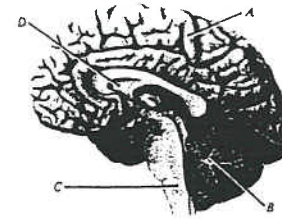


Past HKCEE Questions
Nervous Co-ordination
Paper I

1. The photograph below shows a sectional view of a human brain:



- (i) Identify regions A, B and C and state ONE function for each. (6 marks)
(ii) Region A is highly folded. What is the significance of this feature? (2 marks)
(iii) State TWO functions of the fluid in D. (2 marks)
(HKCEE 1988)

2.

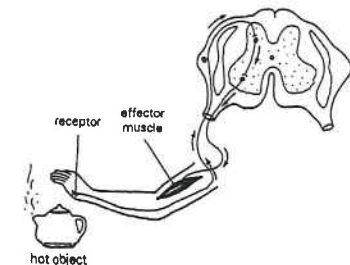


In an experiment to study the sensitivity of different parts of the skin to touch, student X used a felt pen to mark out an area on a certain part of the skin of student Y as shown in the diagram above. While student Y was blindfolded, student X used a pin to touch gently every mark on the test region. Student Y would say 'yes' if he felt the touch. The percentage of positive responses (that is, when student Y could feel the touch) was recorded. The experiment was then repeated on different regions of the skin and the results are summarized as below:

Region of skin	Percentage of positive responses
back of hand	50
palm of hand	85
fingertip	100
forearm	75

- (i) Which of the tested regions was most sensitive to touch? (1 mark)
(ii) Why was student Y unable to feel the touch of the pin on some occasions during the experiment? (1 mark)
(iii) Describe the nervous pathway that enables student Y to feel the touch and to speak out. (4 marks)
(iv) At one point during the experiment, student X carelessly applied a strong force on the pin and student Y withdrew his hand immediately.
(1) Name this type of response. (1 mark)
(2) This type of response usually occurs very rapidly. What is the significance of this characteristic? (1 mark)
(3) State ANOTHER characteristic of this type of response. (1 mark)
(HKCEE 1990)

3. The diagram below shows the cross section of a human spinal cord and the nervous supply to the arm:

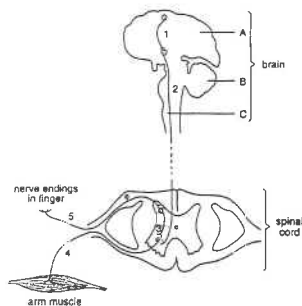


- (i) If the hand touches a hot object accidentally, the hand will withdraw from it immediately.
(1) What happens to the effector muscle in this response? (1 mark)
(2) The action of this effector muscle results in movement at a joint.
(I) Name this joint. (1 mark)
(II) What is the characteristic of the movement at this joint? (1 mark)
(ii) Three men (X, Y and Z) were injured in a traffic accident. A doctor found out that their brains were still functioning normally. He then conducted further tests to check if there was any damage to other parts of their nervous systems.

Man	Test(s) conducted with the eyes of the patients blindfolded	Observations
X	X's finger tip was pricked by a pin	X felt the pain but he did not withdraw his hand
Y	Y's finger tip was pricked by a pin	Y could not feel the pain and did not withdraw his hand
	Y was asked to move his hand	Y could move his hand
Z	Z's finger tip was pricked by a pin	Z withdrew his hand but he was unaware of the touch and the withdrawal of his hand

Which part of the nervous system was most likely damaged in X, Y and Z respectively? Explain your answer in each case. (8 marks) (HKCEE 1991)

4. The diagram below shows the arrangement of some neurones in man:



- (i) Using numbers in the diagram, indicate the pathway of nerve impulses that bring about
 (1) the withdrawal reflex of the arm. (1 mark)
 (2) the voluntary action of the arm. (1 mark)
 (ii) State two differences between reflex actions and voluntary actions. (2 marks)
 (iii) For parts A, B and C of the brain, state and explain one role that each plays when a man is riding a bicycle. (6 marks) (HKCEE 1995)
5. Irritability is the ability of an organism to respond to an external stimulus. Most cases of irritability work in the following pattern:

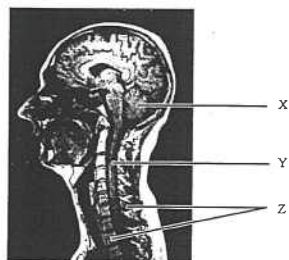


Below are three examples of irritability in humans

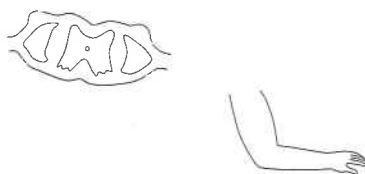
- (I) Secretion of saliva when food is ingested
 (II) Constriction of pupil under bright light
 (III) Running out of the classroom upon hearing the fire alarm

- (i) For case I, state the receptor and effector involved. (2 marks)
 (ii) Based on the above pattern, use a flowchart to show the nervous pathway for case II, including the types of neurones involved. (3 marks)
 (iii)
 (1) Name the region of the brain where the coordinating centre for case III is located. (1 mark)
 (2) State *two* features of the responses controlled by this region. (2 marks) (HKCEE 2004)

6. The figure below shows a magnetic resonance image of the lateral side of the upper body of a person:



- (a) Name structure X and state its function. (2 marks)
 (b) What is the importance of structure Z to structure Y? (1 mark)
 (c) The diagram below shows the transverse section of structure Y and an outline of the arm:



On the above diagram, draw the reflex arc for the withdrawal reflex of the arm and label the different components of the reflex arc. (4 marks)

Past HKCEE Questions Nervous Co-ordination Paper II

90-19

After a car accident, a man had difficulty in balancing himself when walking but he could still hear well. Which of the following structures might have been damaged?

- (1) cerebrum
 (2) cerebellum
 (3) cochlea
 (4) semicircular canals

- A. (1) and (3) only
 B. (1) and (4) only
 C. (2) and (3) only
 D. (2) and (4) only

91-5



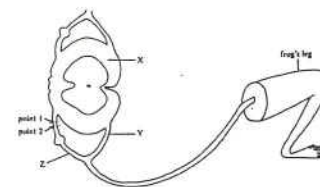
Which of the following features of the neurone shown in the diagram above are essential for the coordinating function of an organism?

- (1) possession of a nucleus
 (2) long cellular extension
 (3) branched endings

- A. (1) and (2) only
 B. (1) and (3) only
 C. (2) and (3) only
 D. (1), (2) and (3)

92.

Directions: Questions 46 and 47 refer to the diagrammatic representation of part of the nervous system in a frog. The basic structural organization of the nervous system of a frog is similar to that of a mammal.



92-46

The parts labelled X, Y and Z are

- | | X | Y | Z |
|----|--------------|--------------|--------------|
| A. | white matter | ventral root | dorsal root |
| B. | white matter | dorsal root | ventral root |
| C. | grey matter | ventral root | dorsal root |
| D. | grey matter | dorsal root | ventral root |

92-47

Application of an electric current of suitable strength onto a nerve fibre will set off a nerve impulse. A segment of structure Z between points 1 and 2 is cut and removed. An electric current is then applied at point 1 and 2 in turns. What would be the responses of the frog's leg?

- | | Point 1 | Point 2 |
|----|-------------|-------------|
| A. | contracting | no response |
| B. | no response | contracting |
| C. | contracting | contracting |
| D. | no response | no response |

92-48

The flow diagram below shows the basic pattern of nervous co-ordination in mammals:

Stimulus → Receptor → Effector → Response

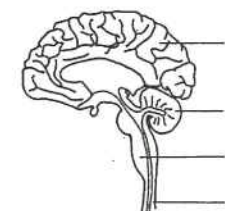
X can be

- (1) the cerebrum.
 (2) the spinal cord.
 (3) the medulla oblongata

- A. (1) only
 B. (2) only
 C. (2) and (3) only
 D. (1), (2) and (3)

93-32

The diagram below shows a sectional view of a part of the human central nervous system



Which of the following is a correct matching between the structure and its function?

- | | Structure | Function |
|----|-----------|----------------------------------|
| A. | 4 | a centre of reflex actions |
| B. | 3 | responsible for body balance |
| C. | 2 | controlling movement of eyeballs |
| D. | 1 | coordinating movement of limbs |

94-29

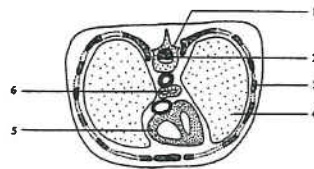
Which of the following response is controlled by the medulla of the brain?
 A. You put down your pencil when you are told to do so.
 B. Your leg kicks forward when your knee is hit.
 C. Your heart beats faster when you are running.
 D. Your band withdraws quickly from a hot object on touching it.

96-29

A patient diagnosed to be a 'vegetable' shows reflex actions, normal heart beat and breathing, but no voluntary responses. Which part of the central nervous system is probably damaged?
 A. cerebrum
 B. cerebellum
 C. medulla oblongata
 D. spinal cord

96.

Directions: Questions 36 and 37 refer to the diagram below which shows a transverse section of the human thorax:



96-36

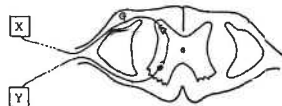
Which structure is responsible for coordinating reflex actions?
 A. 1
 B. 2
 C. 3
 D. 4

96- 37

Which structure can produce red blood cells?
 A. 3
 B. 4
 C. 5
 D. 6

96-38

The diagram below shows a nervous pathway in the human body



Structures X and Y are probably

- | | |
|------------------------|-------------|
| X | Y |
| A. intercostal muscles | ribs |
| B. pancreas | liver |
| C. skin of finger tips | arm muscles |
| D. tongue | teeth |

98-25

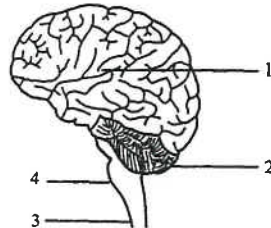
Which of the following are examples of simple reflex action?
 (1) pulling one's hand from a hot object
 (2) shedding tears when one hears a sad story
 (3) shutting one's eyes as an object approaches the face rapidly
 A. (1) and (2) only
 B. (1) and (3) only
 C. (2) and (3) only
 D. (1), (2) and (3)

99-34

Which of the following parts of the central nervous system are directly involved in some reflex actions?
 (1) cerebrum
 (2) medulla
 (3) spinal cord
 A. (1) and (2) only
 B. (1) and (3) only
 C. (2) and (3) only
 D. (1), (2) and (3)

00.

Directions: Questions 32 and 33 refer to the diagram below, which shows part of the human central nervous system:



00-32

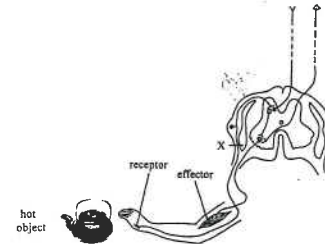
Nerve impulses generated in taste buds are interpreted in
 A. 1.
 B. 2.
 C. 3.
 D. 4.

00-33

The movement of the diaphragm is under the control of
 A. 1 and 2.
 B. 1 and 4.
 C. 2 and 3.
 D. 3 and 4.

01.

Directions: Questions 27 and 28 refer to the diagram below, which shows the nervous pathway involved in the withdrawal reflex when a person touches a hot object:



01-27

How many neurones are involved in this reflex arc?
 A. 2
 B. 3
 C. 4
 D. 5

01-28

In an accident, the dorsal root of a man was damaged at position X. What would happen if this man touched a hot object in a dark room?

	Feel the pain	Withdraw hand immediately
A.	yes	yes
B.	yes	no
C.	no	yes
D.	no	no

03-56

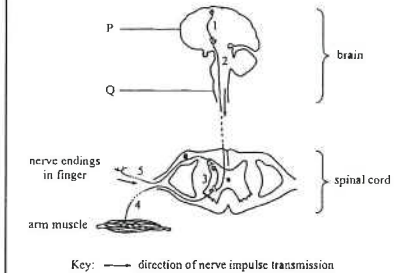
Which of the following comparisons of the cerebrum and the spinal cord is correct

	Cerebrum	Spinal cord
A.	protected by bones	not protected by bones
B.	with blood supply	without blood supply
C.	white matter on the surface	grey matter on the surface
D.	can generate sensation	cannot generate sensation

05-26

Which part of the central nervous system coordinates the muscles of a person when he is riding a bicycle?
 A. medulla
 B. cerebellum
 C. spinal cord
 D. motor areas of cerebrum

Directions: Questions 29 and 30 refer to the diagram below, which shows the arrangement of some neurones in a person:



05-29

If neurone 2 were damaged, would the person be able to detect a sharp prick at the finger tip and withdraw his arm by reflex?

	Detection of sharp prick	Withdrawing the arm by reflex
A.	Yes	Yes
B.	Yes	No
C.	No	Yes
D.	No	No

05-30

Which of the following correctly compares structures P and Q?

	Structure P	Structure Q
A.	grey matter inside	grey matter outside
B.	protected by bone	not protected by bone
C.	controlling voluntary actions	controlling involuntary actions
D.	receiving food from cerebrospinal fluid	not receiving food from cerebrospinal fluid

05-31

Which of the following responses does *not* involve the brain as the coordinating centre?
 A. playing the piano
 B. increase in heart rate during exercise
 C. constriction of the pupil under bright light
 D. kicking up the lower leg when the knee cap is tapped

07-26

The diagram below shows a cross section of the spinal cord. At which part(s) of the spinal cord can synapses be found?



- A. P only
B. Q Only
C. P and R only
D. Q and R only

07-27

John has some problems in his nervous system. When he is blindfolded and the finger of his left hand is pricked with a needle, he cannot feel the pain and does not withdraw his hand. However, he can move his left arm voluntarily. Which of the following components of the corresponding reflex arc is / are probably damaged?

- A. interneurone
B. sensory neurone
C. motor neurone
D. motor and sensory neurones

07-28

The photograph below shows part of the human central nervous system.



The movement of the legs is under the coordination of

- A. 1 and 2 only.
B. 1 and 3 only.
C. 2 and 3 only.
D. 1, 2 and 3.

Past HKCEE Questions

Nervous Co-ordination

Suggested Answers

Paper I

1. (i) A - * cerebrum / cerebral hemisphere
controls voluntary action / memory / thinking 1
(accept any reasonable function)
B - * cerebellum 1
controls balance of the body / co-ordinates muscle movements 1
C - * medulla oblongata 1
controls breathing movements / heart beat 1
(accept any reasonable function)
(ii) this increases the surface area so that a greater number of cell bodies / neurones can be packed in this region 1
(iii) • the fluid supplies nutrients / oxygen to the brain cells 1
• removes the wastes from the brain cells +
• maintains the shape of the brain 1
• serves as a shock absorber (any 2) 1
2. (i) fingertip 1
(ii) because the pin (stimulus) is not applied directly onto a touch receptor / nerve ending 1
(or other reasonable answers)
(iii) touch receptor stimulated 1
nerve impulses pass along the sensory neurone 1
and via the association neurone to the brain where the sensation of touch is produced 1
and then nerve impulses are sent from the brain via the motor neurone to the muscles responsible for speech 1
(N.B. accept flowchart)
(iv) (1) * reflex 1
(2) avoid danger immediately / provide immediate protection 1
(3) • inborn / leaning not required
• involuntary / not controlled by will
• stereotype / fixed response 1
(any 1)

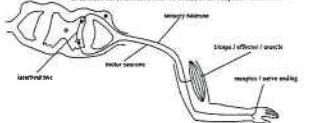
3. (i) (1) it contracts 1
(2) (I) * elbow joint / * hinge joint 1
(II) it allows movement in one plane / 180° only 1
- (ii) Man X:
the motor / association neurone was damaged 1
so that no impulses could be transmitted to the effector muscle / arm to produce the response 1
- Man Y:
the sensory neurone / receptor was damaged 1
so that no impulses from the receptor could be transmitted to the brain for producing the painful feeling 1
- Man Z:
the association neurone to the brain / the spinal cord above the arm level was damaged 1
no impulses could be carried to the brain 1
since Z can withdraw his hand therefore the reflex arc was not damaged. 1

4. (i) (1) 5 → 3 → 4 1
(2) 1 → 2 → 4 1

(ii)

Reflex actions	Voluntary actions
cerebrum is not involved	cerebrum is involved
stereotyped response is produced	different responses are produced
a receptor is involved	a receptor may not be involved / may be initiated spontaneously
inborn	inborn
usually faster	usually faster

any 2 1, 1

- (iii) A: receives / integrates sensory impulses 1
to make an appropriate decision for action 1
OR
A : sends nerve impulses to the skeletal muscles 1
to bring about the movement 1
(any 1 set for A)
B: co-ordinates the action of the skeletal muscles / receives impulses from semi-circular canals, etc. 1
to maintain balance of the body 1
C: increases / controls the rate of heart beat / the rate and depth of breathing 1
to supply more oxygen to the skeletal muscles 1
5. (i) Receptor: taste buds/ smell receptor 1
Effector: salivary glands 1
- (ii) (iii) (1) Cerebrum 1
(2) Any two: 2
- The responses can be controlled voluntarily.
 - They are not stereotyped.
 - They need to be learned.
6. (a) *cerebellum 1
It is for coordinating the activities of muscles in maintaining body balance 1
- (b) Z protects Y from mechanical damage 1
- (c) Drawing of different neurones (D):
correct position of cell bodies,
presence of 2 synapses only 0.5*2
* Labels (L): receptor / nerve ending, sensory neurone, interneurone, motor neurone, effector / biceps / muscle (any four) 0.5*4
Correct pathway (P):
Indicate the direction of nerve impulse transmission
Or
direction can be identified from the label(s) of the component 1
- 
- The diagram illustrates a reflex arc. It starts with a 'receptor' (labeled 'nerve ending') which sends an impulse through a 'sensory neurone' to the 'cell body' (located in the CNS). From there, the impulse travels through an 'interneurone' (also with its cell body in the CNS) to a 'motor neurone'. The motor neurone then carries the impulse to an 'effector' (labeled 'muscle').

Paper II

90-19	D
91-5	D
92-46	A
92-47	A
92-48	D
93-32	A
94-29	C
96-29	A
96-36	B
96-37	A
96-38	C
98-25	B
99-34	C
00-32	A
00-33	B
01-27	B
01-28	D
03-56	D
05-26	B
05-29	A
05-30	C
05-31	D
07-26	A
07-27	B
07-28	A