FAMOUS STUDENTS PLATFORM

QUESTION BOOKLET

GRADE 9 & 10

TIME ALLOWED : 90 MINS

MAXIMUM MARKS : 90

2023

FSP SCIENCE CONTEST

FSP

VIBRANT YOUNGSTERS COMPETITIONS

INSTRUCTIONS

1) Don't start attempting the paper until instructed by the invigilator.
2) instructions from the examination invigilator must be carried out promptly.
3) Carefully recheck your name, father name, school name, address etc at the bubble sheet / answer sheet.
4) Record all answers on the bubble sheet only. select best answer from the four given options and mark only one option in each question.
5) Use blue / black ink to fill up the circles for your answers on the bubble sheet use of lead pencil is not allowed.
6) Use of any helping material including cell phones and electronic devices is strictly prohibited.
7) Every correct answer earns three points. there would be negative marking. one point would be deducted for every incorrect answer.
8) Candidates may not leave the examination room unescorted for any reason, and this includes using the washroom.
9) No materials or electronic devices shall be brought in to the room.
10) There are five categories of the contest as under:
    A) Vibrant Youngsters(Grade I & 2)
    B) Vibrant Youngsters(Grade 3 & 4)
    C) Vibrant Youngsters(Grade 5 & 6)
    D) Vibrant Youngsters(Grade 7 & 8)
    E) Vibrant Youngsters(Grade 9 & 10 / O-levels)
11) Only registered students can participate in the contest.
12) No candidate shall take out of the hall any answer book(s) or part of an answer book, whether used or unused, or other supplied material.
13) If a participant does not understand a word or phrase on the exam paper, neither examiner nor invigilator is permitted to answer.
14) for information about upcoming contests or providing valuable feedback,

    please visit www.fspcompetitions.org
15) Any academic misconduct or malpractice must be reported to fsp vibrant youngsters at info@fspcompetitions.org

READ THE INFORMATION BELOW. QUESTION 1 & 2

The key shows one way to classify flowers based on their method of pollination.

1. Petals small or inconspicuous; feathery flower parts; flower with no odour .....wind
   Large, obvious petals; flower parts not feathery; flower with or without odour.....go to 2

2. Petals white or dull in colour.....go to 3
   Petals coloured.....go to 4

3. Flower with strong, sweet odour..... moth
   Flower with strong, fermenting or fruitlike odour.....bat
   Flower smells of sweat,facing or decaying meat.....fly

4. Flower shape tubular.....go to 5
   Flower shape not tubular.....go to 6

5. Flower with strong, sweet odour.....butterfly
   Flower usually brightly coloured with little or no odour.....bird

6. Flower shape regular and symmetrical; odour often fruity, spicy, sweet or carrion-like.....beetle
   Flower shape not symmetrical; petals blue, yellow or orange; sweet, fragrant odour.....bee

QUESTION 1 :

Shahida found a tree with large white flowers that smelled like fruit.

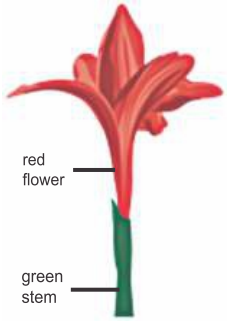
Which organism most likely pollinates these flowers?

(A) bats
(B) bees
(C) butterflies
(D) moths

QUESTION 2 :

Shahida drew the picture shown right of a flower in her garden.

The flower had no odour.



The flower would most likely be pollinated by a

(A) bee
(B) beetle
(C) bird
(D) butterfly

QUESTION 3 :

The table below gives information about identifying bacteria.

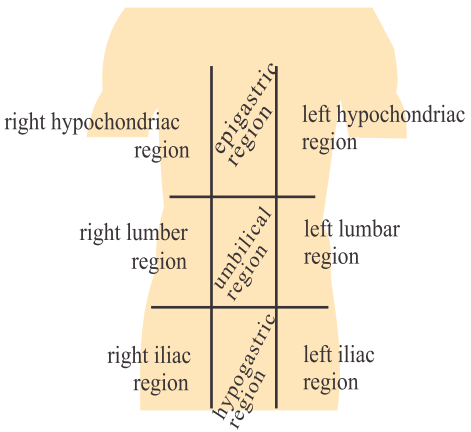
	Bacteria				
Property	*Clostridium*	*Escherichia*	*Salmonella*	*Staphylococcus*	*Streptococcus*
shape	rod-shaped	rod-shaped	rod-shaped	spherical clusters	spherical chains
gram staining	positive	negative	negative	positive	positive
aerobic growth	no	yes	yes	yes	yes
anaerobic growth	yes	yes	yes	yes	yes
formation of endospores	yes	no	no	no	no

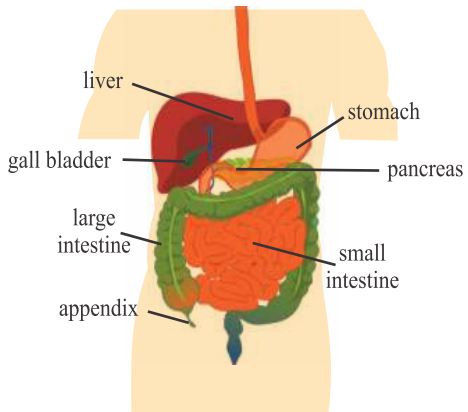
What property of *Staphylococcus* distinguishes it from the other listed bacteria?

(A) shape
(B) gram staining
(C) aerobic growth
(D) formation of endospores

QUESTION 4 :

The abdominal cavity can be divided into nine regions in order to easily describe the location of internal organs. The diagram below shows the front view of the abdominal cavity.





In which region is the gall bladder located?

(A) right hypochondriac
(B) epigastric
(C) left hypochondriac
(D) right lumbar

Read the information below. Question 5 & 6.

Calcium is an important element in the human body. Bones, nerves and muscles all require calcium to function normally.

Table 1 gives information about the recommended daily intake of calcium.

Table 1

Category	Age (Years)	Calcium (mg)
Children	1-3	700
	4-7	800
Girls	8-11	900
	12-15	1000
	16-18	800
Women	19-54	800
	54+	1000
Boys	8-11	800
	12-15	1200
	16-18	1000
Men	19-64	800
	64+	800

Table 2 shows the amount of calcium in some foods.

Table 2

Food	Serving size	Calcium (mg)
Whole milk	1 cup (250 mL)	285
Skim milk	1 cup (250 mL)	310
Natural yoghurt	1 cup (200 g)	340
Low fat yoghurt	1 cup (200 g)	420
Cheese	40 g	310
White bread	1 Slice	15
Cooked spinach	1 cup (340 g)	170
Cooked cabbage	1 cup (100 g)	30
Fish	½ cup	230

Question 5.

Sehar is 14 years old. She had a sandwich for lunch made with 40 g of cheddar cheese and 2 slices of white bread.

Approximately what percentage of the recommended daily intake of calcium did Sehar have in her lunch?

(A) 30%
(B) 35%
(C) 40%
(D) 60%

Question 6.

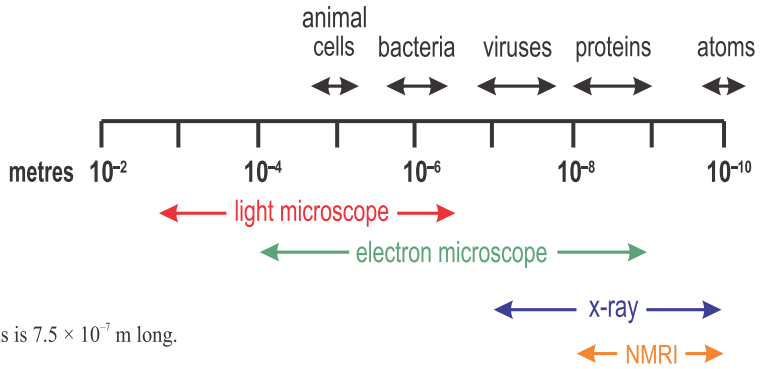
Hamza is 12 years old and likes milk.

What is the minimum amount of whole milk that Hamza would have to drink to get his recommended daily intake of calcium?

(A) 3.4 cups
(B) 3.8 cups
(C) 4.3 cups
(D) 4.5 cups

Question 7.

The diagram gives information about the diameters of classes of microscopic objects in metres and the operating ranges of instruments used to measure them.



The poxvirus is 7.5×10^{-7} m long.

Which instrument is most useful for studying the pox virus?

(A) light microscope
(B) electron microscope
(C) X-ray microscope
(D) NMRI (nuclear magnetic resonance imager)

Question 8.

Many fragrances contain a group of compounds called esters.

The table gives information about some esters and the fragrance they produce.

Ester	Structural formula of molecule	Fragance
ethyl methanoate	$H-C(=O)-O-CH_2-CH_3$	rum
methyl butanoate	$CH_3-CH_2-CH_2-C(=O)-O-CH_3$	apple
ethyl butanoate	$CH_3-CH_2-CH_2-C(=O)-O-Ch_2-CH_3$	pineapple
propyl ethanoate	$CH_3-C(=O)-O-CH_2-CH_2-CH_3$	pear

Which structure do the ester compounds in the table have in common?

(A) $CH_3-C(=O)-O-$
(B) $-CH_2-Ch_2-$
(C) $-O-CH_2-$
(D) $-C(=O)-O-$

READ THE INFORMATION BELOW. QUESTION 9 & 10

Sheraz tested the effectiveness of five different disinfectants. He added the same type of bacteria to five identical nutrient plates and then added a different disinfectant to each plate. He incubated the plates at the same temperature for the same length of time. The bacteria grew on all of the plates except one.

QUESTION 9 :

What can he conclude from his experiment?

(A) One plate was contaminated and needs to be redone
(B) The plates needed to be incubated for a longer period of time
(C) The bacteria require a different temperature for maximum growth
(D) One disinfectant was effective in stopping the bacteria from growing

QUESTION 10 :

Sheraz needed an appropriate control for this experiment.

He should use a nutrient plate with

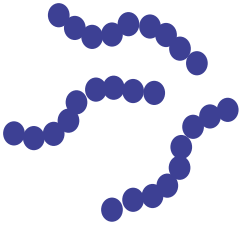
(A) nothing on it
(B) only bacteria on it
(C) all five disinfectants on it
(D) bacteria and all five disinfectants on it

QUESTION 11 :

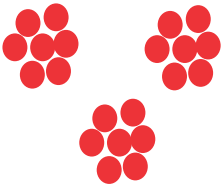
Streptococcus bacteria are spherical in shape and form chains of colonies.

Which drawing represents colonies of *Streptococcus*?

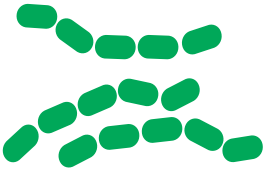
(A)



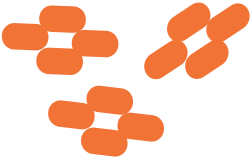
(B)



(C)



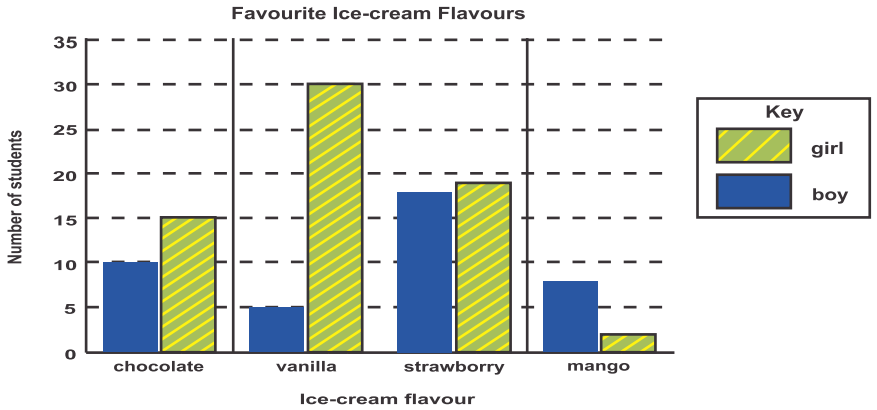
(D)



(A) A
(B) B
(C) C
(D) D

QUESTION 12 :

Sarah's school has six grades. Sarah surveyed students in her own grade to find out their favourite ice-cream. The graph shows her results.



Which ice-cream flavour was the most popular in Sarah's grade?

(A) chocolate
(B) vanilla
(C) strawberry
(D) mango

QUESTION 13 :

The table gives information about the effects of alternating electric current on the body.

Effect	Current causing effect
Tingling sensation	1 mA
Muscle cramps	10-20 mA
Burns	High current density more than 200 mA
Respiratory arrest (stops breathing)	More than 200 mA
Cardiac arrest (blood not pumped)	More than 200 mA
Ventricular fibrillation	100-300 mA

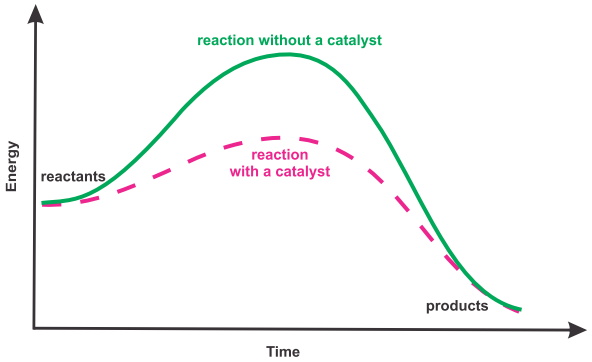
What would be the effect on the body of a current of 150 mA?

(A) burns
(B) cardiac arrest
(C) respiratory arrest
(D) ventricular fibrillation

Question 14.

A catalyst is a substance that speeds up chemical reactions but is not consumed during the reaction.

The graph shows the energy differences in chemical reactions with and without a catalyst.



Catalysts are used in many industrial reactions. What is the most likely reason for using a catalyst?

(A) A catalyst produces a greater amount of product
(B) A catalyst releases more energy during the reaction
(C) Products will not form without a catalyst being present
(D) Less energy is required to begin the reaction when a catalyst is used

Question 15.

Responses of the autonomic nervous system of mammals are grouped into two categories: sympathetic (triggered during times of stress) and parasympathetic.

The table shows the characteristics of the nervous system of a rabbit.

	Sympathetic	Patasympathetic
Heart rate	increases	normal
Breathing	increased	normal
Digestive acids	inhibited	secretes
Adrenaline	secreted	inhibited
Immune system	suppressed	normal

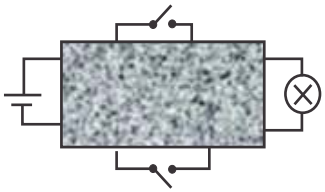
A rabbit is being chased by a pack of wolves and it is under extreme stress.

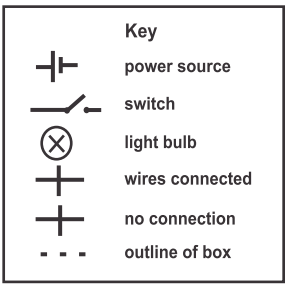
Which response correctly describes the rabbit's autonomic nervous system?

(A) increased breathing; digestion inhibited; adrenaline inhibited
(B) increased heart rate; adrenaline inhibited; increased breathing
(C) adrenaline secreted; increased heart rate; increased digestion
(D) adrenaline secreted; increased heart rate; increased breathing

QUESTION 16 :

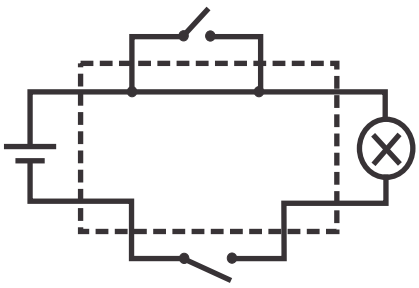
An electric circuit must be closed for an electric current to flow.The diagram shows parts of an electric circuit. Part of the circuit is hidden in a box.



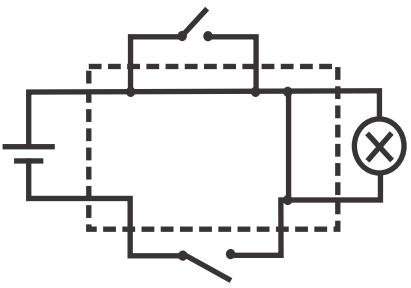


The light bulb shines when both switches are open.

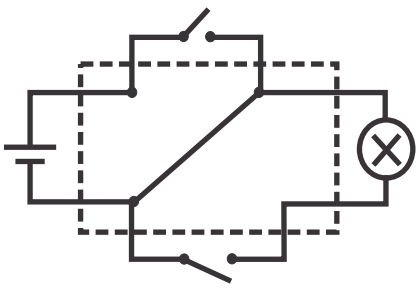
Which diagram correctly shows the complete circuit?



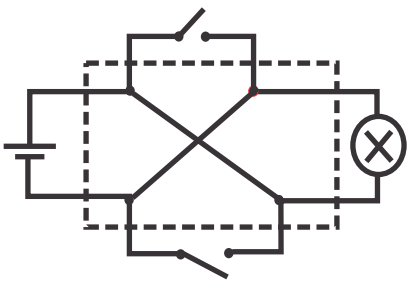
(A)



(B)



(C)



(D)

(A) A
(B) B
(C) C
(D) D

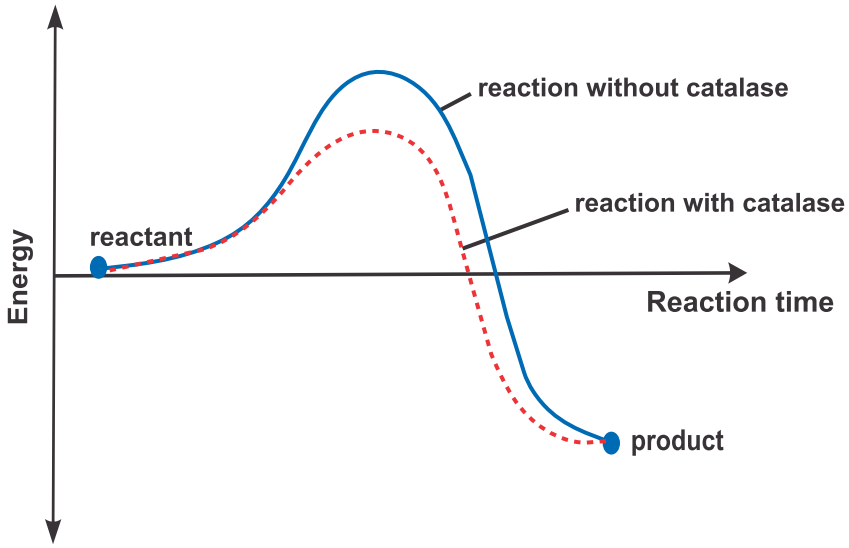
READ THE INFORMATION BELOW. QUESTION 17 & 18 .

Hydrogen peroxide decomposes to form water and oxygen. Catalase is an enzyme that can be used to speed up this reaction.

$$2H_2O_{2(l)} \longrightarrow 2H_2O_{(l)} + O_{2(g)}$$

hydrogen peroxide — water — oxygen

The diagram below shows the energy changes occurring during the decomposition reaction of hydrogen peroxide.



QUESTION 17 :

Which of the following statements can be concluded from the diagram?

(A) Catalase increases the amount of product produced
(B) Catalase decreases the amount of reactant required
(C) Catalase must be present for the decomposition reaction to occur
(D) Catalase decreases the amount of energy required for the decomposition reaction to occur

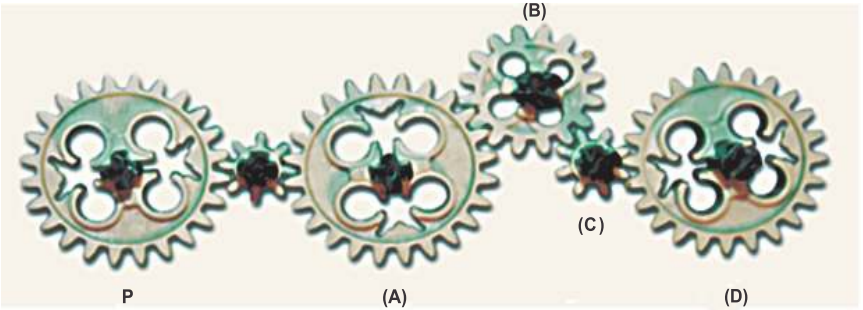
QUESTION 18 :

Which is the reactant?

(A) catalase
(B) hydrogen peroxide
(C) oxygen
(D) water

Question 19.

The photograph shows six gears.

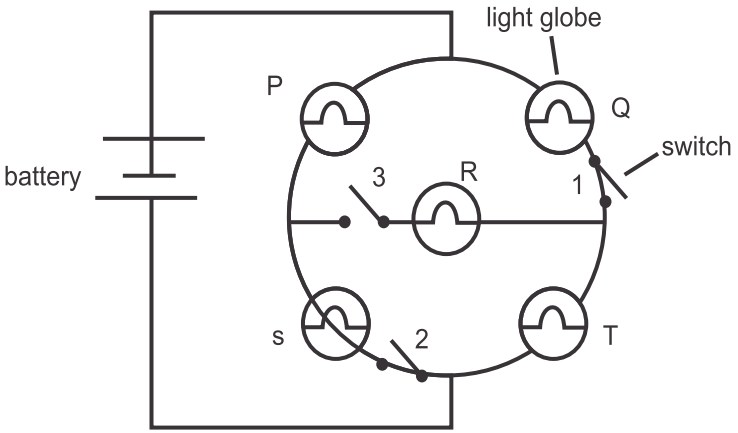


Which gear would rotate at the same speed and in the same direction as gear P?

(A) A
(B) B
(C) C
(D) D

Question 20.

The diagram shows an electric circuit consisting of five identical light globes (P, Q, R, S and T) and three switches (1, 2 and 3) all connected to a battery.



Which globes will be on when only switch 3 is closed?

(A) R only
(B) P, R and T only
(C) P, R and S only
(D) P, Q, R and T only

Question 21.

Pakistan Council of Scientific and Industrial Research (PCSIR) has identified five emerging areas in science which will impact on our future:

- biotechnology
- complex science systems
- information and communication technology
- nanotechnology
- social and economic integration

The scientific study that involves the research and use of living things to develop products and services to benefit society would be classified as

(A) biotechnology
(B) information and communication technology
(C) nanotechnology
(D) social and economic integration

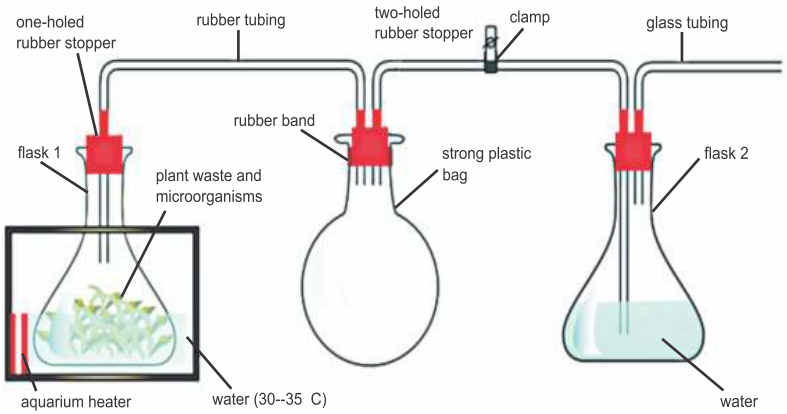
Question 22.

Biogas is a mixture of the methane and carbon dioxide. Digestion of plant waste by microorganisms produces biogas. These microorganisms function at 30–35 °C.

The table shows some characteristics of carbon dioxide and methane.

Characteristic	Carbon dioxide	Methane
solubility in water	high	low
flammability	low	high

A group of students used these pieces of equipment to collect biogas.

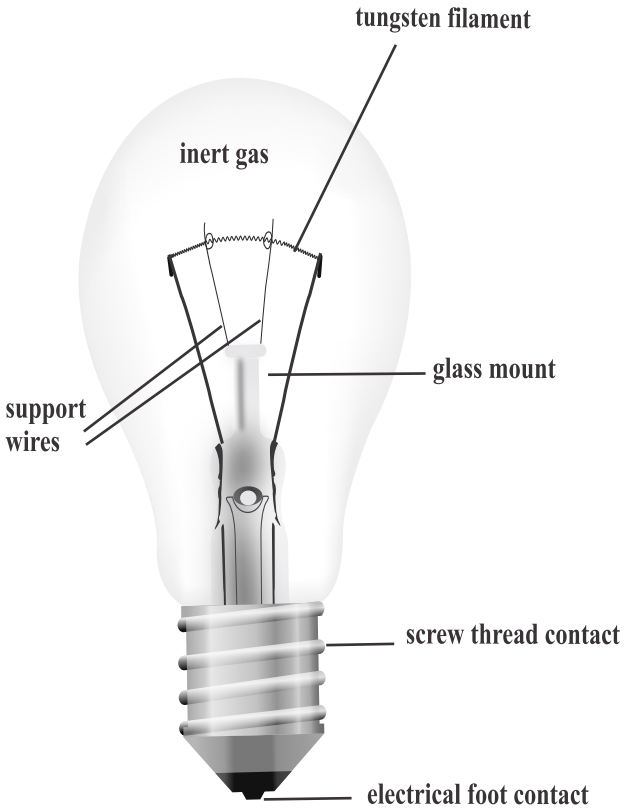


After four weeks, they removed the clamp. What was the purpose of the water in flask 2?

(A) to prevent methane from burning
(B) to provide a warm environment for the microorganisms to function
(C) to dissolve carbon dioxide and separate methane from carbon dioxide
(D) to dissolve the plant waste so that it can be digested by microorganisms

Question 23.

This is a diagram of a light bulb.



For the bulb to shine, a circuit must be formed that includes the filament. If there is enough current, the filament will get hot and give off light.

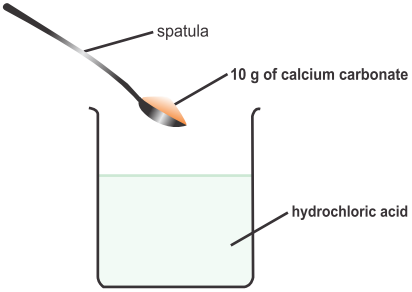
Glass is an insulator and wire is a conductor.

Why is the mount made of glass?

(A) to ensure the current flows along the correct path
(B) to magnify the light produced by the filament
(C) to provide support for the light globe
(D) to complete the circuit

Question 24.

A student added calcium carbonate to hydrochloric acid as shown.



Calcium carbonate reacts with hydrochloric acid according to this equation:

$$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$$

The student carefully weighed the beaker and the solution and the calcium carbonate before mixing them and then weighed the beaker with the contents after the reaction had finished.

How did the mass of the beaker and contents after the experiment compare to the total mass before the student carried out the experiment? Why?

(A) equal, because there are equal numbers of atoms on each side of the equation
(B) greater, because calcium chloride is heavier than calcium carbonate
(C) less, because carbon dioxide gas escaped from the beaker
(D) cannot be predicted without the atomic weights

Question 25.

The slope of a road reduces the amount of effort required to lift a load up a vertical distance. This reduction in the amount of effort required is called the mechanical advantage (MA) of the slope.

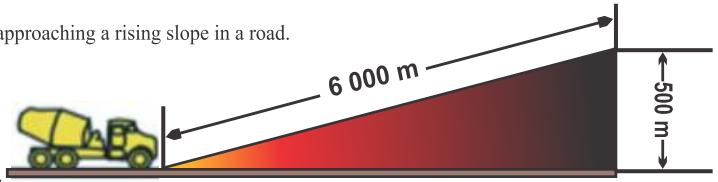
The MA of a slope may be calculated using the following formulas:

$$\text{MA of slope} = \frac{\text{length of slope}}{\text{vertical rise of slope}}$$

$$\text{MA of slope} = \frac{\text{load}}{\text{effort force required to move the load}}$$

Force is measured in newtons (N). On Earth a 1 kg mass has a weight force of approximately 10 N.

The diagram shows a truck approaching a rising slope in a road.



The truck weighs 30 000 kg.

What effort force (N) would be required to lift the truck up the 500 m rise using the slope?

(A) 250 N
(B) 2 500 N
(C) 25 000 N
(D) 250 000 N

QUESTION 26 :

The following quantities can be measured experimentally:

average temperature of the Earth (T_e) = 287 K

radius of the Sun (R_s) = 6.96×10^8 m

average distance between Earth and Sun (D) = 1.5×10^{11} m

The average temperature of the Earth is related to the average surface temperature of the Sun (T_s) by the formula given:

$$T_e = T_s \sqrt{\frac{R_s}{2D}}$$

If the average distance between the Earth and the Sun was increased fourfold, by what factor would the temperature of the Earth change?

(A) 1/16
(B) 1/2
(C) 2
(D) 16

QUESTION 27 :

A compound has the formula XO_2. The table shows the characteristics of the atoms (X and O) that form this compound.

	X	O
number of atoms per molecule	1	2
mass of atom	?	16
% by mass	47	53

What is the mass of atom X?

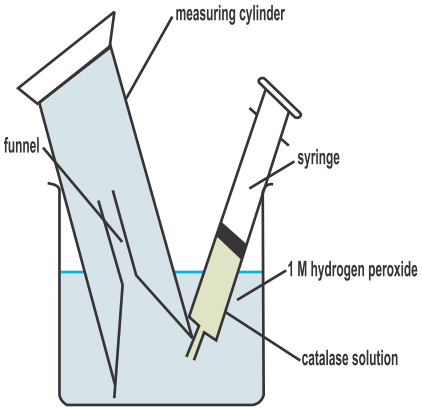
(A) 14
(B) 28
(C) 32
(D) 78

QUESTION 28 :

The enzyme catalase is found in the liver where it decomposes hydrogen peroxide to water and oxygen.

A student wished to find out how the concentration of catalase affects the rate at which hydrogen peroxide is decomposed. He defined the reaction rate as the change in the volume of oxygen divided by the time taken.

He set up the apparatus shown.



The student made up six 10 mL solutions of catalase. He injected the solution into the funnel as shown and recorded the time taken to collect 50 mL of oxygen in the measuring cylinder. The table shows his results.

Concentration of catalase (%)	Time taken to produce 50 mL of oxygen (s)	Reciprocal of the time taken (s^{-1})	Average rate of reaction (mL oxygen S^{-1})
100	20	0.05	2.5
80	25	0.04	2.0
60	33	0.03	1.5
40	50	0.02	1.0
20	100	0.01	0.5
0	no gasproduced	undefined	

Which of these relationships best summarises the data in the table?

(A) The time taken is proportional to the concentration of catalase
(B) The time taken is inversely proportional to the concentration of catalase
(C) The greater the concentration of catalase, the smaller the time taken
(D) The greater the concentration of catalase, the greater the time taken

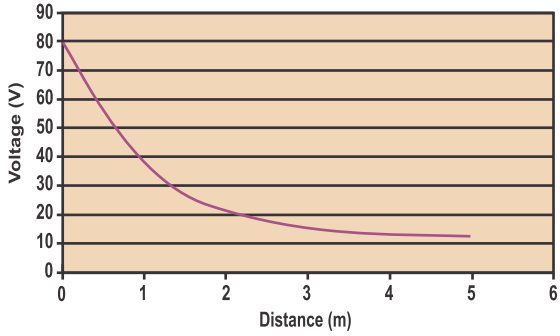
QUESTION 29 :

When earthing high voltage to ground, soil resistivity is the key factor determining the resistance of a ground electrode. The table shows how moisture and temperature affect the resistivity for sandy loam.

Water content (% by weight)	Temperature (°C)	Resistivity (Ω-cm)
0	20	$>10^9$
2.5	20	150 000
5	20	43 000
10	20	18 500
15	10	9 900
15	0 (water)	13 800
15	0 (Ice)	30 000
15	−5	79 000
15	−15	330 000
30	20	4 200

As a person walks towards or away from a source of electricity, it is possible for that person to experience a potential difference (voltage) between their feet. The human body is usually a better conductor of electricity than the ground, so electricity can flow from one foot to the other through the body.

The graph shows how a typical ground (surface) potential difference varies with distance from a grounded electrode.



When a high voltage is earthed, the ground becomes energized. The best way to get to safety (ten meters from the fault) would be to

(A) take the biggest step possible
(B) put your hands to the ground to cancel the potential difference between your feet
(C) ask your friend to hand you the end of a stick then pull you to safety
(D) shuffle or hop keeping your feet close together

QUESTION 30 :

Some materials flow easily only when they are stirred, shaken or have some force applied to them. This property is called "thixotropy".

Which statement about paint demonstrates its thixotropy?

(A) Paint often needs to be mixed with a solvent before applying it to a surface
(B) Paint is easy to apply with a brush, and then stays on a wall or ceiling
(C) Paint brushes need to be washed thoroughly with a solvent
(D) Paint spreads evenly on a wall or ceiling

ANSWER SHEET

GRADE 9&10

Q.NO	ANSWER	Q.NO	ANSWER
1	● B C D	16	A B C ●
2	A B ● D	17	A B C ●
3	● B C D	18	A ● C D
4	● B C D	19	● B C D
5	A ● C D	20	A ● C D
6	A B ● D	21	● B C D
7	A ● C D	22	A B ● D
8	A B C ●	23	● B C D
9	A B C ●	24	A B ● D
10	A ● C D	25	A B ● D
11	● B C D	26	A ● C D
12	A B ● D	27	A ● C D
13	A B C ●	28	A ● C D
14	A B C ●	29	A B C ●
15	A B C ●	30	A ● C D

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