

# 12.1 Sensation, perception and psychophysics: evidence and transfer

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ Total: 8 marks

KEY WORDS difference threshold • transduction

## Objective

Distinguish thresholds, Weber’s law and signal-detection measures; Trace transduction from physical stimulus to neural signal; Apply perceptual organisation and categorical perception principles. Original practice and authored marking guidance.

## 1 Key knowledge and worked examples

**difference threshold** : The minimum detectable change in a stimulus, a constant fraction of the baseline by Weber’s law. **transduction** : Conversion of physical stimulus energy into neural signals by receptors.

A threshold is defined by a detection criterion under specified conditions, often 50% detection for an absolute threshold, rather than a sharp physical boundary between always seen and never seen. Weber’s approximation predicts changes proportional to a baseline within its useful range. Transduction changes energy into neural signalling; perception groups and interprets that input. A change in reporting incentives primarily concerns decision criterion, while changes in physical contrast may affect sensitivity.

Signal detection: four outcomes separate sensitivity from bias

|             | Signal present | Signal absent     |
|-------------|----------------|-------------------|
| Respond yes | Hit            | False alarm       |
| Respond no  | Miss           | Correct rejection |

**Worked case.** With a fictional Weber fraction  $k=.03$ , estimate the just noticeable difference for 100 g and 300 g baselines.

$\Delta I/I=k$ , so  $\Delta I=kI$ .  $\Delta I=.03\times100\text{ g}=3\text{ g}$ ;  $\Delta I=.03\times300\text{ g}=9\text{ g}$ . The fraction is dimensionless and the result has the baseline’s unit. A constant 3 g prediction at both baselines would ignore the proportional model. The approximation does not establish identical thresholds for all observers or intensities.

## 2 Practice

**2.1** With Weber fraction  $k=.02$ , the just noticeable difference for a 250 g baseline is: [1]

A. 0.02 g B. 2 g C. 5 g D. 25 g E. 50 g

**2.2** After a payoff change, an observer says yes more often while the stimulus is unchanged. In signal detection theory, what moved? [1]

A. sensitivity  $d'$  B. the response criterion C. the absolute threshold D. the Weber fraction E. receptor transduction

**2.3** Revisit the worked case. State one conclusion its evidence supports and one stronger conclusion it does not support. Explain the difference. [2]

## 3 Exam-style questions

**3.1** A listener says yes on more signal and more noise trials after a warning. Explain why sensory adaptation is not the only or best initial explanation. Give the interpretation, supporting reasoning, a relevant alternative or limitation, and an appropriate check. [4]

## Solutions

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**2.1** Answer: C.  $\Delta I = k \times I = .02 \times 250 = 5$  g. The other options do not satisfy the stated defining conditions.

**2.2** Answer: B. Payoffs move the criterion (bias); sensitivity depends on the signal and noise distributions. Compare the exact process, design or evidence, rather than an associated keyword.

**2.3** Use the worked case evidence to support a bounded claim and explain why a causal, universal or stronger claim needs additional evidence. The claim must fit the specific design and observed process.

**3.1** A warning can shift the response criterion toward reporting a signal. Compare both hit and false-alarm rates, not hits alone. Sensory adaptation concerns changing sensory response during sustained stimulation; the warning manipulation does not by itself establish that process. A sensitivity analysis could test whether signal/noise separation also changed. Award B1 each (authored) for the interpretation, its reasoning, a relevant limitation/alternative and an appropriate check, up to four points. Accept a different justified answer satisfying these demands.