OSPE- Amphibian graphs.1

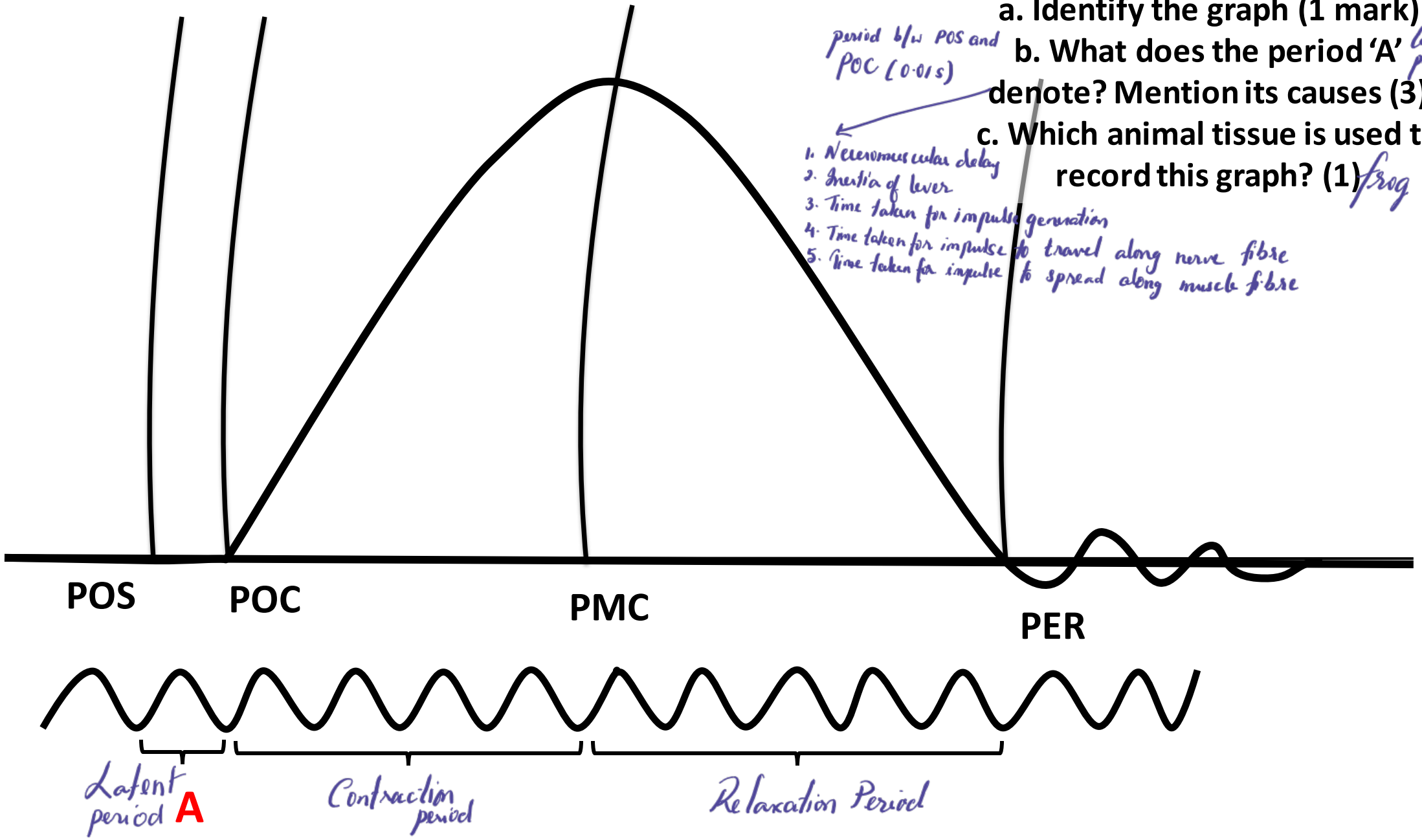
1

Simple Muscle curve

a. Identify the graph (1 mark)

b. What does the period 'A' denote? Mention its causes (3)

c. Which animal tissue is used to record this graph? (1)



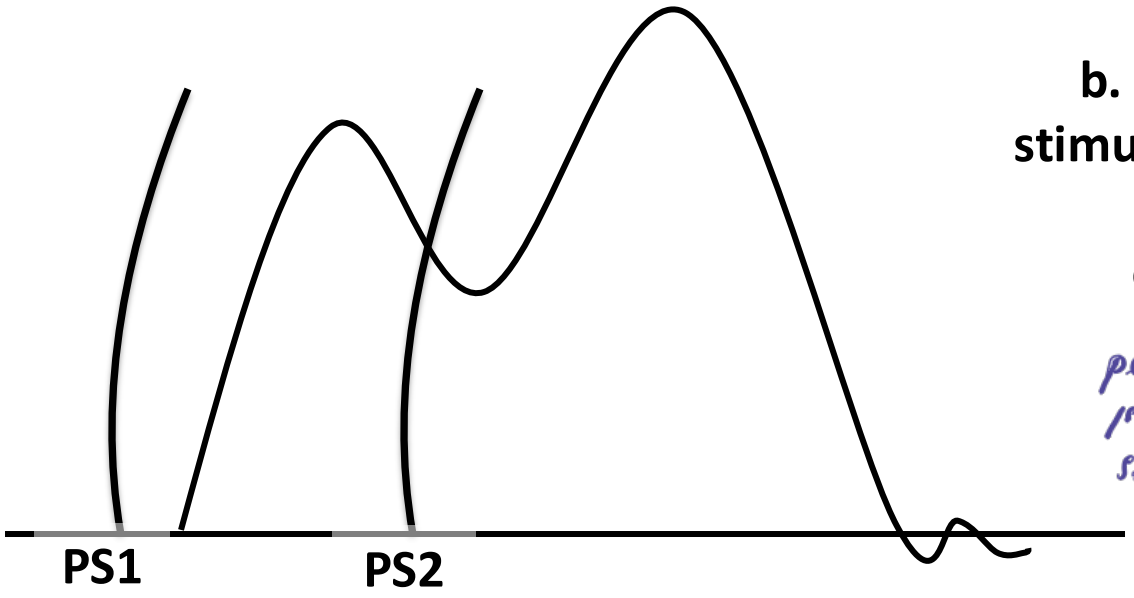
latent period

period b/w POS and POC (0·01 s)

1. Neuromuscular delay
2. Inertia of lever
3. Time taken for impulse generation
4. Time taken for impulse to travel along nerve fibre
5. Time taken for impulse to spread along muscle fibre

frog

2



PS – Relaxation Phase

Superimposition

PS – Relaxation Phase

a. Identify the graph (1mark) Superimposition

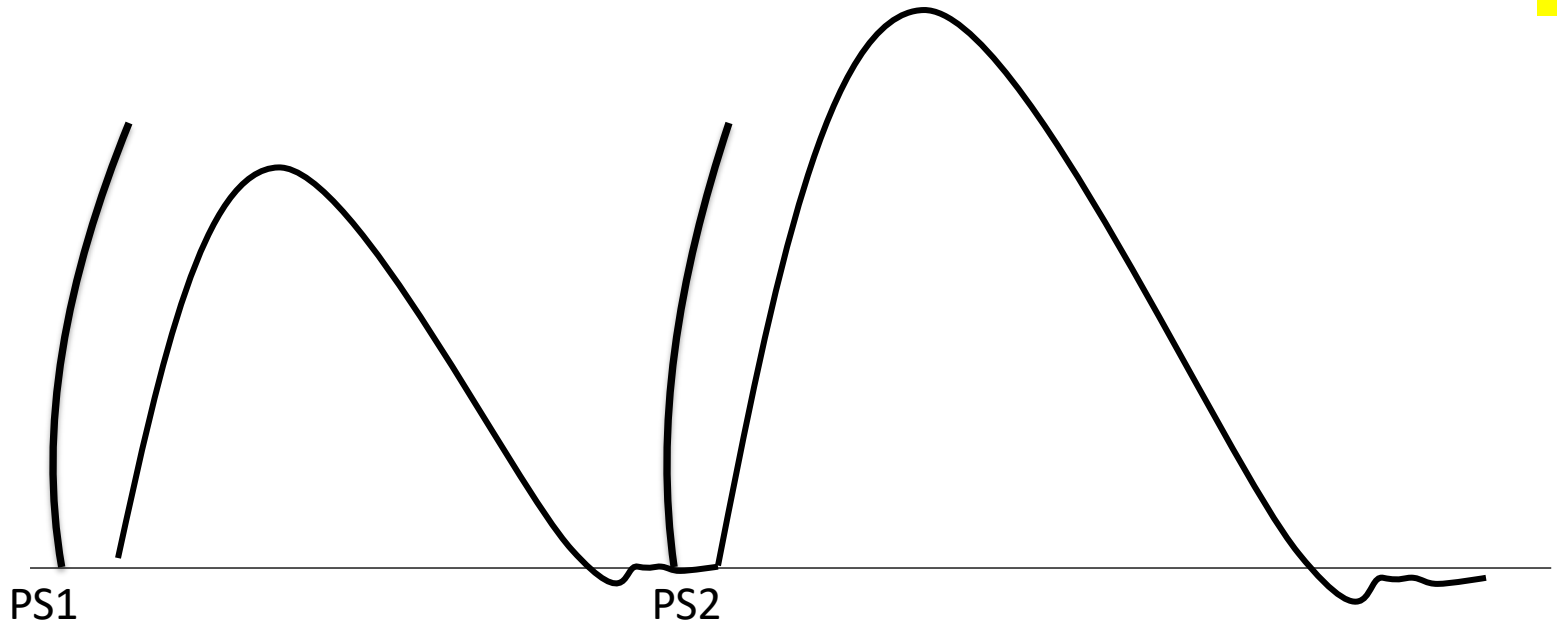
b. What is the effect if the second stimulus falls during the latent period of first contraction? why?(3) We get a curve resembling a simple muscle twitch with 2 PDs. This is because the skeletal muscle is refractory to stimulation during the latent period.

c. Define refractory period (1)

period after the application of the 1st stimulus during which a 2nd stimulus of adequate strength fails to produce a response

- **absolute** – period during which 2nd stimulus will not produce a response whatever the intensity of the stimulus
- **Relative** – period during which a 2nd stimulus of stronger intensity can produce a response.

3



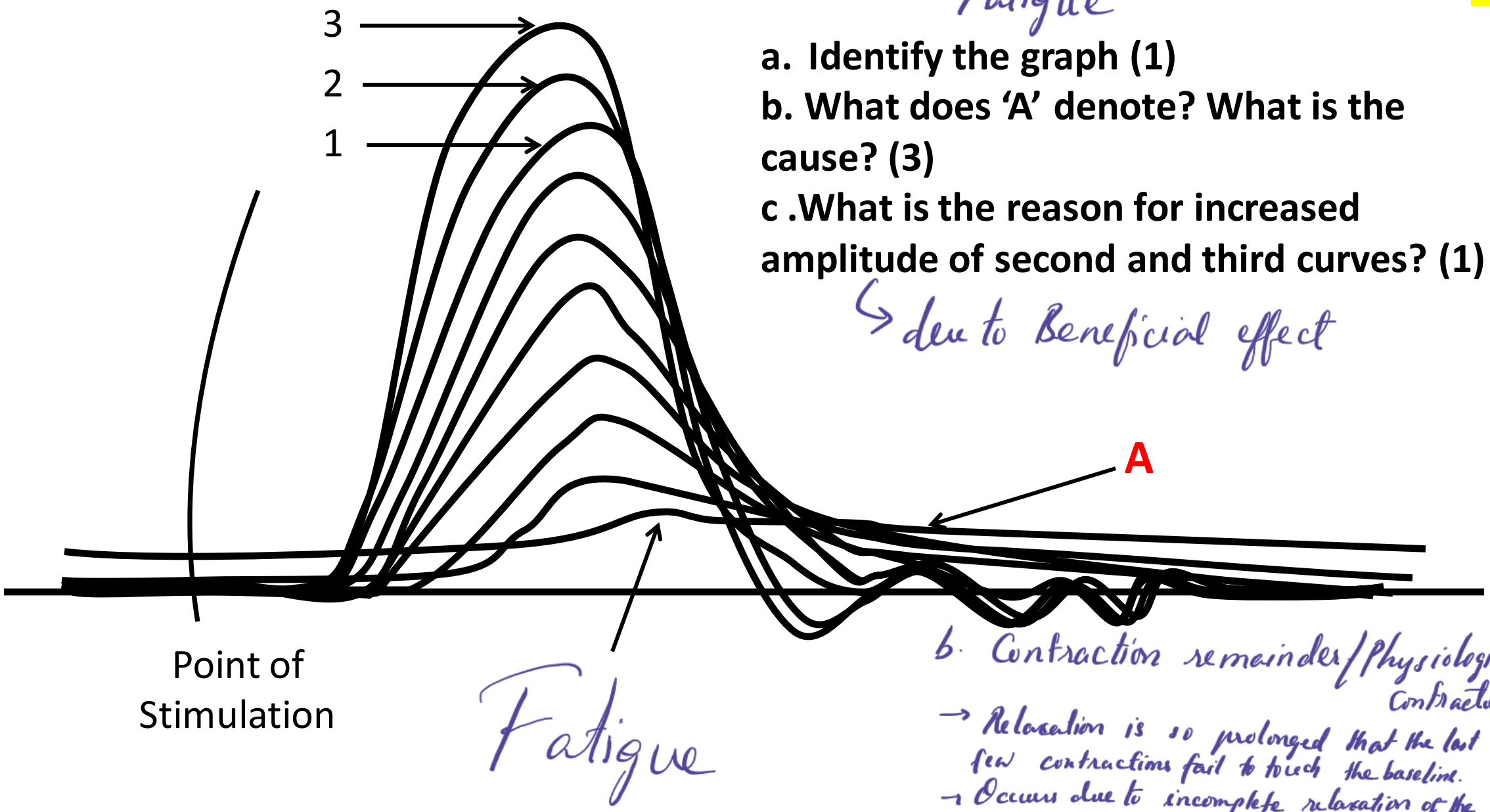
PS – After the first twitch Beneficial effect

a. **Identify the graph (1)**
b. **What is the reason for higher amplitude of second curve? (3)**
c. **Give one practical example for this effect (1)**

When 2nd stimulus falls after the complete relaxation of previous muscle twitch, a curve with greater amplitude is obtained – beneficial effect

Reasons: ∘ Ca^{2+} accum. in sarcoplasm due to previous contraction
∘ Viscoelastic changes.
∘ Rise in temperature ∘ Decrease in pH due to ↑ Lactic acid formation

Fatigue



a. Identify the graph (1)

b. What does 'A' denote? What is the cause? (3)

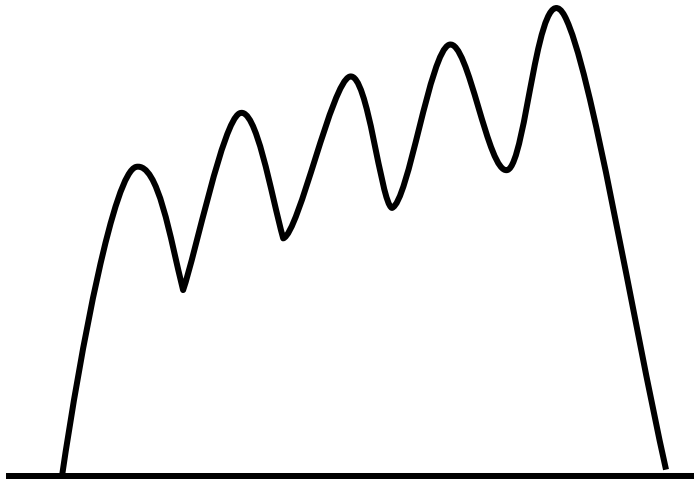
c .What is the reason for increased amplitude of second and third curves? (1)

↳ due to Beneficial effect

b. Contraction remainder / Physiological Contracture

→ Relaxation is so prolonged that the last few contractions fail to touch the baseline.

→ Occurs due to incomplete relaxation of the muscle due to ATP depletion (Lack of ATP or due to improper functioning of Ca^{2+} pump)



15stimuli/sec

5

Clonus / Incomplete tetanus

a. Identify the graph (1)

b. How is it different from Tetanus? (3)

c. What is treppe? (1)

→ At a frequency of 15/s, subsequent curves are superimposed on the previous one and partial fusion of mechanical events – clonus / incomplete tetanus occur.

→ This is due to subsequent stimuli falling during the relaxation period of the previous contraction.

At a frequency of 5/s, the individual contractions are recorded separately but the subsequent contractions show beneficial effect – Treppe or Staircase phenomenon

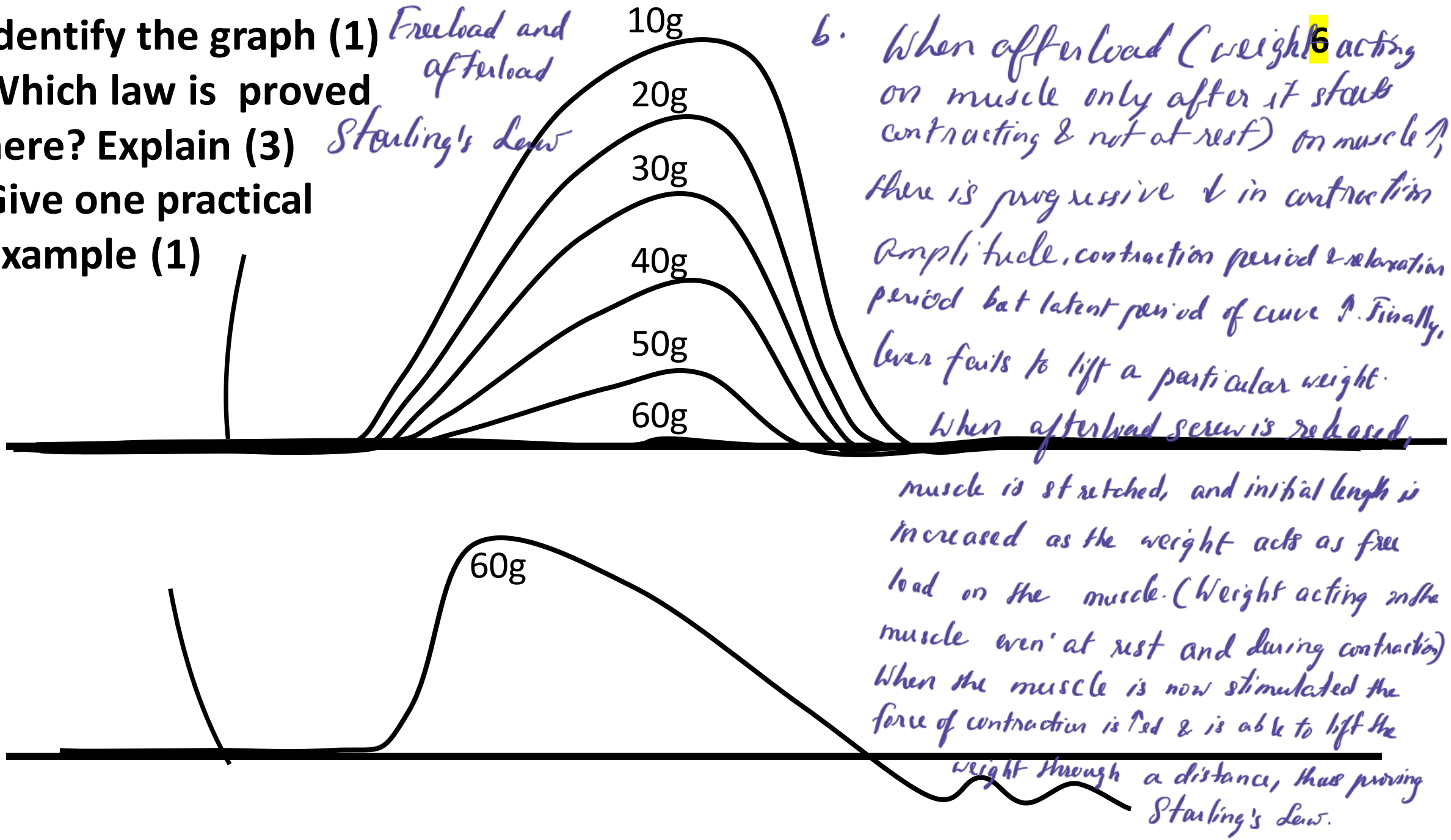
a. **Identify the graph (1)**

b. **Which law is proved here? Explain (3)**

c. **Give one practical example (1)**

Freeload and afterload

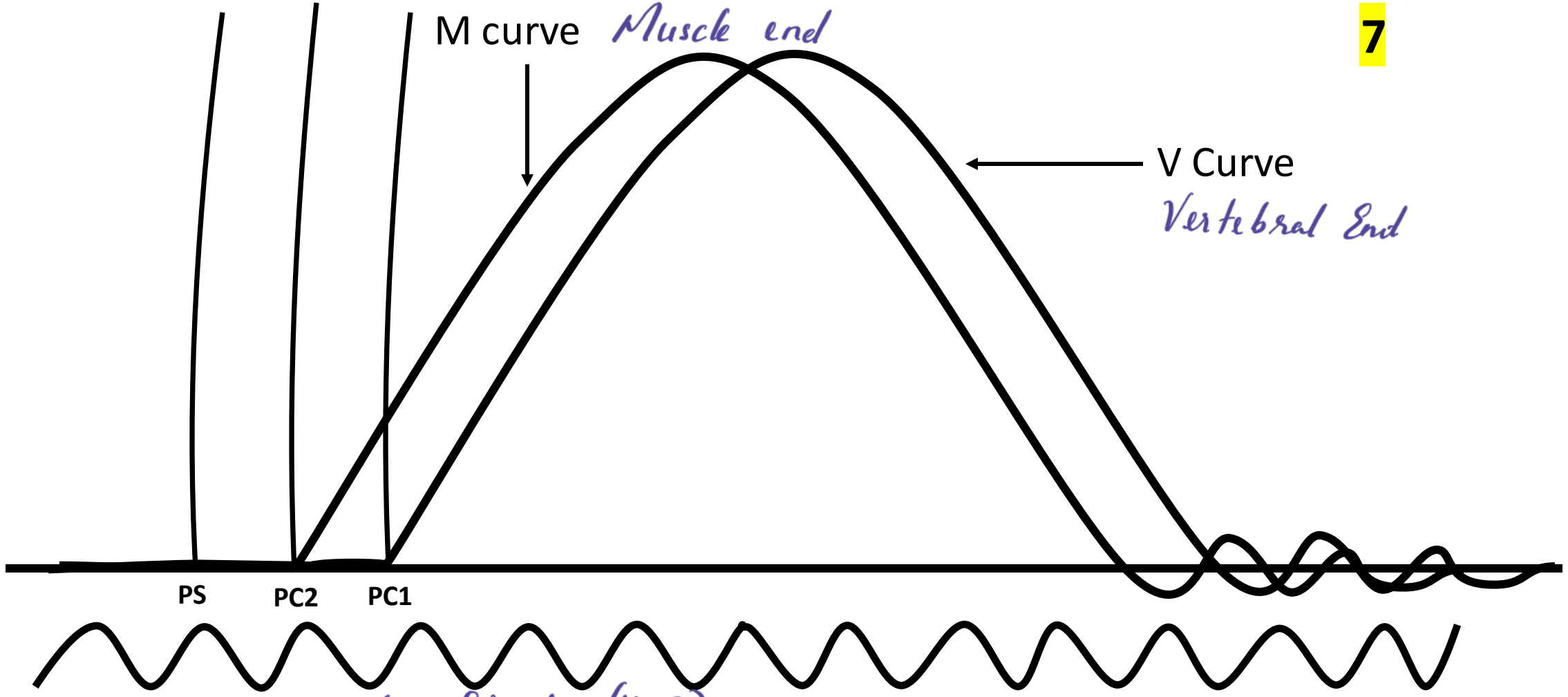
Starling's Law



6

b. When afterload (weight acting on muscle only after it starts contracting & not at rest) on muscle ↑, there is progressive ↓ in contraction Amplitude, contraction period & relaxation period but latent period of curve ↑. Finally, lever fails to lift a particular weight.

When afterload screw is released, muscle is stretched, and initial length is increased as the weight acts as free load on the muscle. (Weight acting on the muscle even at rest and during contraction) When the muscle is now stimulated the force of contraction is ↑ed & is able to lift the weight through a distance, thus proving Starling's Law.



Velocity of Nerve Impulse

a. **Identify the graph**

b. **What are the factors affecting nerve conduction velocity?**

c. **What does 'M ' and "V' denote in the graph?**

b.
- Diameter ($V \propto D$)
- Myelination ($V \propto M$)
- Temperature ($V \propto T$)
  - $T > 43°C$ ↓ v
  - T ↓↓ ↓ v or even stops it
- Fatigue (↓)
- Injury, Hypoxia
- Pressure on nerve (↓ v), drugs (anaesthesia & narcotics)

8

30 stimuli/s

a. Identify the graph (1)
b. How is it different from clonus? (3)
c. Do this type of contractions occur in human body? (1)

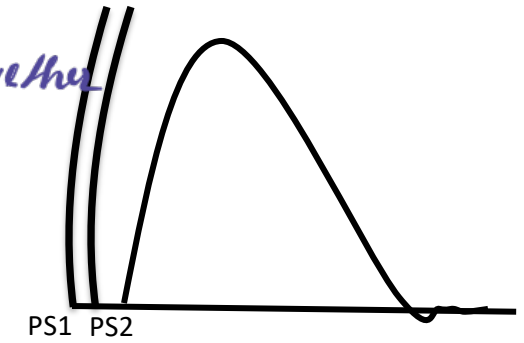
- When second stimulus falls in contraction period of 1st contraction, we get a taller and wider curve with 2 PDS ⇒ Summation
- Mechanical effect of stimuli are fused together
- Two types

Quantal

Strength is ↑ed so that no. of motor units contracting is ↑ed.

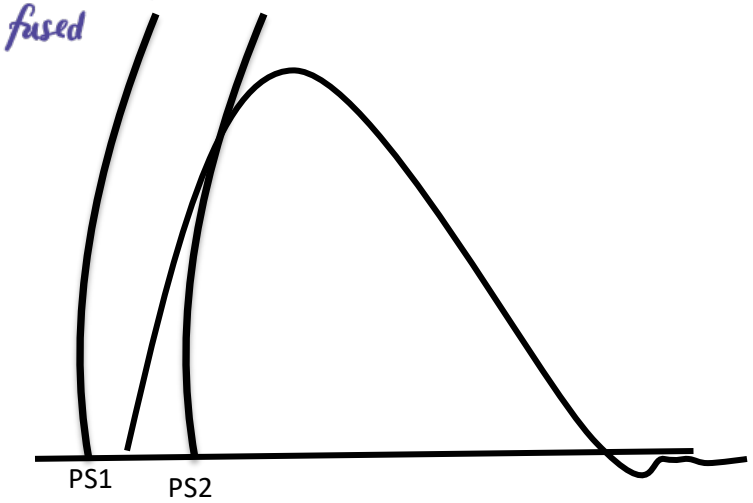
Wave

Stimuli are of same strength but frequency ↑ed & contractions/ waves are fused



PS – 2nd half of 1 P

Wave/ Temporal Summation



PS - Contraction Phase

Quantal/ Wave Summation

a. **What are the differences between the two curves? (3)**
b. **Define and explain two types of summation (2)**