae?

a) They are lactose fermenters
b) They are motile
c) They do not contain any serovars
d) Infections of man are enterocolitis or Enteric fever

44) Why are antibiotics not recommended for Enterocolitis?

Generally when one contracts Enterocolitis from either a person or improperly cooked food, taking antibiotics can result in antibiotic resistance. It will start to diminish our normal flora in the GI tract and cause the salmonellae to spread faster. It may prolong excretion of organisms in the stool and does not shorten the illness.

45) Which of the following Salmonellae type are the only ones with humans as host?

a) **S. Enterica serovar Typhi**
b) S. Enterica
c) S. Bongori
d) S.Enterica serovar enteritidis

- Enteric fever is caused by S. enterica serovar Typhi and Paratyphi
- Enterocolitis (tummy problems) is caused by serovar Enteritidis and Typhimurium
- Stool culture for laboratory diagnosis

46) Escherichia coli turns what color on MacConkey agar?

a) Blue
b) Purple
c) Black
d) Pink

47) Which of the following is most similar to Salmonellae?

a) Shigellae
b) Vibrio cholerae
c) E. coli
d) Campylobacter

- Shigellae is most similar to salmonellae

48) Which of the following is INCORRECTLY matched

a) Shigella sonnei // 70-80% of cases in Europe and North America
b) S. flexneri // found mainly in tropics and cause severe illness
c) Shigella dysenteriae // Severe illness
d) S. flexneri // mild illness

- B) is incorrect, S. Flexneri causes mild illness and not found mainly in the tropic, shigella dysenteriae is severe illness found mainly in the tropic.

49) Which of the following is the most numerous aerobic species of the normal human intestinal flora?

a) Shigella
b) Salmonellae
c) Escherichia coli
d) Typhoid

- E. coli is safe / harmless in the intestine but is is potentially pathogenic elsewhere in the body.
- Most frequent cause of urinary tract infection accounting for about 85% of uncomplicaed bacteriuria

50) Which of the following are CORRECTLY matched?

a) Enteropathogenic E.coli // first pathotype to be described
b) Enterotoxigenic E. coli // travelers' diarrhea
c) Enteroinvasive E. coli // bloody diarrhea and dysentery
d) All of the above are correctly matched

51) Which of the following are CORRECTLY matched?

a) Vibrio cholerae //Waterborne, comma shaped, produces enterotoxin that binds to epithelial cells in small intestine; hinders absorption of sodium
b) Campylobacter jejuni and Campylobacter coli // normal flora in birds and domestic animals; one agent of travellers diarrhoea
c) Pseudomonas // live in moist habitats and in water
d) Haemophilus influenzae // associated with exacerbations of infections in chronic bronchitis, joint infections, Nasopharyngeal normal flora
e) All of the above are correctly matched

52) Compare pseudomonas aeruginosa and cepacia. Why are all pseudomonas infections difficult to treat?

P. aeruginosa have two clinical situations while P. cepacia only has one. Both are found as a respiratory pathogen in cystic fibrosis but P. aeruginosa can cause infections when skin burns are involved. P. cepacia has the ability to multiply in low nutrient environments such as water and saline.

Pseudomonas infections are particularly hard to treat because they are intrinsically resistant to many commonly used antibiotics, and may acquire resistance to additional antibiotics

53) Mycobacteria are causative agents of…

a) Tuberculosis
b) Pseudomonas
c) Leprosy
d) A and C

- Mycobacteria are causative agents of tuberculosis and leprosy

54) Since mycobacteria have a waxy coat interferes with the Gram stain, what is the correct order using Ziehl- Neelsen staining technique? (*to note: fluorescent dyes work as well)*

1)Follow with a gentle wash with water to cool slide
2) Acid alcohol is added to decolorize the slide
3) Ziehl- Neelsen carbol fuchsin to the slide for five minutes while applying heat
4) Wash the slide in water and counterstain with methylene blue for 1-2 minutes

a) 1-2-3-4
b) 3-1-2-4
c) 4-3-2-1
d) 2-3-1-4

55) Which of the following about Mycobacterium tuberculosis is FALSE?

a) It is an acid fast bacillus causing chronic, slowly progressing, most often pulmonary infection
b) Primary tuberculosis - Caused by water containing tubercle bacilli; reach the lung alveoli and multiplies
c) Tubercle bacilli survive insides macrophages
d) Primary infection can allow some tubercle bacilli to escape into the lymphatics and bloodstream and reach the lungs, bones, kidneys, meninges etc. where they produce microscopic foci of infection

- It is not caused by water contamination but aerosol contamination of tubercle bacilli
- In ~6 weeks, Cell mediated immune system is fully active and stop the infections and walls in the microscopic lesions in majority of the cases
- In cases where bacilli survive, reactivation of TB several years later (positive TB test)

56) What is the most important in immunity in Tuberculosis?

a) Humoral immunity
b) Cell mediated immunity
c) Antibiotics
d) Nothing

57) Which of the following is matched INCORRECTLY with Mantoux test?

a) Tuberculin solution // injected INTRADERMALLY
b) Diameter of induration >10mm // NEGATIVE RESULT
c) Diameter of induration 5-9 mm // DOUBTFUL; possible reaction with other mycobacteria
d) Diameter of induration <4 mm NEGATIVE RESULTS

- Anything with >10 mm is a positive result but this does not necessarily mean there is currently an active infection

58) List Laboratory diagnosis of mycobacterium tuberculosis

- Microscopic examination of sputum smears; this is the first line of diagnosis
- Cultures on special media; lowenstein-Jensen

59) Which of the following is NOT a Atypical mycobacteria?

a) M. Kansasii
b) Tubercle bacilli
c) M. tuberculosis
d) M. intracellulare

60) What is the difference between atypical mycobacteria and mycobacterium tuberculosis?

Atypical mycobacteria are non-tuberculous mycobacteria. These cannot be distinguished from tuberculosis as the symptoms are the same. Atypical mycobacteria show higher resistance to anti tuberculosis drugs.

61) Which of these are matched INCORRECTLY?

a) M. marinum // skin infections
b) M. scrofulaceum// soft tissues abscesses
c) M. fortuitum // soft tissue abscesses
d) M. tuberculosis // lungs

- M. marinum produces skin infections, M. scrofulaceum causes lymphadenitis in children, M. fortuitum causes soft tissue abscesses.

62) In tuberculoid leprosy, there are no visible nerve enlargement, many erythematous nodules, many bacilli in infected tissue; high infectivity. This is found often in developed countries. TRUE OR FALSE? WHY?

FALSE; Tuberculoid leprosy has visible nerve enlargement, few erythematous plaques, few bacilli in infected tissues, but many lymphocytes and granulomas. It is low infectivity. The above describes Lepromatous leprosy. These are RARELY found in developed countries. Often seen in Asia and Africa

63) Which of the followings are INCORRECTLY matched?

a) Treponema causes leptospirosis
b) Leptospira causes syphilis
c) Borrelia causes lyme disease
d) A and B

- Treponema causes syphilis while leptospira causes leptospirosis. Borrelia causes lyme disease (relapsing fever).

64) Treponema pallidum is

a) Syphilis
b) Gram negative; helical bacteria
c) Unculturable in vivo
d) Used under a dark field microscopy with giemsa stain and ziehl neelsen
e) All of the above

- All of the above describes treponema pallidum; the reason for not using Gram stain is because it is almost invisible - goes unseen.

65) Which of the following do not use serology for diagnosis?

a) Borrelia burgdorferi
b) Treponema pallidum
c) Syphilis
d) Lepromatous leprosy

- Lepromatous does use microscopy for diagnosis, however it does not use serology

66) Which of the following is FALSE?

a) Chlamydia trachomatis, Chlamydia pneumoniae and Chlamydia psittaci are the main species of chlamydiae
b) C. trachomatis is the most common STD in Canada and US
c) Chlamydia psittaci is a pathogen found innate to humans
d) Chlamydia pneumoniae causes respiratory tract infections

- Chlamydia psittaci is a pathogen found in birds and are transmitted to humans

67) Which of the following is FALSE about mycoplasma

a) They are the smallest free living bacterium (100-200 nm)
b) Saprophytes, part of normal flora of oropharynx and genital tract of humans and animals
c) They have a cell wall
d) Some species are pathogenic

- They lack a true cell wall

68) In genital mycoplasma, the rate of colonization increases with _____.

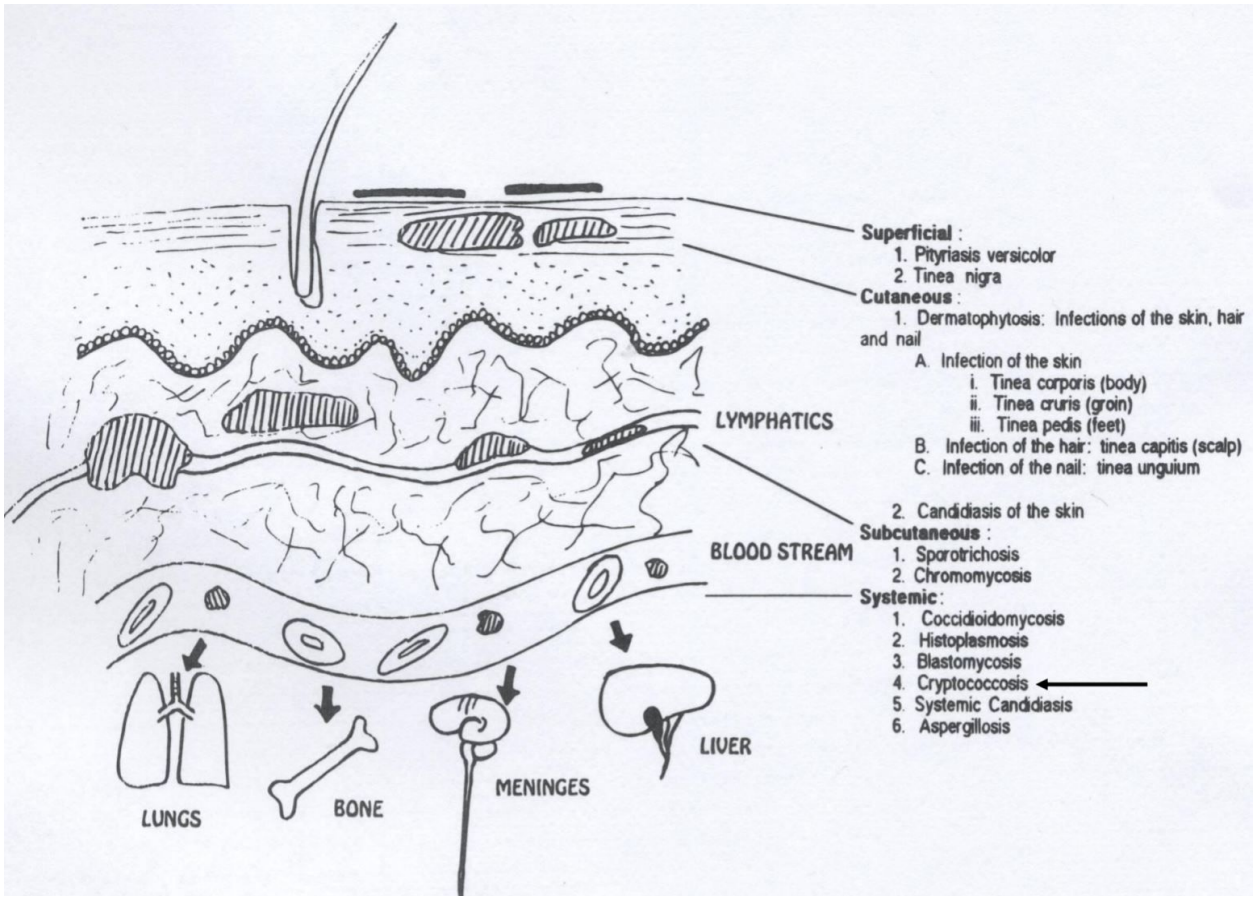
a) Gender
b) Age
c) Family history
d) Number of sexual partners

- Increase the rate of colonization with the number of sex partners

69) Which of the following is CORRECTLY matched?

a) Dimorphic fungi // fungi that grows as either yeast or mold
b) Hyphae // fungi that live and use organic matter such as soil, rotten vegetation as energy source
c) Saprophytes //thread like, branching tubules composed of fungal cells attached end to end
d) Yeast // reproducing bodies of mold

- Dimorphic fungi is matched correctly to its description
- Hyphae is thread like, branching tubules composed of fungal cells attached end to end
- Saprophytes are fungi that live and use organic matter such as soil or rotten vegetation as an energy source
- Yeast is a unicellular growth form of fungi; the can appear spherical to ellipsoidal.
- Spores are reproducing bodies of molds



The level (depth) of infection by fungal pathogens

70) What is parasitism?

Intimate and obligate symbiotic relationship between two organisms of different species. These are metabolically and physiologically dependent on host

71) Which of the following is NOT a true parasite?

a) Protozoans
b) Helminths
c) Mosquito
d) Arthropods

72) What is Giardia lamblia?

Protozoa (unicellular). Giardiasis is a infection of the small bowel, often asymptomatic but also associated with various intestinal symptoms.

73) What is Trichomonas vaginalis?

Protozoa (unicellular). Vaginitis is found usually asymptomatic in males, it causes itching, foul smell and frothy discharge. Transmitted almost exclusively through sexual contact

74) What is Toxoplasma gondii?

Protozoa (unicellular). This disease is usually mild but goes undetected often. May present with fever, lymphadenopathy. Diagnosis is normally serological or mouse inoculation. This is acquired through ingestion of raw or undercooked meat or contact with cat faeces.

75) What is Entamoeba histolytica?

Amoebiasis; infection of the large intestine. Can be asymptomatic or maniest. It is identified by trophozoites or cysts in faeces or lesions by microscopy

76) Which of the following does NOT cause malaria?

a) P. vivax
b) P. malariae
c) P. falciparum
d) P. ovale
e) All of the above cause malaria

77) What is Cryptosporidium species?

A disease that infect humans, it may result in diarrhea, vomiting, anorexia, malaise. May be life threatening in immunocompromised individuals. Diagnosis of oocytes in faecal specimens. It is normally waterborne. Animal reservoirs - mainly cattle. **There is no drug treatment available!!**

78) What is Cyclospora cayetanensis?

It is a disease that may result in prolonged and severe diarrhea. Diagnosis is Identification of oocysts in faecal specimens. It is contracted occur through contaminated water or food. To prevent is proper hygiene habits and sanitary disposal of faeces.

79) Which of the following is not a Metazoa parasite?

a) Nematodes
b) Platyhelminthes
c) C. cayetanensis
d) Cestodes