GAUTENG DEPARTMENT OF EDUCATION SENIOR CERTIFICATE EXAMINATION

PHYSIOLOGY HG

POSSIBLE ANSWERS OCT / NOV 2006

SECTION A QUESTION 1

1.1 D 1.2 А 1.3 D 1.4 D С 1.5 В 1.6 С 1.7 В 1.8 1.9 А 1.10 D 1.11 А 1.12 D 1.13 В 1.14 D 1.15 В 1.16 D 1.17 А А 1.18 В 1.19 С 1.20 С 1.21 1.22 D 1.23 А 1.24 В 1.25 D 1.26 В 1.27 D 1.28 В 1.29 А 1.30 В

30 x 2= (60)

QUESTION 2

2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 2.10	A B A & B A & B B A & B NONE A A NONE	(10)
		QUESTION 3	
3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 3.10	Corpus luteum Acrosome/sperm Pancreas Bowman glands Circumvallate papilla Cones Adrenaline / epinephrine Hypothalamus Myelin sheath Renal capsule	(10)
		QUESTION 4	
4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9 4.10	Villi Umbilical cord Fallopian tubes Myometrium/ uterus Endometrium Amniotic fluid Amnion Foetus / Head of foetus Chorion		10)
4.10	CEIVIX	(10)

TOTAL FOR SECTION A: [90]

SECTION B QUESTION 5

5.1	5.1.1	Thyroid gland, Adrenal cortex, Cells of Leydig (interstitial cells) in Testis Ovaries	, (4)
	5.1.2	Thyroid stimulating hormone (TSH) Adrenocorticotrophic hormone (ACTH) Interstitial cell stimulating hormone (ISCH) Follicle stimulating hormone (FSH)	(4)
5.2	5.2.1	Adeno hypophysis / anterior lobe v	
	5.2.2	Somatothrophic hormone v	
	5.2.3	Musclesv and bonesv	(2)
	5.2.4	Calcitonin v	(1)
5.2.5	a)	Acromegalyv	(1)
	b)	Enlargement v of hands, feet vand jaws. Enlargement of nose and lipsv. The skin thickens as wellv. As the epiphysial plate in the long bones hav closed no lengthening of person.v	/e (3)
5.2.6	a)	Birthvv	(2)
	b)	From 0 to 2 yearsvv	(2)
	c)	60 – 70%v	(1)
	d)	Testis, breasts, ovariesvvv	(3)
	e)	14 v to 18 v years	(2)
	f)	Estrogenv, Testosteronev	(2)
	g)	Voice breaksv, skin thickensv more red blood cells producedv. Beard, pubic hair, hair under armpitsv, enlargements of genitalia, v spermatogenesis, muscles develop Any 4	. (4)

5.3 5.3.1 100 mg/100 ml blood of 3,5 – 5,5 m mol / litre blood

(1)

5.3.2 The degeneration of beta-cellsv of the islets of Langerhans causes hyposecretion of insulin. This causes diabetes mellitusv /sugar diabetes.

Symptoms of this disease are:

- tirednessv
- large volumes of diluted urinev/ polyuria
- glucose in the urinev
- polydipsia / thirstv

(6) **[40]**

QUESTION 6

6.1 6.1.1

		RODS		CONES]
Structure	ð	± 125 million on periphery of retina in each eye .	ð	± 6 million, of which most occur centrally in the retina, in each eye. In the yellow spot (macula lutea)/foyea centralis the highest	
	ð	Usually more slender and longer than the cones	ð	concentration of cones occurs. Cone-shaped	
	ð ð ð	Synapse with bipolar neurons Contains rhodospin as sensitive photopigment in the outer segment Vitamin A is important for the formation of rhodopsin	ð ð	Synapse with bipolar neurons Contains one of three phototpigments – photopsin or iodopsin (blue, green or red) in the outer segment. Vitamin A is important for the formation of photopsin	
Function	ð	Very light sensitive and distinguishes between light and dark	ð	Sensitive to colour and function in bright light Causes sharp and accurate vision especially if image is focused on the fovea centralis	(10)

	6.1.2	Circular and radial muscles			
	6.1.3	In bright light: circular muscles will contractv, the radial muscles will relaxv resulting in the constriction of the pupilv letting less light into the eye preventing UV rays from damaging the retina.	(4)		
	6.1.4	Aqueous humour/ watery fluidv Vitreous humourv	(2)		
	6.1.5	 (a) No.2 : blind spot (b) No.3 yellow spot/ fovea centralis/ macula lutea 	(2)		
6.2	6.2.1	 Scala vestibulum Reissner membrane/ vestibular membrane Scala media/ Scala tympani 			
		5. Cochlear nerve (5)		
	6.2.2	The organ of Cortivv (2)		
	6.2.3	 The vibrations of the oval window will cause wavesv in the perilymphv in the scala vestibulum causing the Reissner-membrane to vibratev This induces waves in the endolymphv of the scala media That will cause the basilar membranev to vibrate The stereocilliav of the sensory hair cellsv embedded on the basilar membranev will be stretched and bentv/ stimulated when the tectorial membrane touches itv The stimulus is converted into an impulse v which is conducted with the sensory neuronsv of the cochlear nervev to the temporal lobev of the cerebrumv and is then interpreted as a sound. (Any 10) (1) 	0)		
6.2.4 l i r		If a person is hit on the ear the tympanic membrane can burstv as the air in the external canal is compressed causing high pressure against the membrane v. Sound waves cannot be converted into vibrations, thus causing conduction deafness. (Any 3) ((3) 1 01		

(3) [**40]**

QUESTION 7

7.1	7.1.1	Secondary oocyte v	and the first polar bodyv	(2)
 7.1 7.1.1 S 7.1.2 2 7.1.3 Ir 7.1.3 Ir 7.1.4 T 7.1.5 T 7.1.6 T 7.1.7 D 7.1.7 D 7.1.7 D 9 7.2 Epididyn Vesicula Prostrate 		23v/ haploid amount	t	(1)
	7.1.3	In the Fallopian tube	eV .	(1)
	7.1.4	The diploid v zygote Each cell divides aga the morulav. On the blastocystv. The cell inner cell massv form wall in between.	v divides through mitosisv to form the two-cell stage.v ain and on the fourth dayv it forms a solid ball of cells, e seventh dayv it is a ball filled with fluidv, the lls in the outer wallv form the trophoblastv while the ms the amnionv and the yolk sacv with the embryonic (any 10)	(10)
	7.1.5	The fallopian tube do uterus and will not e	pes not have all the muscles and elasticityv of the xpand enoughv.	(2)
	7.1.6	The placenta will sep bleeding.v	parate from the uterine wall v causing excessive	(2)
	7.1.7	During pregnancy th secretionv thus prev Progesteronev and e pregnancy preventin	e placenta secretes estrogenv that inhibits FSHv renting the production and release of ovav. estrogen maintain the endometrium v during ig it from breaking downv resulting in menstruation.v	(5)
7.2	Epidic Vesic Prostr Cowp	dymis: v Secreta sperma ula seminalis: v rate gland: v ers' gland: v	es a substance to increase movementv of atozoa Secretes a substance to feedv spermatozoa Secretes an alkaline fluid to activatev the spermatozoa Secretes a sticky substance that provides lubrication and is a neutraliserv.	(8)
7.3	1. 2. 3. 4. 5.	Secondary spermato 2nd polar body Ovum Ovary Spermatogonium	osite	(5)
7.4	Body Sperr that a	cells/somatic cells have natozoa & ovum must fter fertilisation the zyg	ve 46 / diploid amount of chromosomesv. have 23/haploidv amount of chromosomes to ensure gotev will have 46 / diploid amountv	(4) [40]

QUESTION 8

- 8.1 End bulbs of Krause v detects the drop in environmental temperaturev. The decrease in blood temperaturev is detected by receptors in the heat-regulating centrev the hypothalamusv. An impulse v is sent to the vasomotor centrev in the medulla oblongatav causing the following:
 - Arteries in the skin constrictv/ vasoconstriction of the skin blood vessels
 - Less blood flows to the skinv
 - Blood flows to deeper blood vessels v
 - Less heat loss through radiationv, convection, v conductionv
 - Less sweat productionv
 - Less heat loss via evaporationv
 - Impulses from the hypothalamusv
 - Stimulates the erector muscles to contractv
 - Hairs on skin stand erect/ goose-flesh
 - Air layer trapped between hairv
 - Isolationv

- (Any15) (15)
- 8.2 8.2.1 Melanocytesv in the Malpighian layerv of the skin produces the pigment melaninv that protects the skin against the UVv rays of the sun. (4)
 - 8.2.2 Skin damage occurs after too much exposure causing the outer layer of skin to be replaced by a new layerv produced through mitosisv by (3) the Malpighian layerv
- 8.3 Sebaceous glandv
 - Secretes sebumv to prevent the skin and hair from drying outv
 - Keeps skin supplev and waterproofv
 - Cerumen glandsv(wax glands)
 - Secretes cerumenv repels small organisms preventing them from entering the external auditory canalv
 - Keeps the auditory canal clean and supplev
 - Mammary glandsv
 - Modified sweat glandsv that secrete milkv
 - During Lactation v

Sweat glandsv

- Secrete sweatv
- Excretionv, temperature regulationv and osmo-regulationv 4+8= (12)
- 8.4 If fertilization takes placev the CL stays intactv for 12 weeksv to secrete progesteronev as to maintain pregnancy/ endometriumv.
 - If fertilization does not take place the CL disintegrates v and a new primary follicle will developv
 (6)

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SECTION C

QUESTION 9

9.1 The meninges:

The dura materv - it is a tough connective tissuev layer that lines the interior side of the skull,v to protect v the brain The arachnoid materv is the middle membranev that consists of delicate fibres v. Between the pia mater and arachnoid mater is the subarachnoid cavityv filled with CSFv that acts as a cushion and absorbs shockv The pia materv is a thin membrane rich in blood vesselsv that covers the brain tissuev. It provides the brain with O_2 and nutrients.v (3 and Any 9)= (12)

9.2 The lateral ventriclesv or the 1st and 2nd brain ventriclesv are situated inside the two cerebral hemispheresv. Between the talami lies the 3rd ventriclev and is in connection with the lateral ones by the Foramina Monro.v The Aquaduct of Sylviusv connects the 3rd with the 4th ventricle which lies between the cerebellumv and the medullav. The Aquaduct of Sylvius has poresv, foramina or openings of Luschkav and Magendiv, through which CSF drains into the subarachnoid cavityv. The 4th ventricle is also in connection with the central canal in the spinal cordv which is also filled with CSFv. (Any 10) (10)

9.3	600 ml per day v/24 hourv = 25 ml/hourv OR	0,4 ml/min v x 60 minv = 24	
	ml/hourv		(3)

- 9.4 Functions of CSF: The CSF provides the brain with nutrients and O₂v Drains it from metabolic wastev and CO₂ Maintains a constant pressure inside and outsidev Acts as shock absorberv as it enables the brain to "float" Prevents dehydration of brain. (5)
- 9.5 Because the protein molecules are too big (macro moleculesv) to pass through the capillary vessels / endothelial layer of capillaries. (2)
 9.6 9.6.1 Meningitis is inflammation of the meningesvv (2)
 - 9.6.2 (a) In the lumber region of the vertebrae. (L4 L5) (2)
 - (b) Cauda equina (2)

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(11)

9.6.3	(a)	Centra	l canal. vv			(2)
	(b)	-	No pure CSF will be ext It can harm other neuro and lead to paralysisy.	tracted ns of the cauda e	quina	(2)
						(2)
	(C)	1,4 kPa	a /(140 mm water) vv			(2)
	(c)	140 v -	- (20 + 30)v = 90 mlv			(3)
9.6.4 Overproduction of CSF Obstruction of circulation of CSF Disturbance of the absorption of CSF in the venous region.				(3) [50]		
			QUESTION 1	0		
10.1.1	l	Filtrate	, re-absorption and exc	retion amounts in	the nephron	
	Nam subst	e of ancev	Amount filteredv	Amount reabsorbedv	Amount excretedv	
Wat	ter		190 literv	189 liter	1liter v	/

water 190 literv 189 liter 1liter Glucose 270 g 270 g None Urea 48 g 33 g 15 g Chloride 1 090 g 10 g 1 100 gv 1 Mark for table heading 1

10.1

1 Mark for correct column headings 4

1 Mark for correct rows 1 x 4

1 Mark for correct unit for water 1

1 Mark for rest of units in grams 1

10.1.2 Urea is formed through:

_	Excess amount of amino acidsv deaminatedv in liverv to fo	rm	
	ammoniav that binds to CO2v to form urea and to glucosev	/fatv/	
	glycogenv	(Any 5)	(5)

10.2	10.2.1	10 – Interlobular artery 14 – Interlobar artery 15 – Interlobar vein	(3)
	10.2.2	Glomerulusvv	(2)
	10.2.3	(a) 3 – Distal convoluted tubule 6 – Collecting duct	(2)

Osmoreceptors v in the hypothalamus v detects the increase (b) in osmotic concentration of the blood due to dehydrationv. Impulses v are sent to the neurohypophysis v to secrete ADH v in the blood stream. ADH increases the permeability v of the distal convoluted tubule and collecting duct. More water v is re-absorbed into the peritubular capillaries v. The osmolarity returns to normal. (10)

10.2.4	(a) (b)	Ultrafiltrationvv High hydrostatic pressurev: Wider afferent arteriole than efferent arteriolev. More blood supply v causes hydrostatic pressure. Microfilterv: Capillaries of glomerulusv consist of one cell layer v/ thin cell layer with small poresv Large surface areav: large amount of capillariesv. The inner cell wall of Bowman capsulev consists of podocytesv with minor v and majorv processes that enables filtrate to move effectively through the filter slitsv	(2)
		(Any 10)	(10)
10.2.5	(a) (b)	Peritubular capillariesv Blood in closer contact with tubular systemv to enable reabsorptionv of useful substancesv/glucose and amino acids and waterv to enable tubular secretionv of	(1)
		waste productsv into tubules	(4) [50]