



10: Mammalian physiology, control and co-ordination – Topic questions

The questions in this document have been compiled from past papers, as indicated in the table below.

Use these questions to formatively assess your learners' understanding of this topic.

Question	Year	Series	Paper number
1	2017	May/June	41
6	2017	May/June	41
10	2017	May/June	42

The mark scheme for each question is provided at the end of the document.

- Explain what is meant by the term *homeostasis*.

..... [1]

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- A diagram of a kidney in cross-section. The outer boundary is the renal capsule. Inside, the renal sinus is the central cavity, outlined by a dashed line. The renal pelvis is the funnel-shaped part of the urinary tract that leads into the renal sinus. It is shown as a branching structure. Two arrows point towards the renal pelvis, labeled 'B'. A line points to the renal sinus, labeled 'A'.

Fig. 1.1

- A**

B [2]

- U** – ultrafiltration occurs

L – the loop of Henle is found

C – blood urea concentration is low.

[3]

(c) Describe the roles of the hypothalamus and the posterior pituitary in osmoregulation.

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..... [5]

[Total: 11]

- 6 (a) Describe how tropomyosin and myosin are each involved in the sliding filament model of muscle contraction.

(i) *tropomyosin*
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..... [2]

(ii) *myosin*
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..... [4]

(b) Striated muscle is made up of many specialised muscle cells known as muscle fibres or myocytes.

There are two different types of muscle fibre in striated muscle:

- fast twitch muscle fibres that contract quickly, but rapidly fatigue (get tired)
- slow twitch muscle fibres that contract slowly and continue to contract for a long time.

Table 6.1 shows some features of fast twitch and slow twitch muscle fibres.

Table 6.1

feature	fast twitch fibre	slow twitch fibre
respiration	mainly anaerobic	mainly aerobic
glycogen concentration	high	low
capillaries	few	many

Use the information in Table 6.1 to suggest **and** explain **one** advantage of:

(i) the high glycogen concentration in fast twitch fibres

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..... [2]

(ii) many capillaries supplying slow twitch fibres.

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..... [2]

[Total: 10]

- 10 (a)** Compare the endocrine and nervous systems in control and co-ordination in mammals. [8]
- (b)** Outline the role of a chemoreceptor cell in the human taste bud in detecting stimuli **and** in stimulating the transmission of nerve impulses in sensory neurones. [7]

[Total: 15]

[illegible]



[illegible]

Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
AW	alternative wording (where responses vary more than usual)
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	alternative valid point

Question	Answers	Marks
1(a)	maintain / keep / restore, constant / stable / set-point / within narrow limits, internal environment / in body ;	1
1(b)(i)	A – pelvis ; <i>note if labelled medulla as affects ecf in part (ii)</i> B – ureter ;	2
1(b)(ii)	A full labels instead of letters <i>if region A (pelvis) was mislabelled as medulla in (i) can apply:</i> ecf for L placed in pelvis ecf U placed in medulla only if word cortex also written by U / ultrafiltration U – pointing to the cortex ; L – pointing to the medulla ; C – pointing to the renal vein ;	3

1(c)	<p><i>max 5 of:</i></p> <p>1 <u>hypothalamus</u> detects (changes in) water potential (of the blood) ;</p> <p>2 <u>osmoreceptors</u> shrink when, low / less, water in blood ; ora</p> <p>3 ADH, produced / made, in hypothalamus ;</p> <p>4 if low, water / Ψ, ADH secreted from <u>posterior pituitary</u> ; ora</p> <p>R ADH <i>produced</i> in posterior pituitary</p> <p>5 <i>ref. to</i> neurosecretory cells</p> <p>or</p> <p>impulse / ADH transported, from hypothalamus to posterior pituitary ;</p> <p>6 aquaporins ;</p> <p>7 ADH increases <u>permeability</u> of, distal convoluted tubule / collecting duct ; ora</p> <p>8 ADH causes, more water reabsorption / smaller volume of urine / more concentrated urine ; ora</p> <p>A both with and without ADH compared</p>	5
		Total: 11

Question	Answers	Marks
6(a)(i)	<p><i>max 2 of:</i></p> <p>1 tropomyosin / it, covers / uncovers, myosin binding sites on actin ; R inhibits R active site</p> <p>2 when calcium ions bind to troponin, tropomyosin / it, moves / changes shape ;</p> <p>3 allows myosin to, bind to actin / form cross-bridges ; ora</p>	2
6(a)(ii)	<p><i>max 4 of:</i></p> <p>1 ATP hydrolysis / $\text{ATP} \rightarrow \text{ADP} + \text{P}_i$;</p> <p>2 (causes myosin) <u>head</u> to, pivot / rotate / tilt / stand up ;</p> <p>3 myosin / head, binds to actin / forms cross-bridges with actin ; R active site</p> <p>4 ADP and P_i detach ;</p> <p>5 (myosin) <u>head</u>, swings back / returns to previous position ;</p> <p>6 actin is moved / power stroke occurs ;</p> <p>7 (new) ATP binds ;</p> <p>8 myosin / head, detaches from actin / cross-bridges break ;</p> <p>A mps in any order apart from 1, 4 and 7 which must be linked to correct action</p>	4
6(b)(i)	<p><i>max 2 of:</i></p> <p>1 to, supply / provide, (enough / plenty of) <u>glucose</u> ;</p> <p>2 for <u>glycolysis</u> ;</p> <p>3 as little ATP is produced by anaerobic respiration ;</p> <p>4 as few capillaries are present (to supply glucose directly) ;</p>	2
6(b)(ii)	<p><i>max 2 of:</i></p> <p>1 to, supply / provide, (enough / plenty of) <u>oxygen</u> ;</p> <p>2 aerobic respiration / oxidative phosphorylation ;</p> <p>3 to remove, carbon dioxide / lactate ; A lactic acid</p> <p>4 to, avoid fatigue or promote, stamina / endurance (for exercise / work) ;</p>	2
		Total: 10

Question	Answers				Marks
10(a)	Differences				max 8
		nervous		endocrine	
1	communication	action potential / impulse	and	hormone ;	
2	nature of communication	electrical (and chemical)	and	chemical ;	
3	mode of transmission	neurone / nerve cell	and	blood ;	
4	response destination	muscle / gland	and	target, organs / tissue / cells ;	
5	transmission speed	fast(er)	and	slow(er) ;	
6	effects	specific / localised	and	(can be) widespread ;	
7	response speed	fast(er)	and	slow(er) ;	
8	duration	short-lived / temporary	and	can be long-lasting / permanent ;	
9	receptor location	on cell surface membrane	and	either on cell surface membrane or within cell ;	
	Similarities				
10	cell signalling	both involve cell signalling ;			
11	detail	both involve signal molecule binding to receptor ;			
12	chemicals	both involve chemicals ;			

10(b)	<ol style="list-style-type: none"> 1. chemicals act as a stimulus ; 2. <i>ref. to</i> specificity of chemoreceptors ; 3. sodium ions diffuse into cell ; 4. via microvilli ; 5. membrane depolarised ; 6. receptor potential / generator potential ; 7. stimulates opening of calcium (ion) channels ; 8. calcium ions enter cell ; 9. causes movement of vesicles containing neurotransmitter ; 10. neurotransmitter released by exocytosis / described ; 11. neurotransmitter stimulates, action potential / impulses, in sensory neurone ; 12. <i>ref. to</i> (chemoreceptors are) transducers / description ; 13. AVP ; e.g. threshold / all or nothing law / papilla 	max 7
		Total: 15