A4 A What is innate behaviour? (p 534)
Behaviours that develops independently of environmental context (it is not learned) and it is present at birth

Has a genetic basis and is inherited (usually shared by most members of a population, perhaps with some variation on how it presents)

Innate behaviour is acted on by Natural Selection (so it must have a genetic basis), as it increases your chances of surviving to reproduce, the behaviour increases in subsequent generations

Innate behaviour ensures survival PRIOR to learning (early in life)

Examples of innate behaviour:
**Taxis:** directional response towards or away from a stimulus
Ex, phototaxis: move towards the light
positive phototaxis ex. Euglena a single celled protest is **photosynthetic and moves towards light.**
Negative phototaxis: move away from the light, ex. Blowfly larvae, eat carrion(dead organism), move away from light and further into the dead organism

**Kinesis:** Rate of movement is related to the intensity of stimulus (non-directional) Ex. Wood lice will move MORE often in dry conditions, random-NOT directional, looking for a more humid location
A4 B Autonomic and involuntary responses are referred to as reflexes. (p 535)

Involuntary: not under conscious control
*the autonomic nervous system is a division of the peripheral nervous system

**Reflex**: a rapid unconscious response to a stimulus, many reflexes are controlled by the autonomic nervous system ex. Pupil reflex Doesn’t require input from the brain

**Stimulus**: a change in the environment (internal or external) that is detected by a receptor and elicits a response.

**Response**: a change in an organism produced by a stimulus ex. movement

- Swallowing is often given as an involuntary /autonomic response, co-ordinated by the medulla oblongata of the brain and voluntarily by the cerebral cortex.
Ex. Withdrawal reflex of the hand from a painful stimulus. (p 536) SEE NEXT PAGE FOR OTHER NECESSARY DETAILS

Pain withdrawal reflex is an innate response to pain, Touching a hot object-you remove your hand quickly without conscious thought
A pain receptor senses the heat and this and elicits a very fast INVOLUNTARY response, the reflex goes through the spinal cord and bypasses the brain (this makes it faster!), this increases your chance of survival. (brain still receives the information and more complex response may occur after)
Reflex arcs comprise the neurons that mediate reflexes. (p 535)

A reflex arc is composed of an impulse travelling from a receptor through a sensory neuron to a relay/interneuron in the Central Nervous System to a motor neuron which then causes an effector (such as a muscle or gland)

(a reflex is usually through the spinal cord, such as te pain withdrawal reflex, however in SL we will discuss the blink reflex is a cranial reflex and goes through the brain given the close proximity of the eye to the brain it is the shortest distance)
**Drawing and labelling** a diagram of a reflex arc for a pain withdrawal reflex. (p 536)

You must be able to draw this—however this is often a LABEL question:

*on a diagram the ventral side has more of an indent*
A4 E Learned behaviour develops as a result of experience. (p536- 537)

Learned behaviour is acquired by experience and modification of behaviour in light of further experiences. Offspring learn from their parents, the environment is constantly changing so learning is important to ensure survival. Ex Koko the gorilla learning sign language, Dolphins learning to hunt together.

The role of inheritance and learning in the development of birdsong. (p 537) Do data based below from p 537

( the image above is a sonogram, listen to this video of the bird song so you understand how biologist take sound and convert into a sonogram:  https://www.allaboutbirds.org/guide/Black-capped_Chickadee/sounds)


Birds sing to attract mate, mark territory, communicate (alert). Both learning and innate behaviour are important in bird song. A “template” /basic song is inherited and then refined by learning and hearing others in their population. Song is learned early in development (there is plasticity) but it will become fixed after a critical period of development.

LOOK carefully at p 537 you can see that a bird raised in captivity NEVER hearing any other birds sing will have a very basic form of its species bird song. If it is raised with birds from another species its song is a mix of the innate inherited template and the learning from its environment.
A4 D Reflex conditioning involves forming new associations. (p 538)

Reflex conditioning is a type of ___LEARNING_________ that involves forming ____NEW___ associations by establishing new pathways in the brain by associating new stimuli.

Ex. Pavlov’s experiments into reflex conditioning in dogs. (p 538)
A hungry dog salivates when it sees or smells food (the smell/sight of the food is the unconditioned stimulus). A second stimulus (bell/metronome) not related to food is introduced. After consistently hearing a bell at the same time as food was seen or smelled, a dog forms a NEW association and becomes *conditioned* to salivate when the bell rings even when food is NOT seen or smelled. **Watch this video:** [https://www.youtube.com/watch?v=hhqumfpxuzI](https://www.youtube.com/watch?v=hhqumfpxuzI)

*Unconditioned stimulus*: type of stimulus responded to without learning (reflexive), ex. Smell of food

*Conditioned stimulus*: another stimulus ASSOCIATED with the first stimulus ex. Sound of the BELL

*Unconditioned response*: response to the unconditioned stimulus ex. Salivating when food is smelled/seen

*Conditioned response*: response to conditioned stimulus, ex. Salivate when hears bell EVEN if no food LEARNING HAS OCCURRED with the association to the 2 stimuli
A4 F **Imprinting is learning** occurring at a particular life stage and is independent of the consequences of behaviour. (p 539)

Imprinting only occurs at a particular stage of life, it is rapid and independent of the consequences of behaviour, it usually involves the establishment of trust and recognition.

Ex. young geese _imprint_ on large moving object in _early critical period_ of development (13-16 hours after hatching) regardless of the consequences!

Ex. in the photo the goslings have imprinted on an adult human...other cute videos seen with dogs/geese etc.

A4 G **Operant conditioning is** a form of learning that consists of trial and error experiences. (p 539)

More complex than reflex conditioning, it is learning by trial and error, EX. Association between a behaviour and resulting consequence of the behaviour

Reflex conditioning is initiated by an environmental stimulus, whereas operant conditioning involves an animal testing a behaviour to see what the consequences are.
IF the results are positive or negative the behaviour pattern is either reinforced or inhibited.

Ex. Lambs not touching an electric fence after accidentally touching it (modified behaviour in light of the consequence..learning has occurred)

This chart is probably extra information, it is unclear how much detail is needed for operant conditioning, watch this video for a funny example: https://www.youtube.com/watch?v=LhI5h5JZi-U

<table>
<thead>
<tr>
<th></th>
<th>Reinforcement <strong>INCREASE</strong> a behaviour</th>
<th>Punishments <strong>DECREASE</strong> a behaviour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Positive</strong></td>
<td>I give you a candy (you want this positive stimulus) for being on time, you come to class on time more so your behavior <strong>INCREASES</strong> (positive reinforcement)</td>
<td>I give you a detention (applying a negative stimulus) for swearing, you stop swearing (decreasing behavior) to avoid the adverse stimulus</td>
</tr>
<tr>
<td><strong>Negative</strong></td>
<td>You get a bad mark on a test (you are trying to avoid this negative stimulus) and you study MORE so your behavior <strong>INCREASES</strong></td>
<td>I remove cell phone privileges (took away a pleasing stimulus) to get you to <strong>DECREASE</strong> the behavior of swearing in class</td>
</tr>
</tbody>
</table>
Learning is the acquisition of skill or knowledge. (p 539 – 540)

Learning is a higher order brain function, social organisms can learn from others. Define learning as: act of acquiring, new or modifying existing knowledge, behaviour and skills. Learning increases the chances of survival. (*but learning is NOT coded into our DNA or genes, the ability to learn may be but what you learn is NOT passed directly to your offspring in DNA-be careful not to imply this in any long answer questions*).

Motor skills can be learned over a lifetime ex. Language, hunting, foraging,

Knowledge can be learned ex. Which organisms are predators, eating something that tastes bad, avoiding touching a hot object, where to find food (hummingbird) or water (elephants)
A4 I Memory is the process of encoding, storing and accessing information. (p 540)

Memory is also a higher order brain function, it involves encoding information, putting it into a form that can be stored, accessing memory is recall or retrieval of information to use in a thought process.

New synapses and pathways form (hippocampus and amygdala are parts of the brain involved in memory)

Involves changes in neurons by SLOW ACTING neurotransmitters

Short term memory depends on a change in the strength of existing neuron connections. Long term potentiation is a lasting increase in strength of a synaptic transmission.
Skills

**Analysis of data from invertebrate behaviour experiments in terms of the effect on chances of survival and reproduction. (p 534-535)**

*When we do experiments on invertebrates, we DO NOT use endangered animals, we do NOT cause pain or suffering, we use animals from a supply company and do NOT take them from the wild (unless they are quickly returned unharmed)*

Laboratory work is used often over field work b/c we can control more factors, however for innate behaviour work done in the field we allow animals to behave normally which is difficult in the lab. (Learning is best observed in the field.)

NOS

**Looking for patterns, trends and discrepancies—laboratory experiments and field investigations helped in the understanding of different types of behaviour and learning. (3.1) (p 534)**