



# Science

Study Guide- Specialization Test  
(Grade 3 – Grade 8) Teachers

Year 2019



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## Educational Professions Licensure

### Science Study Guide

The Teacher Licensing System in the Ministry of Education of the United Arab Emirates is one of the educational priorities that aim at optimizing investment in teachers in order to help them to achieve the objectives of the ministry and to improve educational outcomes.

The Science Test for teachers is one of the Professional teacher's license requirements for Science teachers of grades 3 through grade 8.

### Test Overview

Test Name	Science Test
Number of questions	100
Test Duration	2 hours
Format of questions	Multiple Choice questions
Test Delivery	Computer delivered

Content Domains	Approximate Percentage of Test	Approximate Number of Questions	<p>Approximate % of Test Domains</p> <p>1. Nature of Science and Technology 2. Earth Science 3. Life Science 4. Physical Education</p>
1. Nature of Science and Technology	10%	10	
2. Earth Science	20%	20	
3. Life Sciences	30%	30	
3. Physical Sciences	40%	40	



## Test specifications

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### 1. Nature of Science and Technology

#### 1.1 Scientific Investigations and Applications

- 1. Scientific Inquiry and Investigation:** Knowledge and understanding of concepts of scientific inquiry, theories, models, laws, investigations, observations, hypotheses, conclusions; scientific method.
- 2. Experimental Design:** Understanding experimental design and use of variables (dependent, independent, controls).
- 3. Data and Analyses:** Knowledge of units of measurements, scientific notation, accuracy, forms of data presentation, basic statistical knowledge, data trends and predictions, drawing conclusions from evidence; applying mathematical concepts.
- 4. Work in the Laboratory:** Knowledge of laboratory procedures, equipment (use, care and maintenance), preparation, safety, emergency procedures.

#### 1.2 Interactions of Science, Engineering and Technology

- 1. Applications and Impacts of Science and Technology:** Understanding of scientific concepts, historical and modern research and innovations, historical concepts and theories.
- 2. Interactions between Science, Engineering and Technology:** Understanding the links between science, engineering and technology
- 3. Historical Figures and their Contributions:** Familiarity of historical figures and their contributions in science
- 4. Science and Technology in Everyday Use:** Knowledge of the use of science and technology in household products, human devices, agricultural practices, medical technologies, and biotechnologies

### 2. Earth Science

#### 2.1 Geology and Human Activity

- 1. Structure and Internal Processes of the Earth:** Knowledge of the internal structure and processes of the earth; layers of the earth; size and shape of the earth



2. **Plate Tectonics:** Understanding of plate tectonics and associated features and processes, earthquakes, volcanoes, folding, faulting; interactions with humans
3. **Rocks and Minerals:** Familiarity with types, characteristics and formation processes of rocks and minerals
4. **Historical Geology, Events and Fossils:** Familiarity of historical concepts in geology, geologic time scale, fossils and fossil formation; historical geologic events

## 2.2 Earth's Location in the Universe

1. **Astronomy and Space:** Knowledge of concepts in astronomy, solar system, planets, the sun, the moon, earth's location and movements in space, orbiting objects in space, space features within the solar system and other parts of the universe
2. **Origins of the Universe and Theories:** Familiarity of theories and concepts of the universe and its origins
3. **Space Exploration and Technologies:** Familiarity of space exploration, technologies, human interactions and contributions

## 2.3 Earth Systems

1. **Surface Processes of the Earth:** Understanding of the processes of weathering (physical and chemical), erosion and deposition, land features associated with these processes, soil formation and characteristics; natural resources; environmental destruction and waste disposal; interactions with humans and human impacts
2. **The Atmosphere, Weather and Climate:** Understanding of concepts and interactions in weather, climate and the atmosphere; atmospheric processes; climatic zones and seasons; pollution, climate change and global warming; effects of latitude, location and elevation; earth's tilt; solar radiation; interactions with humans and human impacts
3. **The Hydrosphere and Earth's Water Bodies:** Knowledge of locations, structure, processes and features of earth's oceans and water bodies, tides, currents and waves; features of glaciers and polar ice; earth's fresh water supplies, access to fresh water; properties of water; interactions with humans and human impacts; water cycle processes and linkages



### 3. Life Sciences

#### 3.1 Organisms and Molecular Structure and Function

**1. Living Things: Basic Structure and Function of Cells:** Understanding of the basic structure and function of cells, cell types, cell reproduction and cellular processes, biological molecules (such as DNA, proteins, enzymes...)

#### 3.2 Biological Diversity: Similarities and Differences

**1. Levels of Organisation:** Knowledge of the levels of organisation in living things: cells, tissues, organs, organ systems.

**2. Classification of Organisms:** Knowledge of the classification of organisms, classification schemes, characteristics of organisms; unicellular/ multicellular organisms

**3. Structure and Function of Plants:** Understanding of the functions of plants and their structures, growth and reproduction; photosynthesis and cellular respiration

**4. Animal Anatomy, Physiology and Behaviours:** Knowledge of anatomy and physiology of animals, structure and function of body systems and organs (including the human body), internal and external exchange systems (such as respiratory, circulatory), movement and support, reproduction and development, and other major body systems; behavior

**5. Diet, nutrition and healthy lifestyles:** Understanding nutrition and healthy lifestyles in humans

#### 3.3 Genetics and Genetic Differences

**1. DNA, Heredity and Genes:** Knowledge of the structure and function of DNA, alleles, inheritance, mutations and genetic disorders; heredity; knowledge of genes and traits

**2. Theories and Concepts in Evolution:** Familiarity of theories, concepts and mechanisms and evidence of evolution

**3. Adaptations in plants and animals:** Understanding of adaptations in plants and animals

#### 3.4 Ecological Systems: Interactions, Energy and Dynamism



**1. Ecological Systems and Energy Flows:** Understanding of populations, communities, ecosystems, biomes: characteristics and dynamics; energy flows and cycles, energy transformations; biodiversity; environmental impacts

## 4. Physical Sciences

### 4.1 Matter and its Transformations

**1. Structure and properties of matter:** Knowledge of the structure and properties of matter, abundance of elements and their isotopes; chemical and physical properties, states of matter, phase changes and related theories and laws

**2. Structure and Characteristics of Atoms:** Knowledge of atoms, atomic structure and characteristics, atomic models; ions, electrons and arrangements, atomic radiation and radioactivity and human uses.

**3. Periodic table:** Familiarity of the organization and use of the periodic table; physical and chemical properties of elements, chemical reactivity.

**4. Chemical Formulae and Bonding:** chemical bonding types and characteristics, chemical formulae and structure, methods of representing compounds and formulae.

**5. Chemical Reactions and Equations:** understanding chemical reactions: types, rates and energy relationships, catalysts; balancing equations.

**6. Acids and bases:** Knowledge of the chemical and physical properties of acids and bases; pH.

**7. Solutions:** Knowledge of solutes, solvents and solutions and factors affecting solubility; pure/impure substances.

### 4.2 Motion and Forces

**1. Mechanics and Motion:** Understanding of the concepts of mechanics and motion: types of motion, laws of motion, relationships involving motion, work, energy, power, gravity, mass and weight; forces; basic motion and force calculations; simple machines; fluid dynamics

**2. Electricity, Magnetism, Wave Energy:** Understanding of electrical energy and magnetism: conductivity, attraction, series and parallel circuits, types of current, resistance, voltage and power, sources of energy, basic laws; magnetic forces and fields, electromagnets



**3. Light and Sound, and the Electromagnetic Spectrum, Dynamics of Waves:** Knowledge of waves, light and sound, the nature of light and the electromagnetic spectrum; types and features of waves; wave phenomena (such as reflection, refraction, transmission, etc); lenses, mirrors and optics; characteristics of sound and sound waves; uses of light and sound and associated devices for humans

#### 4.3 Energy

**1. Relationships between Energy and Matter, Transfers and Transformations:** Understanding of the relationships between energy and matter, laws, forms of energy, energy transformations and transfers

**2. Energy Production:** Knowledge of energy production, conservation, renewable and non-renewable sources and characteristics; human interactions with energy; natural resource



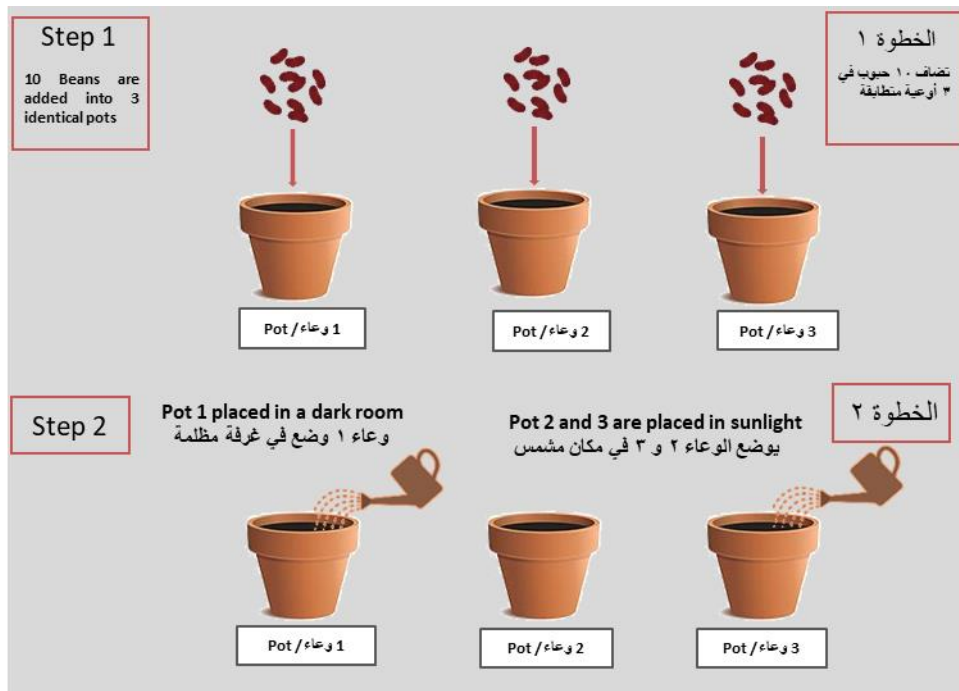
## Sample Questions

Choose the most correct answer:

### Question 1

A scientist wants to study the effects of sunlight and water on seed growth. He sets out the experimental setup shown in the figure below.

يريد عالم دراسة تأثير أشعة الشمس والماء على نمو البذور، يقوم بإعداد التجربة كما في الشكل أدناه.



While analyzing the effect of sunlight on seed growth, the amount of water is considered a/an.....variable.

أثناء تحليل تأثير أشعة الشمس على نمو البذور ، تعتبر كمية الماء متغيرًا .....

a. experimental

تجريبي

b. controlled

متحكم فيه

c. dependent

مستقل

d. independent

غير مستقل



## Question 2

A student placed a piece of zinc into excess dilute hydrochloric acid and measured the reaction rates as shown in the table:

وضع الطالب قطعة من الزنك في حمض الهيدروكلوريك الزائد المخفف وقاس معدلات التفاعل كما هو موضح في الجدول:

الوقت (s) Time (s)	حجم الهيدروجين (cm <sup>3</sup> ) Volume of hydrogen (cm <sup>3</sup> )
0	0
20	42
40	66
60	75
80	80
100	82

Which of the following statements about this reaction is correct?

أي من العبارات التالية حول هذا التفاعل صحيحة؟

a. The rate of reaction in the first 20 seconds and the last 20 seconds is the same

معدل رد الفعل في أول 20 ثانية وآخر 20 ثانية هو نفسه

b. The rate of reaction between 40 seconds and 60 seconds is 1.25 cm<sup>3</sup> of hydrogen produced per second

معدل التفاعل بين 40 ثانية و 60 ثانية هو 1.25 سم<sup>3</sup> من الهيدروجين المنتج في الثانية

c. The rate of reaction between 60 seconds and 80 seconds is slower than the rate of reaction in the first 20 seconds

يكون معدل التفاعل بين 60 ثانية و 80 ثانية أبطأ من معدل التفاعل في أول 20 ثانية

d. The rate of reaction stays constant throughout the entire time interval

يبقى معدل التفاعل ثابتاً طوال الفترة الزمنية



### Question 3

A geologist was giving a speech explaining some rock findings at a nearby quarry. This is part of his speech:

***“Deep magma pushed its way up slowly through cracks between the relatively soft layers of limestone. The intense heat and pressure from the rising magma, seemed to create layers of white marble adjacent to the limestone....”***

Which of the following processes is most likely what the geologist is describing?

كان جيولوجي يلقي خطابًا يشرح فيه بعض الاكتشافات الصخرية في محجر قريب. هذا جزء من خطابه:

***“الحمم البركانية المنصهرة العميقة دفعت طريقها للأعلى ببطء من خلال الشقوق بين الطبقات الناعمة نسبيًا من الحجر الجيري. بدا أن الحرارة الشديدة والضغط الناجم عن الحمم البركانية المنصهرة المرتفعة تخلق طبقات من الرخام الأبيض بجوار الحجر الجيري ...”***

أي من العمليات التالية هي على الأرجح ما يصفه الجيولوجي؟

a. Volcanic eruption

انفجار بركاني

b. Weathering of limestone

التجوية من الحجر الجيري

c. Sedimentation

ترسيب

d. Metamorphism

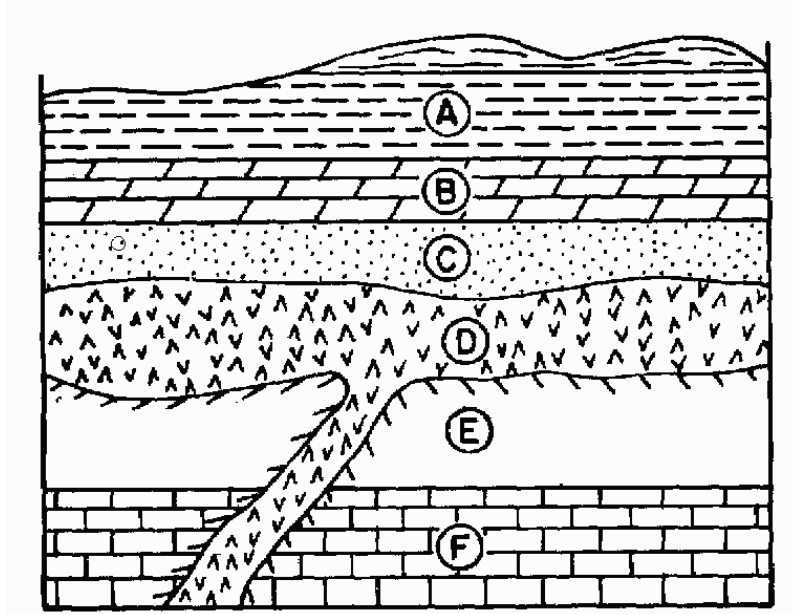
التحول



#### Question 4

The diagram represents a cross-section of layers below the surface of the Earth, labelled from A to F.

يمثل الرسم البياني مقطعًا عرضي للطبقات أسفل سطح الأرض، مسمى من A إلى F



Which of the following statements about the layers shown in the diagram is most accurate?

أي العبارات التالية حول الطبقات الموضحة في الرسم البياني هي الأكثر دقة؟

a. Layer A is older than layer F.

الطبقة A أقدم من الطبقة F

b. Layer D is the oldest layer.

الطبقة D هي أقدم طبقة

c. Layer C is older than layer A.

الطبقة C أقدم من الطبقة A

d. Layers B and F are the same age.

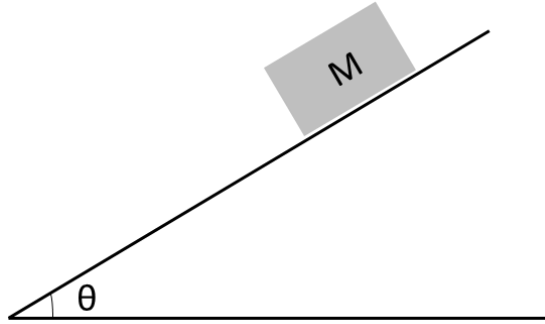
الطبقات B و F هي من نفس العمر



### Question 5

A box M of mass 2kg is placed on an inclined surface with friction  $f=6.7\text{N}$ . At what angle  $\theta$  will the box be in equilibrium.

وضع صندوق M بحجم 2kg على سطح مائل مع قوة احتكاك  $f = 6.7\text{N}$ . في أي زاوية  $\theta$ ، سيكون الصندوق في حالة توازن.



a.  $10^\circ$

b.  $20^\circ$

c.  $30^\circ$

d.  $40^\circ$



### Question 6

The following extract was taken from a biology textbook:

**“...homologous chromosomes make contact with each other called chiasmata and “تعاير” occurs. This is where chromosomes exchange sections of DNA.”**

The extract is describing which of the following stages of cell division?

المقتطف التالي مأخوذ من كتاب علم الأحياء:

“تتلامس الكروموسومات المتجانسة مع بعضها البعض وتشكل تصالبات حيث تحدث عملية التعاير. هذا هو المكان الذي تتبادل فيه الكروموسومات أجزاء من الحمض النووي.”

هذا المقتطف يصف أي من المراحل التالية لانقسام الخلية؟

a. Prophase I in meiosis

“Prophase I” في الانقسام الاختزالي

b. Prophase in mitosis

“Prophase” في الانقسام المتساوي

c. Anaphase I in meiosis

“Anaphase I” في الانقسام الاختزالي

d. Anaphase in mitosis

“Anaphase” في الانقسام المتساوي

### Question 7

What is the electron configuration of Br<sup>-</sup>?

ما هو التوزيع الإلكتروني ل Br<sup>-</sup> ؟

a. [Ar] 3d<sup>10</sup> 4s<sup>2</sup> 4p<sup>5</sup>

b. [Ar] 4d<sup>10</sup> 5s<sup>2</sup> 5p<sup>5</sup>

c. [Ar] 3d<sup>10</sup> 4s<sup>2</sup> 4p<sup>6</sup>

d. [Ar] 4d<sup>10</sup> 5s<sup>2</sup> 5p<sup>6</sup>



### Question 8

Which statement about the periodic table is correct?

أي عبارة عن الجدول الدوري للعناصر الكيميائية صحيحة؟

a. Sodium and Potassium are in the same period

الصوديوم والبوتاسيوم في نفس الدورة

b. Carbon and Oxygen are in the same group

الكربون والأكسجين في نفس المجموعة

c. Sodium and Potassium have the same atomic radius

الصوديوم والبوتاسيوم لهما نفس نصف القطر الذري

d. Krypton and Radon are both noble gases

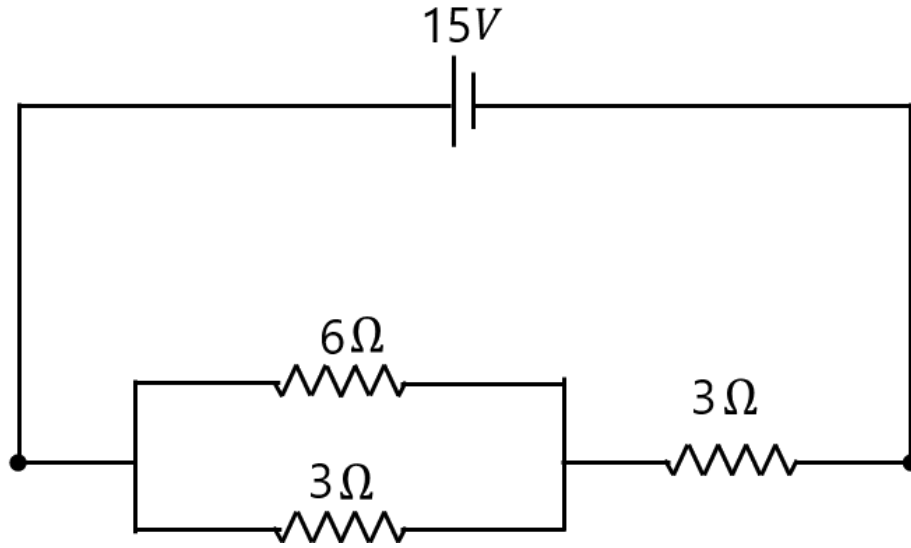
كريبتون ورادون كلاهما غازات نبيلة



### Question 9

The diagram shows a circuit with a power source of 15 Volts. What would be the current of the 6 Ohms resistor?

يُظهر الرسم البياني دائرة كهربائية بها مصدر طاقة يبلغ 15 فولت. ماذا قيمة التيار الذي يمر في المقاومة 6 أوم؟



a. 1 A

b. 2 A

c. 4 A

d. 3 A



### Question 10

The contents of a pressure cooker are heated with 20J of energy. However, excess vapour pressure causes the lid to blow off with a force of 3 N causing it to rise 2.5 m into the air. What is the total change in the energy of the system?

تم تسخين محتويات طبخ الضغط بواسطة 20 J من الطاقة. ولكن، قد تسبب ضغط البخار الزائد إلى انفصال الغطاء بقوة 3N وارتفاعه 2.5 متر في الهواء. ما هو التغير الكلي في طاقة النظام؟

a. 12.5 J

b. 7.5 J

c. -12.5 J

d. -7.5 J

### Question 11

In plants, in which tissue system would you find Parenchyma, Collenchyma and Sclerenchyma tissue?

في النباتات، في أي نظام أنسجة سوف تجد الأنسجة الحشوية والغروية والخشبية؟

a. Ground

أنسجة أرضية

b. Dermal

أنسجة جلدية

c. Vascular

الأنسجة الوعائية النباتية



### Question 12

Which of the following groups of animals is characterized as having a two chambered heart?

أي من المجموعات التالية من الحيوانات تتميز بوجود قلب ذو غرفتين؟

a. Fish

الاسماك

b. Birds

الطيور

c. Reptiles

الزواحف

d. Mammals

الثدييات

### Question 13

In a completely dark room, white light is shined at a red ball after passing through a blue filter and a red filter respectively.

في غرفة مظلمة تماما, يضيء ضوء أبيض على كرة حمراء بعد المرور عبر مرشح ضوئي أزرق ومرشح ضوئي أحمر على التوالي. ما اللون الذي ستظهر به الكرة؟

What color will the ball appear to have?

a. Red

أحمر

b. Blue

أزرق

c. black

أسود

d. Green

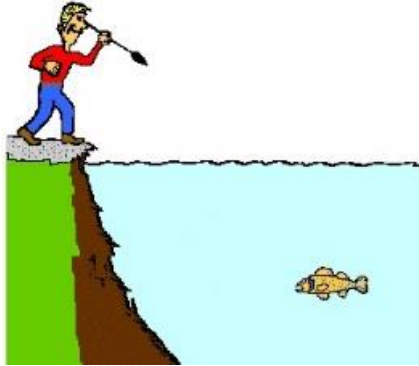
أخضر



### Question 14

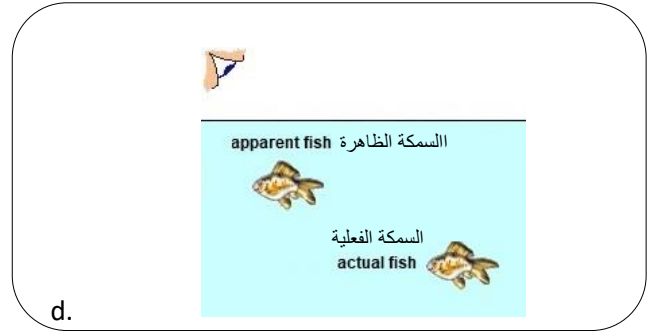
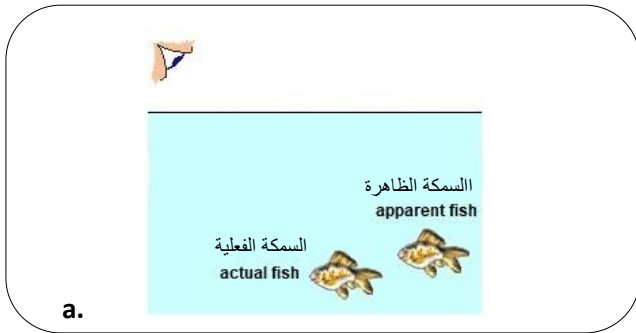
Salim is trying to spear a fish in a lake.

يحاول سالم أن يرمي سمكة في بحيرة.



Which one of the following diagrams represents the image of the fish as observed by Salim?

أي من المخططات التالية تمثل صورة السمكة كما يراها سالم؟

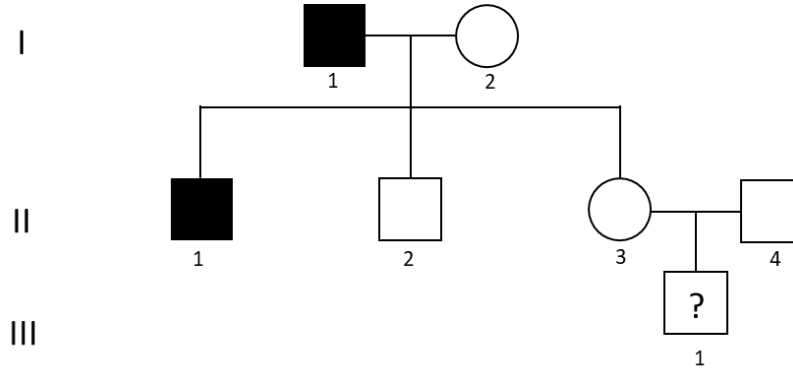




### Question 15

The diagram below shows a pedigree of a family with a history of an X-linked disease.

يوضح الرسم البياني أدناه شجرة نسب عائلة لها تاريخ من مرض مرتبط بالصبغي X.



What is the risk that the newborn III-1 will be expressing the disease?

ما هي نسبة احتمال أن يكون المولود الجديد III 1 مصاباً بهذا المرض.

a. 25%

b. 50%

c. 75%

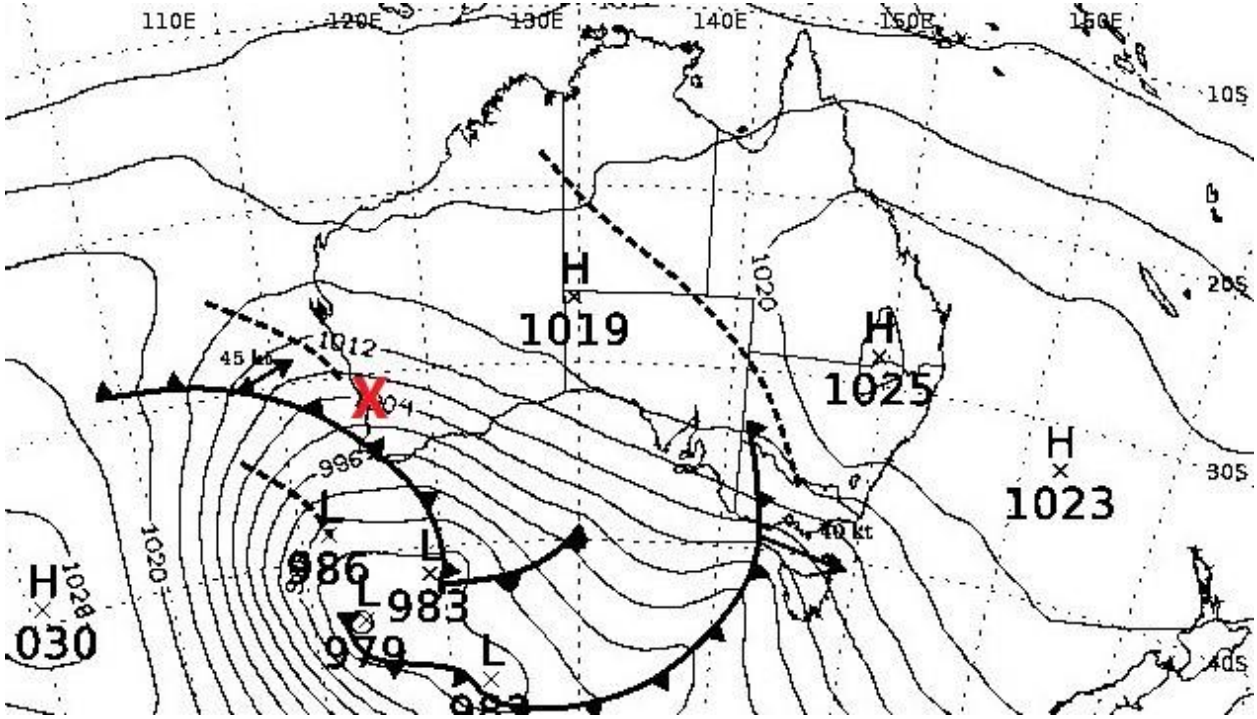
d. 100%



### Question 16

The diagram below is a synoptic chart showing weather conditions for Australia on a particular day in June.

الرسم البياني أدناه عبارة عن خريطة طقس إجمالية للأحوال الجوية في أستراليا في يوم معين في يونيو.



Source: Bureau of Meteorology Australia

Which of the following best describes the expected **weather conditions at location X** for around 6 hours after the chart was drawn?

أي مما يلي يصف أفضل الأحوال الجوية المتوقعة في الموقع "X" لحوالي 6 ساعات بعد رسم المخطط؟

a. Hot and dry with north-west winds

حارة وجافة مع رياح شمالية غربية

b. Cold and wet with north-west winds

باردة ورطبة مع رياح شمالية غربية

c. Cold and wet with south-west winds

باردة ورطبة مع رياح جنوبية غربية

d. Cold and dry with south-east winds

باردة وجافة جنوبية شرقية



## Answer Key

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Question	Answer
1	b
2	c
3	d
4	c
5	b
6	a
7	c
8	d
9	a
10	a
11	a
12	a
13	c
14	a
15	b
16	c