Key

**Unit 3: Medicolegal Death Test Review**

**Death: Meaning, Manner, Mechanism, Cause, and Time**

1. What is death? What is autolysis? → irreversible cessation of blood circulation → when cells start to break down
2. Fill in the blanks.

| | Manner | Mechanism | Cause |
|---|---|---|---|
| Definition | way a person can die | specific change in the body that brought about the cessation of life | reason someone dies |
| Example | natural<br>accidental<br>suicidal<br>homicide<br>undetermined | loss of blood<br>heart stopped | injury<br>stroke<br>shooting<br>suffocation<br>bludgeoning |

3. **Livor Mortis (Lividity)**
   a. What is livor mortis (lividity)? death color, purplish color that settles to the lower part of the body after death
   b. When does it start after death? -2hrs after death
   c. When does it become permanent? after 8 hours
   d. What can livor mortis reveal about the body in an investigation? position of the body after death
4. **Rigor Mortis**

**Progression of Rigor Mortis**

| Time After Death | Event | Appearance | Circumstances |
|---|---|---|---|
| 2 - 6 hours | rigor begins | body becomes stiff & stiffness moves down the body | begins in eyelids & jaw muscles after 2 hrs, then center of body, then arms & legs |
| 12 hours | rigor complete | peak rigor | entire body is rigid |

| | Event | Appearance | Circumstances |
|---|---|---|---|
| 18 - 36 hours | slow loss of rigor | loss of rigor in small muscles 1ST, followed by larger muscles | rigor lost 1ST in head & neck, last in bigger leg muscles |
| 36 - 48 hours | rigor totally disappears | muscles become relaxed | variable may extend rigor past 36 hours |

**Factors Affecting Rigor Mortis**

| Factor | Event | Effect | Circumstances |
|---|---|---|---|
| Temperature | cold temperature | inhibits rigor | slows onset of rigor & slower progression through rigor |
| | warm temperature | accelerates rigor | faster onset & progression through rigor |
| Activity Before Death | aerobic exercise | accelerates rigor | faster onset & progression |
| | sleep | slows rigor | slower onset & progression |
| Body Weight | obese | slows rigor | slower onset & progression |
| | thin | accelerate rigor | faster onset & progression |

5. **Algor Mortis**
   a. What is it? Time of death
   b. How to calculate time of death:
      i. Subtract the body temperature from 37°C.
      ii. Divide the answer by .78 °C/hr.
         1. If the answer is 12 or less, this is the time of death. Stop here.
         2. If the answer is more than 12, do the following:
            a. Take your answer from (i) and subtract 9.36°C.
            b. Divide the answer by .39°C/hr. Add this answer to 12 hours and this is your time of death.

i 37°C − 19°C = 18°C

18°C / .78°C/hr = 23.0 hrs dead more than 12 hrs.

12 hrs + 22.2 hrs = 34.2 hrs

ii 37°C − 31°C = 6°C

6°C / .78°C/hr = 7.7 hrs.

18°C − 9.36 = 8.64°C

8.64°C / .39°C/hr = 22.2 hrs

c. Practice
   i. A body was found with an internal temperature of 19°C. Estimate the time of death.
   ii. A body was found with an internal temperature of 31°C. Estimate the time of death.
d. Describe how the time of death can be affected in the following situations.
   i. It's really cold. - It can make time of death longer than it really is
   ii. It's really hot. - it can make time of death shorter than it really is
   iii. The body is obese - Obese bodies lose heat more slowly than thin bodies, time of death is longer than calculated.

**6. Stomach and Intestinal Contents**

a. How long ago did death occur if there are still undigested food in the stomach? 0-2 hrs ago
b. How long ago did death occur if food is found in the small intestine? 2-6 hrs ago
c. How long ago did death occur if food is found in the large intestine? 12 or more hours ago

**7. Eye Changes After Death**

a. How long after death does the thin film cover the eye if the eye is open at death? 2-3 hrs.
b. How long after death does the thin film cover the eye if the eye is closed at death? within 24 hrs

**8. Stages of Decomposition of a Body**

| Stage | What happens during decomposition |
|---|---|
| Initial Decay | corpse appears normal on the outside, inside is starting to decompose from bacteria & autolysis |
| Putrefaction | odor of decaying flesh is present, corpse appears swollen |
| Black Putrefaction | very strong odor. parts of flesh appear black. gases escape & the corpse collapses. |
| Butyric Fermentation | corpse is beginning to dry out. most of the flesh is gone. |
| Dry Decay | corpse is almost dry. any further decay is slow because of a lack of moisture. |

Blowfly

W/i minutes of death, blowflies arrive to lay eggs. Eggs hatch into larva 1 (instar 1) within 2 days. Then larva 1 turn into larva 2 (instar 2), this stage lasts 3 days. Larva 3 comes after 4-5 days, Then pre-pupa after 8-12 days, pupa after 18-24 days, & new adults after 21-24 days

After blowflies, tiny wasps lay eggs on maggots on the body. cheese skippers come once putrefaction begins. mites & beetles arrive once corpse starts drying out

**9. Insects**

a. What is the progression of insects through a body?

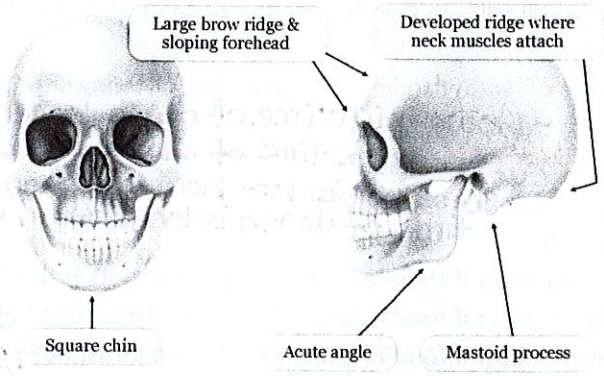
**Forensic Anthropology (Bones)**

10. How do bones develop?
11. What are 3 ways that bones connect? (1) cartilege (2) ligaments (3) tendons
12. How do bones age? What condition occurs when the bones lost calcium and it is not replaced?
    ↳ bones deteriorate, or break down, faster than they are built. If calcium is lost, osteoporosis develops

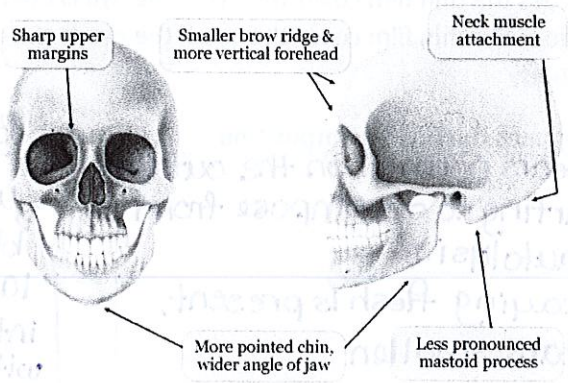
↳ Bones begin as cartilage. Osteoblasts move to the center of the cartilage & deposit calcium phosphate which hardens to form bone, in a process called ossification. Trapped osteoblasts are called osteocytes.

13. How to distinguish male from female bones:

**a. Skull**

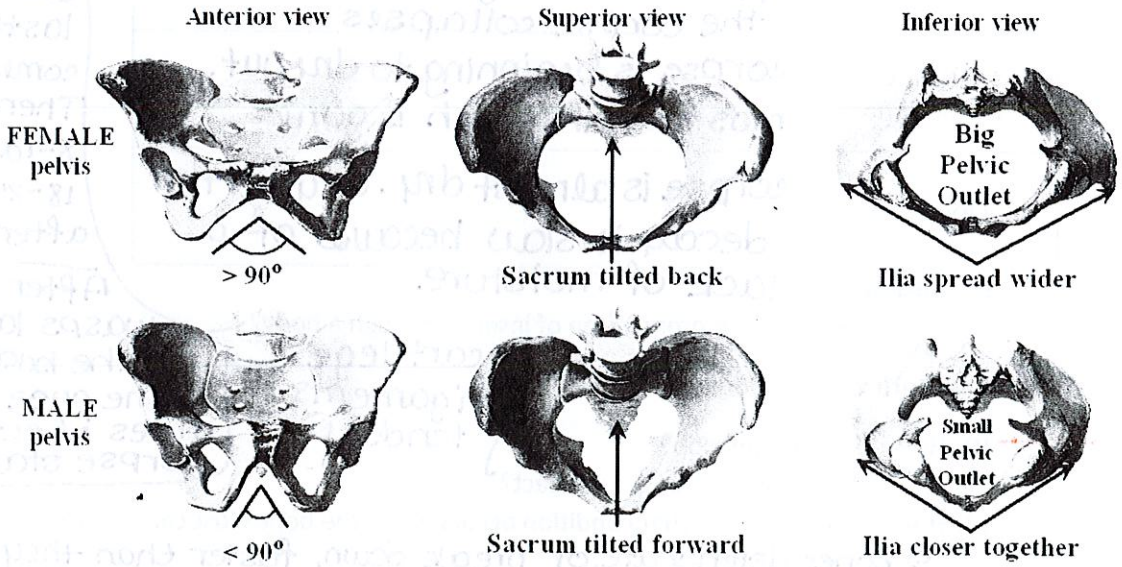



Male Skull

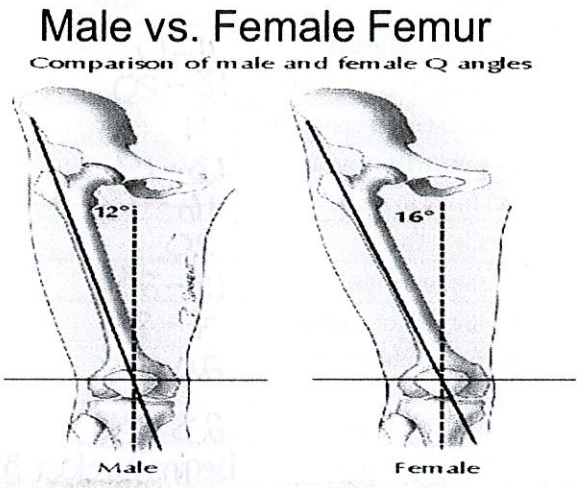



Female Skull

**b. Pelvis**

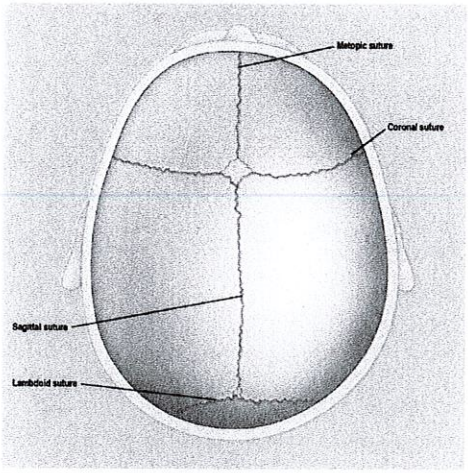


c. **Thigh Bone**



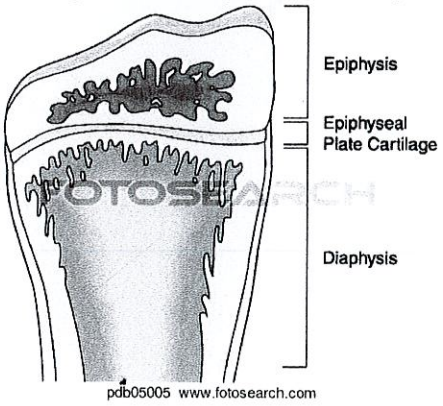

**14. How to determine the age of bones**

a. Suture Marks in the Skull




- Coronal suture closes at age 50.
- Lambdoidal suture begins closing at 21, accelerates at age 26, and closes at 30.

b. Cartilaginous Lines (Growth Plates)




Babies are born with more than 450 bones. Adults have 206 bones.

As cartilage is slowly replaced with bone, the plate slowly disappears.

c. Estimation of Age Using Bones – Fill in the chart

| Region | Bone | Age |
|---|---|---|
| Arm | humerus bone (head fused) | 4-6 |
| | humerus bones (head fused to shaft) | 18-20 |
| Leg | femur (greater trochanter 1st appears) | 4 |
| | femur (less trochanter 1st appears) | 13-14 |
| | femus (head fused to shaft) | 16-18 |
| | condyles join shaft | 20 |
| Shoulder | clavicle & sternum close | 18-24 |
| Pelvis | pubis, ischium are almost united | 7-8 |
| | ileum, ischium, & pubic bones fully ossified | 20-25 |
| | all segments of sacrum united | 25-30 |
| Skull | lombdoidal suture closed | begins 21, close 30 |
| | sagittal suture closed | 32 |
| | coronal suture closed | 50 |

d. How to Estimate Height

**Figure 13-20.** *Height estimation formula.*

*Bone length for American Caucasian males.*

| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Height (cm) = 2.89 × humerus | + 78.10 cm | ± 4.57 |
| Height (cm) = 3.79 × radius | + 79.42 cm | ± 4.66 |
| Height (cm) = 3.76 × ulna | + 75.55 cm | ± 4.72 |
| Height (cm) = 2.32 × femur | + 65.53 cm | ± 3.94 |
| Height (cm) = 2.60 × fibula | + 75.50 cm | ± 3.86 |
| Height (cm) = 1.82 × (humerus + radius) | + 67.97 cm | ± 4.31 |
| Height (cm) = 1.78 × (humerus + ulna) | + 66.98 cm | ± 4.37 |
| Height (cm) = 1.31 × (femur + fibula) | + 63.05 cm | ± 3.62 |

*Bone length for American Caucasian females.*

| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Stature (cm) = 3.36 × humerus | + 57.97 cm | ± 4.45 |
| Stature (cm) = 4.74 × radius | + 54.93 cm | ± 4.24 |
| Stature (cm) = 4.27 × ulna | + 57.76 cm | ± 4.30 |
| Stature (cm) = 2.47 × femur | + 54.10 cm | ± 3.72 |
| Stature (cm) = 2.93 × fibula | + 59.61 cm | ± 3.57 |

*Bone length for Caucasians, both sexes.*

| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Stature = 4.74 × humerus | + 15.26 cm | ± 4.94 |
| Stature = 4.03 × radius | + 69.96 cm | ± 4.98 |
| Stature = 4.65 × ulna | + 47.96 cm | ± 4.96 |
| Stature = 3.10 × femur | + 28.82 cm | ± 3.85 |
| Stature = 3.02 × tibia | + 58.94 cm | ± 4.11 |
| Stature = 3.78 × fibula | + 30.15 cm | ± 4.06 |

*Bone length for African-American and African males.*

| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Height (cm) = 2.88 × humerus | + 75.48 cm | ± 4.23 |
| Height (cm) = 3.32 × radius | + 85.43 cm | ± 4.57 |
| Height (cm) = 3.20 × ulna | + 82.77 cm | ± 4.74 |
| Height (cm) = 2.10 × femur | + 72.22 cm | ± 3.91 |
| Height (cm) = 2.34 × fibula | + 80.07 cm | ± 4.02 |
| Height (cm) = 1.66 × (humerus + radius) | + 73.08 cm | ± 4.18 |
| Height (cm) = 1.65 × (humerus + ulna) | + 70.67 cm | ± 4.23 |
| Height (cm) = 1.20 × (femur + fibula) | + 67.77 cm | ± 3.63 |

*Bone length for African-American and African females.*

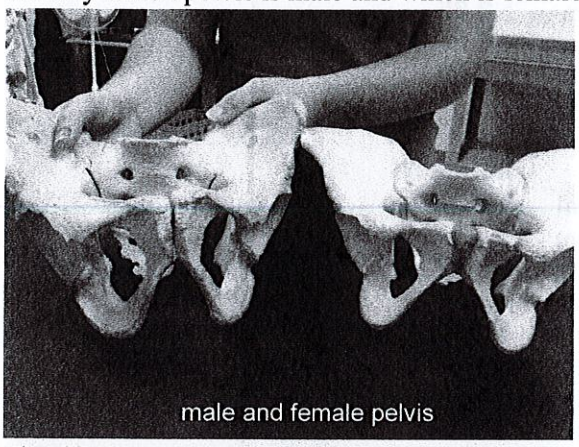
| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Stature = 3.08 × humerus | + 64.67 cm | ± 4.25 |
| Stature = 3.67 × radius | + 71.79 cm | ± 4.59a |
| Stature = 3.31 × ulna | + 75.38 cm | ± 4.83 |
| Stature = 2.28 × femur | + 59.76 cm | ± 3.41 |
| Stature = 2.49 × fibula | + 70.90 cm | ± 3.80 |

*Bone length for All ethnic groups or, if ethnicity is unknown, both sexes.*

| **Factor × bone length** | **plus** | **Accuracy** |
|---|---|---|
| Stature = 4.62 × humerus | + 19.00 cm | ± 4.89 |
| Stature = 3.78 × radius | + 74.70 cm | ± 5.01 |
| Stature = 4.61 × ulna | + 46.83 cm | ± 4.97 |
| Stature = 2.71 × femur | + 45.86 cm | ± 4.49 |
| Stature = 3.01 × femur | + 32.52 cm | ± 3.96 |
| Stature = 3.29 × tibia | + 47.34 cm | ± 4.15 |
| Stature = 3.59 × fibula | + 36.31 cm | ± 4.10 |

Practice Problems:

15. A body was found with lividity on his back, buttocks, and the heels of his feet that turned white when pressed. Estimate how long ago he died?
16. A body was found to have permanent lividity after being found outside on a warm night. He had rigor everywhere except in his head. How long ago did he die?
17. A body was found in an abandoned house with no lividity or rigor mortis. How long ago did she die?
18. A body was found in an alley. Permanent lividity was present on her abdomen, face, and upper thighs. She has rigor in her hips and legs and her stomach and small intestine were empty but food was found in her large intestine. How long ago did she die?
19. A body was found lying in the grass in the park on a warm night at midnight. Her internal body temperature was 33°C. Calculate the time of death.
20. A body was found inside the kitchen of a house. The man's body temperature was 25°C. Calculate the time of death. Blowfly eggs and larva 1 (instar 1) were found on the body.
21. A body of an ill man was found to have a temperature of 36°C. His wife mentioned that she had taken his temperature before going to bed and his fever was 39°C. Calculate the time of death.
22. Identify which pelvis is male and which is female? Explain your answers.


male and female pelvis

23. Identify the male and female skull. Explain your answers.

24. Estimate the height of these individuals.
    a. Caucasian male femur – 50.6cm.
    b. African-American female femur – 49.5cm.
    c. African-American male humerus – 39.94cm.
    d. Causasian female ulna – 23.4cm

15. He died between 2 and 8 hours ago

16. According to livor mortis, at least 8 hours ago.
According to rigor mortis, he is past full rigor, which occurs at 12 hours after death. So estimate he died between 12-18 hours ago

17. According to livor mortis, there is no lividity, 0-2 hours.
According to rigor mortis, there isn't any so she died either 0-2 hours ago or after 36 hours. She died 0-2 hours ago

18. According to livor mortis, at least 8 hours ago.
According to rigor mortis, at least 24-36 hours ago because the only place she still has rigor is in her hips & legs.
If food was found in her large intestines only, she been dead at least 12 hours. She died 24-36 hours ago.

19. $\begin{array}{r} 37°C \\ -\ 33°C \\ \hline 4°C \end{array}$ $\quad \frac{4°C}{.78°C/hr} =$ 5.13 hours ago or 5 hours 8 mins.

20. $\begin{array}{r} 37°C \\ -\ 25°C \\ \hline 12°C \end{array}$ $\quad \frac{12°C}{.78°C/hr} =$ 15.38 hrs. more than 12 hours

$\begin{array}{r} 12°C \\ -\ 9.36°C \\ \hline 2.64°C \end{array}$ $\quad \frac{2.64°C}{.39°C/hr} =$ 6.77 hrs

6.77 hrs + 12 hrs = 18.76 hours ago or 18 hours & 46 min

21. $\begin{array}{r} 39°C \\ -\ 36°C \\ \hline 3°C \end{array}$ $\quad \frac{3°C}{.78°C} =$ 3.85 hours ago or 3 hours, 51 min.

22. Pelvis: Left = male, right = female

23 Skull: Left = male, right = female

24 a) $(2.32 \times 50.6\text{cm}) + 65.53\text{cm} = 117.392 + 65.32 = 182.71\text{cm}$

b) $(2.28 \times 49.5\text{cm}) + 59.76\text{cm} = 112.86 + 59.76 = 172.62\text{cm}$

c) $(2.88 \times 39.94\text{cm}) + 75.48\text{cm} = 115.027 + 75.48 = 190.51\text{cm}$

d) $(4.27 \times 23.4\text{cm}) + 57.76\text{cm} = 99.918 + 57.76 = 157.68\text{cm}$