6.9 Biological Rhythms: Circadian, Infradian and Ultradian: 30-minute Pack

AQA 7182 · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions.

1 Define an infradian rhythm in the context of human biology and give one example with its typical timescale.

(Total for Question 1 is 3 marks)

2 Define an ultradian rhythm and give one human example identified using sleep-stage research.

(Total for Question 2 is 2 marks)

3 Outline Folkard et al.'s research into shift work and circadian disruption and one practical implication for workplaces.

(Total for Question 3 is 3 marks)

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4 Outline Dement and Kleitman's (1957) study of sleep stages and one key finding about REM sleep as an ultradian rhythm. Include the method context and the conclusion about REM periodicity.

(Total for Question 4 is 3 marks)

5 Outline the role of melatonin, produced by the pineal gland, in the regulation of the sleep-wake cycle and one way light influences its secretion.

(Total for Question 5 is 3 marks)

6 A business executive travels from London to Sydney, crossing multiple time zones, and experiences difficulty sleeping at the destination for several days. Explain how both endogenous pacemakers and exogenous zeitgebers contribute to jet lag in this scenario, and suggest one practical strategy to reduce jet lag.

(Total for Question 6 is 4 marks)

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7 Outline one strength and one limitation of using isolated cave studies, such as Siffre's, to investigate endogenous pacemakers in humans. Relate each point to the study context.

(Total for Question 7 is 4 marks)

8 Explain how exogenous zeitgebers such as light and social cues can entrain the sleep-wake cycle, giving one specific example of each type of cue.

(Total for Question 8 is 3 marks)

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Mark scheme · 6.9 Biological Rhythms: Circadian, Infradian and Ultradian: 30-minute Pack

Question 1

defines infradian rhythm as a biological cycle longer than 24 hours oe	**M1**
gives an example, e.g. the human menstrual cycle, with a typical timescale of about 28 days oe	**A1**
alternative example allowed, e.g. seasonal affective disorder showing seasonal (annual) variation oe	**A1**

Answer: An infradian rhythm is a biological cycle longer than 24 hours; example: the menstrual cycle, typically about 28 days (or seasonal affective disorder with annual seasonal variation).

Question 2

ultradian rhythm: a biological cycle shorter than 24 hours oe	**B1**
example: roughly 90-minute cycles of REM and non-REM stages during sleep, as shown by sleep-stage research such as Dement and Kleitman oe	**B1**

Answer: An ultradian rhythm is a biological cycle shorter than 24 hours; example: the roughly 90-minute cycle of REM and non-REM sleep stages.

Question 3

outlines Folkard et al.'s focus on how rotating shift patterns disrupt normal circadian rhythms and affect sleep and performance oe	**M1**
identifies a finding such as increased fatigue and reduced alertness among night-shift workers, leading to higher error rates oe	**A1**
gives a practical implication, e.g. suggesting that employers minimise quick rotations, schedule regular rest breaks, or provide controlled light exposure to reduce risk oe	**A1**

Answer: Folkard et al. studied how rotating shift work disrupts circadian rhythms, finding increased fatigue and reduced alertness on night shifts. Practical implication: employers should avoid rapid shift rotations and allow appropriate rest breaks or controlled light exposure to reduce errors.

Question 4

outlines that Dement and Kleitman used EEG, monitored eye movements and woke participants to report dreams, to study REM and non-REM sleep stages oe	**M1**
states a key finding: REM sleep tended to occur in roughly 90-minute cycles across the night, supporting the idea of an ultradian rhythm oe	**A1**
notes that participants' reports linked REM periods with vivid dreaming, supporting the behavioural significance of the REM stage oe	**A1**

Answer: Dement and Kleitman monitored EEG and eye movements and woke participants to obtain dream reports. They found REM recurred in approximately 90-minute cycles and REM periods were associated with vivid dreaming, supporting REM as part of an ultradian rhythm.

Question 5

states that the pineal gland secretes melatonin and that melatonin promotes sleepiness/helps initiate sleep oe	**M1**
explains that melatonin secretion increases in darkness and decreases in response to light, so light exposure suppresses melatonin production oe	**A1**
links the mechanism to the SCN or retinal input as the route by which light controls melatonin timing oe	**A1**

Answer: The pineal gland secretes melatonin, which promotes sleepiness; melatonin secretion rises in darkness and is suppressed by light exposure, with light information reaching the gland via the SCN and retinal pathways.

Question 6

explains that the executive's endogenous pacemaker (SCN and melatonin rhythm) is still aligned to the original time zone, causing desynchrony with the new local time oe	**M1**
explains that exogenous zeitgebers such as the new light-dark cycle and social schedule at the destination gradually shift the circadian rhythm, but this can take several days oe	**A1**
suggests a practical strategy, e.g. timed bright-light exposure at the destination or taking melatonin at the appropriate local evening to accelerate re-entrainment oe	**A1**
explains why the strategy helps, e.g. light suppresses melatonin and shifts the SCN, so timed exposure advances or delays the rhythm to match local time oe	**A1**

Answer: Jet lag occurs because the executive's SCN-driven circadian rhythm and melatonin timing remain set to London time, while local light-dark cycles and social schedules in Sydney are different; the mismatch causes sleep disturbance until exogenous zeitgebers reset the clock. Practical strategy: use timed bright-light exposure or take melatonin in the local evening to shift the rhythm, because light and melatonin influence the SCN and speed re-entrainment.

Question 7

strength: identifies a strength such as the ability to observe free-running rhythms without external zeitgebers oe	**M1**
explains why this matters in context, e.g. removing light and social cues allows researchers to infer the role of endogenous pacemakers directly oe	**A1**
limitation: identifies a limitation such as small, unrepresentative samples and artificial conditions oe	**M1**
explains why this matters in context, e.g. a single volunteer in a long cave residency may not generalise to wider populations and results may be influenced by the unusual setting oe	**A1**

Answer: Strength: cave studies allow observation of free-running rhythms without external zeitgebers, so endogenous pacemaker effects can be isolated. Limitation: such studies use small, unusual samples and artificial conditions, limiting generalisability and possibly introducing effects specific to the extreme setting.

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Question 8

explains that exogenous zeitgebers are external cues that synchronise internal biological clocks to the environment oe	**M1**
gives a specific light example, e.g. natural daylight or timed bright-light exposure shifting sleep timing/entraining the SCN oe	**A1**
gives a specific social cue example, e.g. meal times or work schedules acting as social zeitgebers that influence sleep-wake timing oe	**A1**

Answer: Exogenous zeitgebers are external cues that synchronise internal clocks. Light, such as daytime sunlight or controlled bright-light therapy, entrains the SCN and shifts sleep timing. Social cues, such as regular meal times or imposed work schedules, act as social zeitgebers that help set sleep-wake timing.

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