Cambridge Assessment
Admissions Testing

NAZARBAYEV
UNIVERSITY

Foundation Year Programme

Entrance Tests

BIOLOGY AND CHEMISTRY

SPECIMEN PAPER

For

NUFYP SET 2018

V1.0 October 2017

Cambridge Assessment
Admissions Testing

Biology and Chemistry

SPECIMEN **60 minutes**

Additional materials: Answer Sheet

Instructions to Candidates

Read this page carefully, but do not open the question paper until you are told that you may do so.

A separate answer sheet is provided for this paper. Please check you have one.

You require a soft pencil and an eraser.

Check that the title of the paper you are taking matches the title on the answer sheet.

Complete the top section of the answer sheet in soft pencil with your personal details.

There are 30 questions in this paper. Each question is worth one mark. There are no penalties for incorrect responses, only marks for correct answers, so you should attempt all 30 questions.

Answer in soft pencil on the answer sheet provided. Questions ask you to show your choice between options. Choose the **one** option you consider correct and record your choice on the separate answer sheet. If you make a mistake, erase thoroughly and try again.

You can use the question paper for rough working, but no extra paper is allowed.

Only your responses on the answer sheet will be marked.

Speed as well as accuracy is important in this paper. Work quickly, or you might not finish the paper.

Dictionaries and calculators may NOT be used.

Please wait to be told you may begin before turning this page.

This question paper consists of 19 printed pages and 5 blank page.

SPECIMEN for NUFYP SET 2018

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1 The table below shows information about gas exchange in an active muscle when blood first enters that muscle.

Which row of the table is correct?

	oxygen concentration in red blood cells	*process of gas exchange*	*oxygen concentration in muscle cells*	*concentration of carbon dioxide in muscle cells*
A	low	diffusion	high	low
B	low	osmosis	high	low
C	low	osmosis	low	high
D	high	diffusion	high	low
E	high	diffusion	low	high
F	high	osmosis	low	high

2 Which one of the following needs active transport?

A loss of urine from the urethra

B movement of carbon dioxide into alveoli in the lungs

C release of glucose into the small intestine

D transfer of oxygen into the blood from the alveoli

E uptake of ions from soil into a root hair cell

3 In a population with 50 healthy men and 50 healthy women, what is the percentage of each type of sex chromosome?

	percentage of each sex chromosome	
	X	*Y*
A	25	50
B	50	75
C	75	25
D	25	75
E	50	50
F	50	25

4 The following statements are about cell division by meiosis and mitosis.

1 In mammals meiosis only occurs in the reproductive organs.

2 Mitosis can result in the formation of clones.

3 Meiosis results in two nuclei.

4 Mitosis results in four nuclei.

5 Only mitosis occurs during asexual reproduction.

Which of these statements are correct?

A 1, 2 and 3 only

B 1, 2 and 5 only

C 1, 3 and 4 only

D 2, 4 and 5 only

E 3, 4 and 5 only

5 Which substances would be secreted into the stomach after swallowing some food?

A amylase, hydrochloric acid and mucus

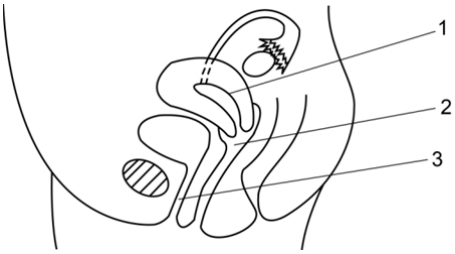
B amylase, hydrochloric acid and protease

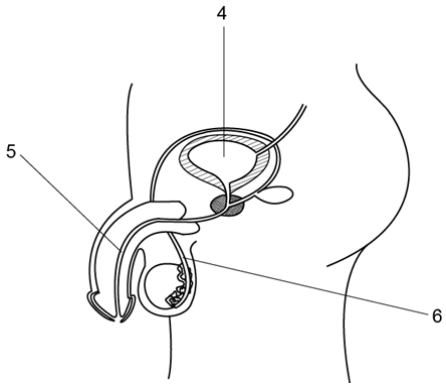
C bile, lipase and protease

D bile, mucus and protease

E hydrochloric acid, mucus and protease

6 Which numbered structures in the diagram of a human female reproductive system and the diagram of a human male reproductive system have the same name?





	structures with the same name	
	female	*male*
A	1	4
B	2	5
C	2	6
D	3	5
E	3	6

7 The three statements below are about breathing out.

1 The ribs swing down and inwards during breathing out.

2 The diaphragm muscles contract during breathing out.

3 The pressure in the lungs increases during breathing out.

Which of the statements is/are correct?

A 1 only

B 2 only

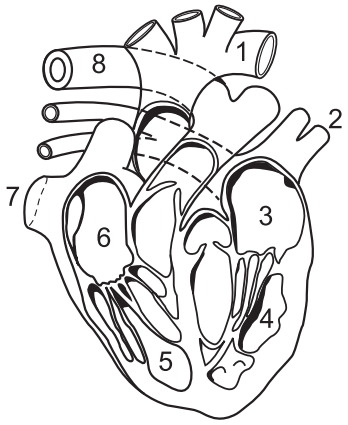
C 3 only

D 1 and 2 only

E 1 and 3 only

F 2 and 3 only

8 The diagram shows a view from the front of a section through the heart and associated blood vessels.



Which sequence of numbers shows the course of blood flow from the point of entry to the heart from the lungs, to its eventual exit from the heart to supply the lungs?

A 2 → 3 → 4 → 8 → 1 → 5 → 6 → 7

B 2 → 3 → 4 → 1 → 7 → 6 → 5 → 8

C 7 → 6 → 5 → 8 → 2 → 3 → 4 → 1

D 7 → 6 → 5 → 1 → 8 → 4 → 3 → 2

E 8 → 5 → 6 → 7 → 2 → 3 → 4 → 1

F 8 → 5 → 6 → 7 → 1 → 4 → 3 → 2

9 A section of DNA is 420 base pairs long and contains 42% of one of the bases, adenine (A).

Which row in the table correctly states the length of the amino acid chain (number of amino acids) coded for by this section of DNA, and what percentage of the base guanine (G) is present in this section of DNA?

	number of amino acids	*percentage of guanine (G)*
A	140	8
B	140	13
C	140	42
D	260	16
E	260	42
F	420	8
G	420	13
H	420	16

10 In a reflex action in which a person touches a hot plate and pulls their arm away, neurons of different lengths are involved.

Which answer identifies the relative lengths of the neurons?

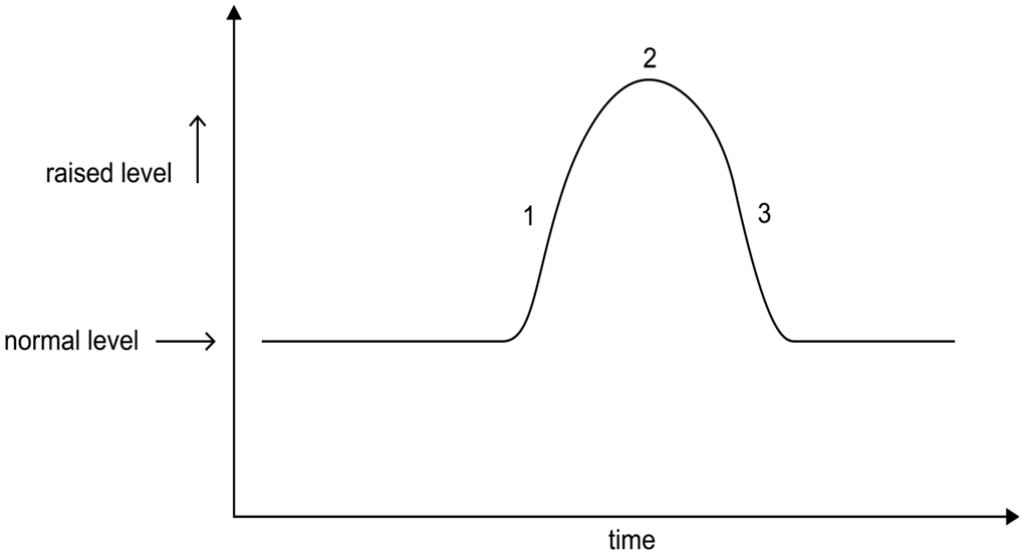
	length of neuron		
	longest	*medium*	*shortest*
A	sensory	relay	motor
B	motor	sensory	relay
C	relay	motor	sensory
D	motor	relay	sensory
E	relay	sensory	motor
F	sensory	motor	relay

11 A person is suffering from a condition/disease in which they have fewer blood platelets than a healthy person. They also have a lot of abnormal white blood cells when compared to a healthy person; however, they have a normal number of red blood cells.

Which row of the table shows this patient's symptoms?

	disease resistance	*blood clotting*	*oxygen transport*
A	low	low	low
B	high	low	high
C	low	normal	low
D	high	normal	normal
E	low	low	normal
F	high	normal	high

12 The graph below shows how one factor in the internal environment of a person changes, and is returned to a normal level.



If someone had a condition that made their homeostatic system less able to respond to this factor, how would the shape of the graph be altered?

A 1 would be earlier

B 1 would be less steep

C 2 would be earlier

D 2 would be higher

E 3 would be steeper

F 3 would be earlier

13 Salla disease is a rare recessive condition that occurs in some humans.

In one family it is known that the father has a genotype that is heterozygous for the condition, however the genotype of the mother is unknown. The mother and father have two children and neither of them shows the condition.

Which of the following genotypes could the mother have?

1 heterozygous

2 homozygous dominant

3 homozygous recessive

A only 1

B only 2

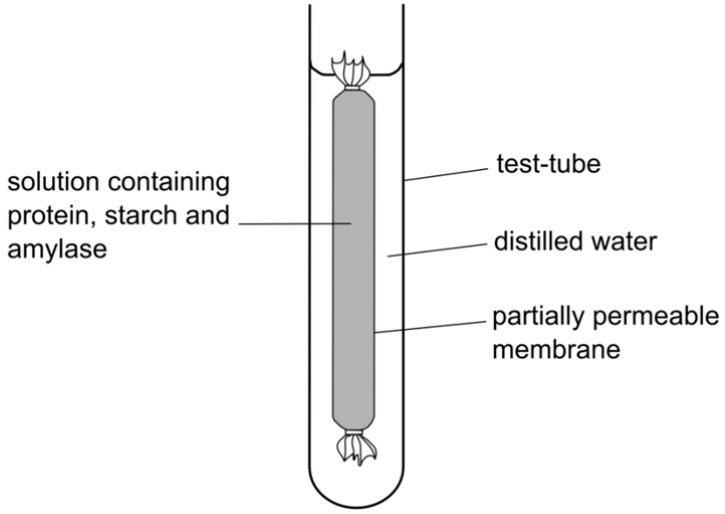
C only 3

D either 1 or 2

E either 1 or 3

F either 2 or 3

14 The diagram shows an experiment kept at room temperature.



The experiment is left for 45 minutes.

Which molecules are in the distilled water after 45 minutes?

Key

✓ present

x not present

	amino acids	*amylase*	*glucose*	*protein*	*starch*	*glycerol*
A	✓	x	x	x	x	x
B	x	x	✓	x	x	x
C	✓	x	✓	x	x	✓
D	x	x	✓	x	x	✓
E	x	✓	x	✓	x	x
F	x	✓	x	✓	✓	x

15 Which of the following could be found in a healthy adult liver cell?

1 gene for amylase

2 at least one X chromosome

3 starch

A none of them

B 1 only

C 2 only

D 3 only

E 1 and 2 only

F 1 and 3 only

G 2 and 3 only

H 1, 2 and 3

16 Which of the following ionic equations are correct?

1 $X^+ + e^- \rightarrow X$

2 $X^- - e^- \rightarrow X$

3 $O^{2-} + 2e^- \rightarrow O$

4 $O^{2-} - e^- \rightarrow O_2$

5 $2I^- - 2e^- \rightarrow I$

6 $Ca^{2+} + 2e^- \rightarrow Ca$

A 1, 2 and 6 only

B 1, 3 and 5 only

C 1, 4 and 5 only

D 2, 3 and 6 only

E 2, 4 and 5 only

F 3, 4 and 6 only

17 In which reaction (**A**-**E**) would the position of equilibrium shift to the left when the pressure is increased?

Assume that each reaction reaches equilibrium in a closed system of fixed volume, and that there is no change in temperature when the pressure is increased.

A $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

B $S(s) + O_2(g) \rightleftharpoons SO_2(g)$

C $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

D $2Zn(s) + O_2(g) \rightleftharpoons 2ZnO(s)$

E $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

18 When concentrated aqueous sodium chloride solution is electrolysed using inert electrodes, a reaction occurs at each electrode.

Which is the correct combination of elements actually produced at the electrodes in this electrolysis?

A anode = oxygen; cathode = hydrogen

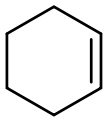
B anode = chlorine; cathode = sodium

C anode = oxygen; cathode = sodium

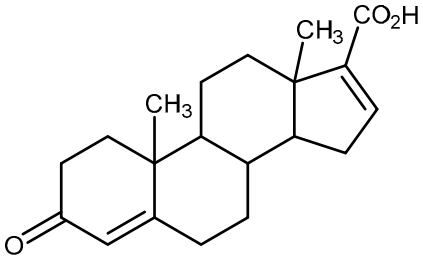
D anode = chlorine; cathode = hydrogen

E anode = sodium; cathode = chlorine

19 Cyclohexene, C_6H_{10}, can be drawn as:



What is the total number of carbon atoms in the steroid molecule below?



A 17

B 20

C 21

D 22

E 26

F 27

20 A sample of an acid, H_2X, with a mass of 4.5 g was dissolved in water.

This solution was neutralised by 50.0 cm^3 of aqueous sodium hydroxide of concentration 2 mol/dm^3.

$$H_2X(aq) + 2NaOH(aq) \rightarrow Na_2X(aq) + 2H_2O(l)$$

What is the relative formula mass, M_r, of the acid?

A 45

B 90

C 100

D 180

E 205

21 A particle consists of 19 protons, 18 electrons and 20 neutrons.

Which row in the table shows the correct atomic number, mass number and charge of this particle?

	atomic number	*mass number*	*charge*
A	18	37	−1
B	18	37	+1
C	19	39	−1
D	19	39	+1
E	20	37	−1
F	20	39	+1

22 Naturally occurring chlorine is a mixture of two isotopes with mass numbers 35 and 37. The isotope with mass number 35 is three times as common as the isotope with mass number 37.

Naturally occurring bromine is a mixture of two isotopes with mass numbers 79 and 81. They are present in equal amounts.

What fraction of the naturally occurring compound CH_2BrCl has a relative molecular mass of 128?

[A_r values: H = 1, C = 12]

A $\frac{1}{8}$

B $\frac{1}{4}$

C $\frac{3}{8}$

D $\frac{1}{2}$

E $\frac{5}{8}$

23 Lithium (Li) and potassium (K) are elements in Group 1 of the Periodic Table.

Which statement best explains why potassium reacts more violently with water than lithium?

A Potassium atoms have more protons than lithium atoms, so the nuclear charge in potassium atoms is greater than in lithium atoms, so water molecules are attracted more strongly.

B Potassium atoms are larger than lithium atoms, so water molecules will collide more frequently with potassium atoms than with lithium atoms.

C The metallic bonding in potassium is stronger than the metallic bonding in lithium.

D Potassium atoms have more electrons than lithium atoms, so transfer of electrons to water molecules will take place more frequently with potassium atoms than with lithium atoms.

E The outer electron in potassium atoms is further from the nucleus than in lithium atoms, so it is more easily lost from potassium atoms than from lithium atoms.

24 1.15 g of sodium completely reacts with water at standard temperature and pressure (stp).

What volume of hydrogen at stp is produced by this reaction?

(Assume in this question that 1 mole of any gas at stp has a volume of 22.4 dm^3.)

(A_r values: H = 1, O = 16, Na = 23)

A 280 cm^3

B 560 cm^3

C 600 cm^3

D 1120 cm^3

E 1200 cm^3

25 By using standard techniques to balance chemical equations, and ensuring that the net charge is equal on both sides, find the correct value for '***e***' in the balanced equation below:

$$\boldsymbol{a}\,C_2H_4O(aq) + Cr_2O_7^{2-}(aq) + \boldsymbol{b}\,H^+(aq) \rightarrow \boldsymbol{c}\,C_2H_4O_2(aq) + \boldsymbol{d}\,Cr^{3+}(aq) + \boldsymbol{e}\,H_2O(l)$$

A 1

B 2

C 4

D 6

E 8

26 Carbon, in the form of coke, is used to reduce iron oxide in a blast furnace. The three stages are shown below:

1 $C + O_2 \rightarrow CO_2$

2 $CO_2 + C \rightarrow 2CO$

3 $3CO + Fe_2O_3 \rightarrow 2Fe + 3CO_2$

If 12 g of carbon is used in stage 2 and all the carbon monoxide produced is used in stage 3, what mass of carbon dioxide is produced in stage 3?

[A_r values: C = 12, O = 16]

A 17.8 g

B 35.6 g

C 44.0 g

D 88.0 g

E 132 g

27 Azurite is a mineral made up of a mixture of $CuCO_3$ and $Cu(OH)_2$ in a simple whole number molar ratio.

Which one of the following is a possible formula of azurite?

A $Cu_3CH_4O_4$

B $Cu_3CH_4O_5$

C $Cu_3CH_4O_6$

D $Cu_3C_2H_2O_6$

E $Cu_3C_2H_2O_7$

F $Cu_3C_2H_2O_8$

28 An impure sample of sodium hydroxide has a mass of 1.20 g. All the sodium hydroxide completely reacts with a minimum of 50.0 cm^3 of 0.50 mol/dm^3 hydrochloric acid.

What is the percentage purity of the sodium hydroxide sample?

[A_r values: H = 1, O = 16, Na = 23, Cl = 35.5]

A 37.5%

B 41.6%

C 72.7%

D 75.0%

E 83.3%

F 90.4%

29 Ammonia is manufactured from the reaction between nitrogen and hydrogen. In practice, the manufacturing process can be represented as a reaction going to completion. This reaction is given below:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

What is the maximum mass of ammonia that can be manufactured from a mixture of 56 g of nitrogen with 9 g of hydrogen?

[A_r values: H = 1, N = 14]

A 34 g

B 51 g

C 65 g

D 68 g

E 83 g

30 The following chemicals are mixed together. In which of the mixtures will a displacement reaction occur?

1 $Pb(NO_3)_2(aq) + Al(s)$

2 $KCl(aq) + 2KF(aq)$

3 $Al_2(SO_4)_3(aq) + 3Fe(s)$

4 $CuSO_4(aq) + Zn(s)$

A 1 only

B 2 and 3 only

C 3 and 4 only

D 1 and 4 only

E 1, 2 and 4 only

F 2, 3 and 4 only

END OF TEST

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