**Subtopics:**

**A1 Neural Development**

**A2 The Human Brain**

**A3 Perception of Stimuli**

**Option A: Neurobiology & Behavior**

***EQs:*** *Can reason independent of sense perception ever give us knowledge? If our senses can be fooled by illusions, what are the implications for knowledge claims based on empirical evidence?*

***Major Understandings, Applications & Skills (Study Guide):***

*A1.  Neural Development*

Proficient:

* The neural tube of embryonic chordates is formed by infolding of ectoderm followed by elongation of the tube.
* Neurons are initially produced by differentiation in the neural tube.
* Immature neurons migrate to a final location.
* An axon grows from each immature neuron in response to chemical stimuli.
* Some axons extend beyond the neural tube to reach other parts of the body.
* A developing neuron forms multiple synapses.
* Synapses that are not used do not persist.
* Neural pruning involves the loss of unused neurons.
* The plasticity of the nervous system allows it to change with experience.

Exceeds:

* Application: Incomplete closure of the embryonic neural tube can cause *spina bifida.*
* Application: Events such as strokes may promote reorganization of brain function.
* Skill: Annotation of a diagram of embryonic tissues in *Xenopus*, used as an animal model, during neurulation.

*A2. The Human Brain*

Proficient:

* The anterior part of the neural tube expands to form the brain.
* Different parts of the brain have specific roles.
* The autonomic nervous system controls involuntary processes in the body using centres located mainly in the brain stem.
* The cerebral cortex forms a larger proportion of the brain and is more highly developed in humans than other animals.
* The human cerebral cortex has become enlarged principally by an increase in total area with extensive folding to accommodate it within the cranium.
* The cerebral hemispheres are responsible for higher order functions.
* The left cerebral hemisphere receives sensory input from sensory receptors in the right side of the body and the right side of the visual field in both eyes and vice versa for the right hemisphere.
* The left cerebral hemisphere controls muscle contraction in the right side of the body and vice versa for the right hemisphere.
* Brain metabolism requires large energy inputs.

Exceeds:

* Application: Visual cortex, Broca’s area, nucleus accumbens as areas of the brain with specific functions.
* Application: Swallowing, breathing and heart rate as examples of activities coordinated by the medulla.
* Application: Use of the pupil reflex to evaluate brain damage.
* Application: Use of animal experiments, autopsy, lesions and fMRI to identify the role of different brain parts.
* Skill: Identification of parts of the brain in a photograph, diagram or scan of the brain.
* Skill: Analysis of correlations between body size and brain size in different animals.

A3. perception of Stimuli

Proficient:

* Receptors detect changes in the environment.
* Rods and cones are photoreceptors located in the retina.
* Rods and cones differ in their sensitivities to light intensities and wavelengths.
* Bipolar cells send the impulses from rods and cones to ganglion cells.
* Ganglion cells send messages to the brain via the optic nerve.
* The information from the right field of vision from both eyes is sent to the left part of the visual cortex and vice versa.
* Structures in the middle ear transmit and amplify sound.
* Sensory hairs of the cochlea detect sounds of specific wavelengths.
* Impulses caused by sound perception are transmitted to the brain via the auditory nerve.
* Hair cells in the semicircular canals detect movement of the head.

 Exceeds:

* Application: Red-green colour-blindness as a variant of normal trichromatic vision.
* Application: Detection of chemicals in the air by the many different olfactory receptors.
* Application: Use of cochlear implants in deaf patients.
* Skill: Labelling a diagram of the structure of the human eye.
* Skill: Annotation of a diagram of the retina to show the cell types and the direction in which light moves.
* Skill: Labelling a diagram of the structure of the human ear.

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***Key Terms:***

*Make a list of key terms as your read through the coversheet.*