1. A student carried out four tests on a sample of biological molecules.

Test	Observation
emulsion	cloudy
Benedict's	yellow
biuret	purple
iodine	yellow

Which conclusions made by the student are correct?

A. Fat was present.
B. Glucose was present.
C. Protein was present.
D. Starch was not present.

1. A, B, C and D
2. A, B and D only
3. A, C and D only
4. B and C only

2. Many flowers have adapted to have specialised patterns of pigments on their petals which are only visible in the ultraviolet (UV) range of light, thus being invisible to the human eye. It is found that these flowers are pollinated by insects such as the European honey bee (Apismellifera) whose vision includes this ultraviolet range.

What is a reasonable inference to draw from this relationship?

1. The ultraviolet pigments assist the plant in the light capture phase of photosynthesis.
2. Insect pollinators evolved ultraviolet vision after several generations of trying to locate their food sources.
3. These flowers were genetically modified for commercial purposes and have established themselves in natural ecosystems.
4. The plants which developed ultraviolet pigmentation attracted more pollinators and thus were more reproductively successful.

3. Why do the contents of xylem vessels always flow upwards from roots to leaves, while the contents of phloem sieve tubes can flow either upwards or downwards?

1. Xylem vessels use gravitational force, while phloem sieve tubes rely on diffusion.
2. Xylem vessels rely on transpirational pull, root pressure, and capillary action, whereas phloem sieve tubes use a pressure-flow mechanism from source to sink.
3. Xylem vessels are thicker and more rigid than phloem sieve tubes, which allows for unidirectional flow.
4. Xylem vessels transport organic nutrients, while phloem sieve tubes transport water and minerals.

4. Which of the following are true about cytokinesis of an animal cell?

I : Spindle threads emerge from centrioles
II : Constriction of plasma membrane
III : Spindle threads emerge from the cytoplasm
IV : Formation of cell plate

1. I and II only
2. III and IV only
3. I, II and III only
4. II, III and IV only

5. During the photosynthesis experiment, a student sets up three plants under different conditions:

Condition A : Place the plant in normal sunlight with a sufficient amount of water and carbon dioxide.

Condition B : Place the plant in dim light with a sufficient amount of water and carbon dioxide.

Condition C : Place the plant in normal sunlight but without carbon dioxide.

After one week, which condition would likely show the least plant growth and why?

1. Condition A only because it lacks sufficient carbon dioxide for photosynthesis.
2. Condition B only because it lacks sufficient light energy for photosynthesis.
3. Condition C only because it lacks sufficient water for photosynthesis.
4. Conditions B and C because they both lack essential factors required for photosynthesis.

6. DNA replication is semiconservative. This statement means that:

1. each replicated strand of DNA is made of a quarter the original DNA and three quarters new DNA from free nucleotides
2. each replicated strand of DNA is made of half original DNA and half new DNA from free nucleotides
3. the nucleotides are moved from the old strand to the new stand
4. each strand of DNA has 50% new nucleotides

7. Use the scale bar to calculate the diameter of the virus in Figure 1 Then work out how many viruses could line up inside the bacterium shown in Figure 2

From scale bar with the virus diagram,

5 mm represents 1nm

Diameter of virus in diagram = 40 mm

From scale bar with the bacterium diagram, 12 mm = 0.1 μm

Length of bacterium in diagram = 54 mm

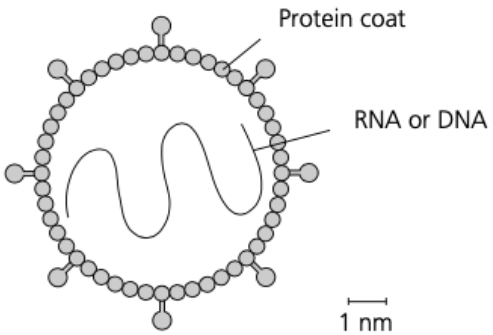


Figure 1 : Structure of a virus

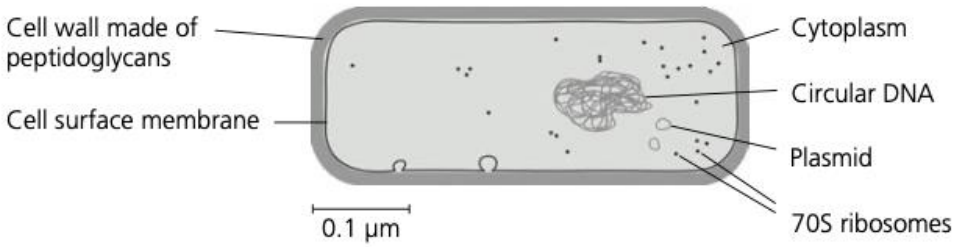


Figure 2 : Structure of a prokaryotic cell

1. 5.6×10^4
2. 5.6×10^5
3. 6.5×10^4
4. 6.5×10^5

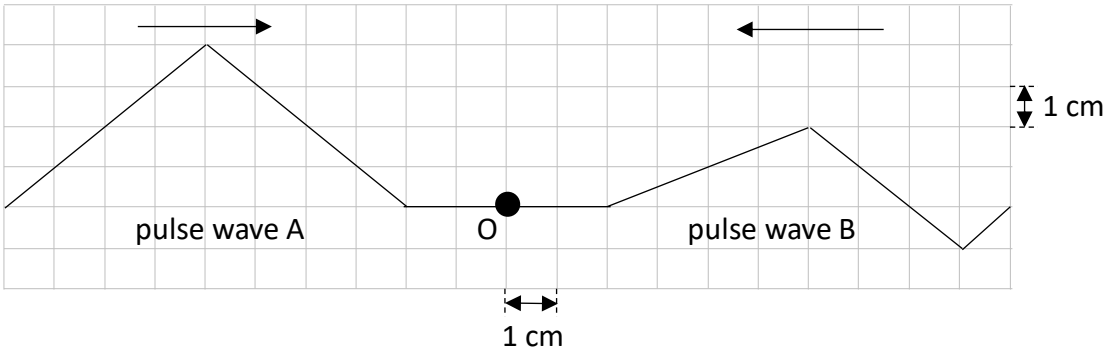
8. A mass of 100 g is attached to a spring given by the equation $x(t) = 20 \sin (5\pi t + \frac{\pi}{2})$ cm. How far has this mass moved from its initial position after 1.2 seconds?

1. 1.6 m
2. 2.0 m
3. 2.4 m
4. 2.8 m

9. If a man weighed 720 N on the surface of a planet with a radius of 2,500 km, how much would he weigh at the top of a mountain at height 500 km comparing to on the surface of the planet?

1. 144 N
2. 250 N
3. 288 N
4. 500 N

10. Impulse waves A and B, as shown in the diagram, are approaching each other on a rope at a speed of 10 cm/s each. Initially, point O is 2 cm away from both waves. After 0.4 seconds passing, what will be the displacement of point O?

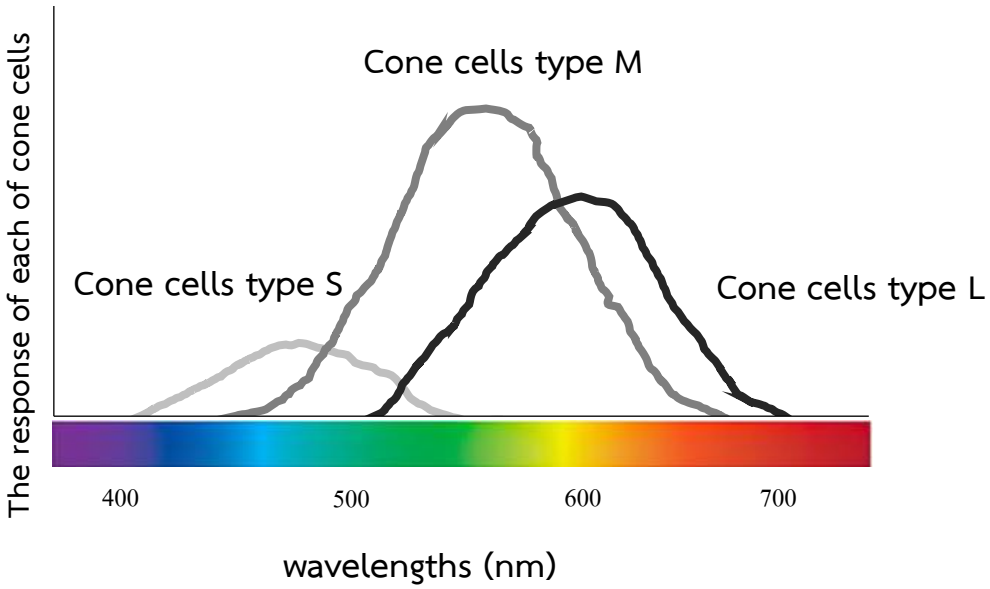


1. 2 cm
2. 3 cm
3. 4 cm
4. 5 cm

11. A water wave has a frequency of 30 Hz and a velocity of 3.6 m/s. If the initial phase of this wave is 20°, what will be the phase of the wave at after 1/45 second passing by considering a specific point on the water surface?

1. 240°
2. 260°
3. 280°
4. 300°

12. The graph below shows the response of each of cone cells to different wavelengths of light in the human eye. Consider the following statements



(A) Humans perceive different colors due to light interacting with the retina, which contains cone cells of 3 types: S, M, and L cones. Each type responds to a specific color of light: S cones respond to blue light, M cones respond to green light, and L cones respond to red light.

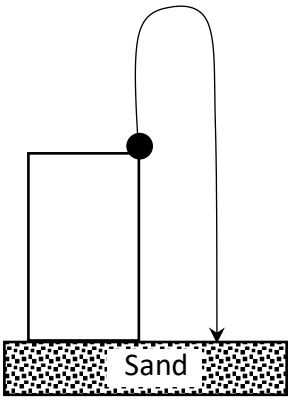
(B) If light with a wavelength of 580 nm interacts with the retina, both M and L cone cells will respond to this light, causing our brain to interpret it as seeing yellow light.

Which statement is correct?

1. Both statements are correct.
2. Statement (A) is correct, but statement (B) is incorrect.
3. Statement (A) is incorrect, but statement (B) is correct.
4. Both statements are incorrect.

13. A rock of mass 200 g is shot vertically upward with a velocity of 5 m/s from the wall which is 2 m high from the sand ground, as shown in the diagram. During its journey, the rock loses energy due to air resistance totaling 2 J and buries 25 cm deep in the sand. What is the average resistance by the sand?
Given that the acceleration due to the gravity is 10 m/s².

1. 17 N
2. 18 N
3. 19 N
4. 20 N



14. Calculate the number of grams of hydrofluoric acid (HF) solution that contains 20 g of HF from a 52% HF solution by weight.

1. 34.86 g
2. 36.14 g
3. 38.46 g
4. 40.38 g

15. A scientist is conducting an experiment to investigate the role of organelles in protein production in yeast cells, aiming to optimize conditions for enhanced protein synthesis. They genetically modify yeast cells to overexpress a protein of interest and compare it to the wild-type yeast as a control. After culturing both types of yeast under identical conditions, they measure the following parameters:

Protein Production: Assessed by quantifying the protein of interest and enzyme activity.

Energy Production: Assessed by using the ATP levels as a measure of cellular energy status.

Cellular Growth: Assessed by using optical density (OD) as a measure of yeast cell density. The higher the OD value, the higher the growth of yeast cells.

Organelle Function: Assessed by using specific markers for organelle integrity and function.

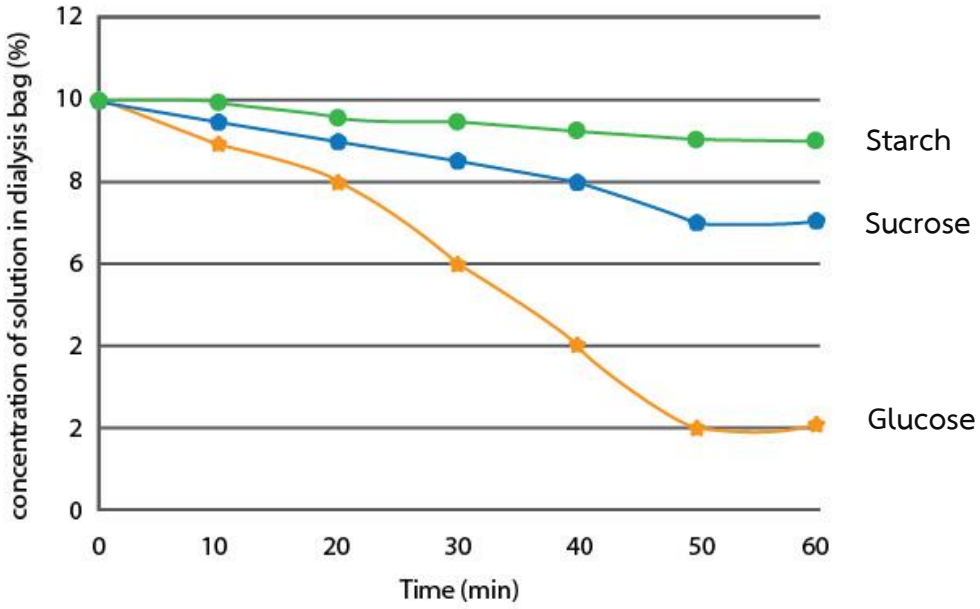
The results are shown in the table below.

Parameters	Wild-type yeast	Genetically modified yeast
Protein production	100%	200 %
Energy production	100%	120%
Cellular growth	100%	110%
Organelle function	Normal	Higher

Based on these results, which organelle is likely to play a crucial role in an increase in protein production observed in the genetically modified yeast cells?

1. Chloroplasts
2. Ribosomes
3. Mitochondria
4. Golgi Apparatus

16. A scientist designed a model membrane using a dialysis tubing. He placed three different solutions into each piece of dialysis tubing and followed the movement of solutes from each of them into the surrounding water in a beaker. The concentration of the solute in each of the dialysis tubing was measured at different times. The results are shown on the graph below.



Based on the result, why was the rate of movement of glucose out of the dialysis tubing the highest?

A. Glucose is positively charged and is attracted to the surrounding water molecules.

B. Glucose molecules are smaller and can pass through a semipermeable membrane more easily than larger molecules.

C. Dialysis tubing is semipermeable, allowing certain molecules to pass through based on their size. This causes the rate of movement of glucose out of the tubing to be the highest.

D. Glucose forms stronger hydrogen bonds with the pores of the membrane, allowing diffusion to become faster.

E. Glucose requires an active transport mechanism to move across the membrane, which allows it to move faster.

1. A, B, and E are correct.
2. B is correct
3. B and C are correct
4. B, C, D, and E are correct.

17. Use the Born-Haber cycle and the information below to calculate the lattice energy of sodium chloride (NaCl).

Sublimation energy of Na : 108 kJ/mol

Ionization energy of Na : 495 kJ/mol

Bond dissociation energy of Cl_2 : 244 kJ/mol

Electron affinity of Cl : –349 kJ/mol

Formation enthalpy of NaCl : –411kJ/mol

1. – 878 kJ
2. 878 kJ
3. – 787 kJ
3. 787 kJ

18. An element in group 3 of the periodic table is in a solid state. It can react with an oxygen gas to form compound A. The pH of the solution increases when compound A is dissolved in water. What is compound A?

1. Si_2O_4
2. MgO
3. P_2O_5
4. Al_2O_3

19. In a double-slit experiment, light with a wavelength of 500 nm is incident on a pair of slits that are separated by a distance of 0.25 mm. If the experimenter switches to using light with a wavelength of 680 nm instead, what will be the distance between a pair of slits?

1. 0.17
2. 0.34
3. 0.51
4. 0.68

20. When 50 cm^3 of 1.0 mol/dm^3 hydrochloric acid is dissolved in 4.7 g of zinc carbonate, what kind of gas will be produced and in what volume at room temperature?

1. O_2 0.61 dm^3
2. CO_2 0.61 dm^3
3. O_2 1.20 dm^3
4. CO_2 1.20 dm^3

21. Glue G is composed of C (24.24%), H (2.34%), N (14.14%), and O (60%) by weight and is dissolved in substance P. The boiling point of a pure substance P is 117.15 °C. A molal boiling point elevation constant (K_b) is 2.79°C kg/mol. The solution contains 13.2 g of glue G dissolved in 140 g of substance P, and the boiling point of a solution is 117.59 °C. Find the molecular formula for glue G.

1. $C_6H_7N_3O_{11}$
2. $(C_6H_7N_3O_{11})_2$
3. $(C_6H_7N_3O_{11})_3$
4. $(C_6H_7N_3O_{11})_4$

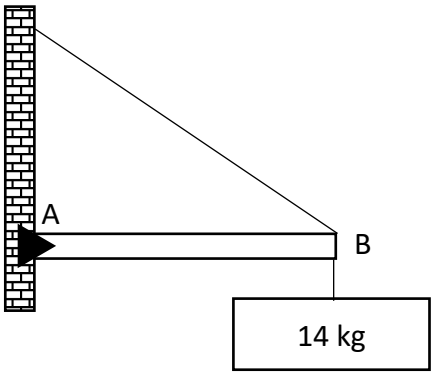
22. A ball with mass of 500 g and a cross-sectional area of 0.1 m² is thrown with an initial velocity of 25 m/s at an angle of 53° with the horizontal direction.
A wind blowing in the opposite direction clauses an air resistance of 20 N per square meter of cross-sectional area. What is the displacement of the ball horizontally?
Given that sin 53° = 0.8 and cos 53° = 0.6, and the acceleration due to gravity at the Earth's surface is 10 m/s^2

1. 18 m
2. 20 m
3. 22 m
4. 24 m

23. An object of mass m1 collides with another object of mass m_2, which is at rest, at a speed of 8 m/s. After the collision, the first rebounds at an angle α along its initial path with a speed of 4 m/s as the other rebounds at an angle β along its initial path of the first object with a speed of 6 m/s. What is the ratio of mass m_1 to mass m_2 when the 2 objects undergo a perfectly elastic collision?

1. 1:2
2. 2:3
3. 3:4
4. 5:6

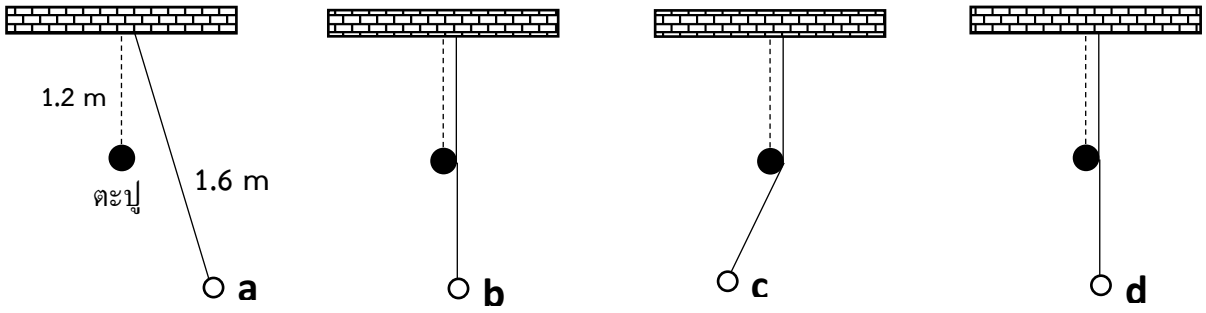
24. A uniform beam of mass 32 kg and length 4 m is suspended horizontally. At its end A, it is hinged to a wall; at its end B, it is supported by rope of length 5 m and hung with an object of mass 14 kg, as shown in the figure.



Determine the reaction force exerted by the wall on end A, given that the acceleration due to gravity at the Earth's surface is 10 m/s^2

1. 160.0 N
2. 400.0 N
3. 430.8 N
4. 623.4 N

25. A pendulum bob attached to a 1.6 m long string swings in a simple harmonic motion from one angle, as shown in the figure. The rope, however, trips a screw at a point of 1.2 m under its hinge point vertically. How long does the pendulum bob swing from point a to point b to point c, and back to point d ? Given that $\pi \approx 3.14$ and the acceleration due to gravity at the Earth's surface is 10 m/s^2



1. 0.628 s
2. 1.256 s
3. 1.570 s
4. 3.768 s

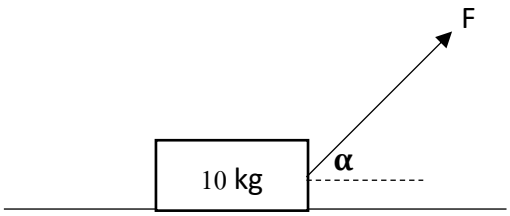
26. One end of a chord of length 1.2 m is attached tightly to the wall. The other end is attached to a wave oscillator which is vibrating vertically with the chord at a frequency of 75 Hz. What is the speed of wave in this chord if 8 nodes of standing wave are formed?

1. 11.25 m/s
2. 22.5 m/s
3. 33.75 m/s
4. 45 m/s

27. The school requires everyone to exchange cards when passing through the gate. A student is cycling 90 m away from the gate in a straight line. To comply with the school's regulations, what maximum velocity should the student not exceed if the maximum deceleration of his bicycle is 5 m/s²?

1. 30 m/s
2. 25 m/s
3. 30 m/s
4. 35 m/s

28. A student wants to drag a box of mass 10 kg across a surface with a coefficient of kinetic friction of 0.2 as shown in the figure. How much α should be to move this box horizontally with an acceleration of 2 m/s² without friction (frictional force is zero)?



1. arctan 5
2. arctan 0.2
3. arctan 2
4. arctan 0.5

29. While you and your friends are traveling on a mine cart (frictionless rail) with a total mass of 625 kg at a constant speed of 1.25 m/s, you find that the cart's brakes are not working. In order to stop the mine cart smoothly, Given that the mine cart carries various loads with a combined mass of 375 kg, as shown in the table.

Stuff	No.	mass (kg)	Maximum throwing velocity (m/s)
Backpack	5	40	6
Trolley bag	5	80	4
Bottle	5	1.25	10

How should you and your friends throw away the stuff?

Choice	Throwing direction	Backpack	Trolley bag	Bottle
1.	same direction to the cart	1	3	4
2.	opposite direction to the cart	1	1	2
3.	same direction to the cart	1	3	4
4.	opposite direction to the cart	1	1	2

30. A nearsighted man cannot clearly see objects more than away. 1.25 m. The distance from his lens of eye to his retina is 2 cm. As an amateur optometrist, what corrective eyeglass lenses and its focus length would you prescribe to enable him to clearly see distant objects with normal vision?

1. Concave lens , 125 cm
2. Concave lens , 200 cm
3. Convex lens , 125 cm
4. Convex lens , 200 cm

31. A substance consists of 3 oxygen atoms, 1 nitrogen atom, and 1 hydrogen atom. If you have 37.8 g of this substance, how many ions are present?

1. 7.20×10^{-23}
2. 7.21×10^{-23}
3. 7.22×10^{-23}
4. 7.23×10^{-23}

32. Given the bond lengths of C-H and C-C are 109 pm and 154 pm, respectively, estimate the length of the C-H bond for methane (CH_4).

1. 107 pm
2. 108 pm
3. 109 pm
4. 110 pm

33. A 5-kg bucket of water is accelerated upward by a cord of negligible mass whose breaking strength is 75 N. If the bucket starts from rest, what is the minimum time required to raise the bucket a vertical distance of 6.4 m without breaking the cord? Given the acceleration due to gravity is 10 m/s^2

1. 1.1 seconds
2. 1.6 seconds
3. 2.1 seconds
4. 2.6 seconds

34. A 1.50-m-long rope is stretched between two supports with a tension that makes the speed of transverse waves 50 m/s. What is the wavelength of the sixth harmonic?

1. 0.5 m
2. 1.0 m
3. 1.5 m
4. 2.0 m

35. Green sea slugs are animals that live in water and have developed the ability to produce their own chlorophyll. These creatures can also pass this ability to make chlorophyll to their offspring. Once the offspring have one meal of algae, they are able to make food using sunlight. This one meal provides the baby slugs with the chloroplasts needed to make use of the chlorophyll, and they are able to produce their own food in the future.

The best explanation for why sea slugs are able to pass on this ability to make food to their offspring is that

1. the gene for making algae is in all their body cells
2. making food is beneficial, so the slugs needed to mutate
3. the environment causes the slugs to become green
4. the gene for chlorophyll production is part of their DNA

36. Scientists have found what they think could be an important weapon in the fight against superbugs, and it lives in your nose. A new antibiotic made by nose-dwelling bacteria, *Staphylococcus lugdunensis* (*S. lugdunensis*) has been found to kill drug-resistant MRSA, *Staphylococcus aureus* (*S. aureus*), which kills up to 10,000 people a year in the United States. As a result of swabbing noses, scientists discovered that MRSA and *S. lugdunensis* are rarely found together. This discovery supports the idea that *S. lugdunensis* helps in fighting off MRSA. This bacterium produces an antibiotic, called lugdunin, which prevents MRSA from growing in Petri dishes. When applied to the skin of mice infected with MRSA, it reduced or eliminated the infection. MRSA shows no sign of antibiotic resistance to lugdunin. Although *S. lugdunensis* is effective in treating MRSA infections, it carries its own risk of causing infections in the heart, joints, skin, and eyes.

Normally, antibiotics are formed by soil bacteria and fungi. The idea that human bacteria may be a source of antimicrobial agents is a new discovery. A new class of antibiotics like this has not been found since the 1980s.

Which statement should describe observations made by scientists that led them to think that lugdunin would be effective against MRSA.

1. It is derived from a fungus known to inhibit bacterial growth.
2. MRSA has shown initial sensitivity to traditional antibiotics.
3. Swabs of noses showed that *S. lugdunensis* and *S. aureus* were rarely found together.
4. Lugdunin is commonly used in traditional medicine practices.

37. A camera lens has a focal length of 200 mm. How far from the lens should the subject for the photo be if the lens is 20.4 cm from the film?

1. 4.8 m
2. 6.4 m
3. 8.8 m
4. 10.2 m

38. A movie stuntman (mass 90.0 kg) stands on a window ledge 5.0 m above the floor. Grabbing a rope attached to a chandelier, he swings down to grapple with the movie's villain (mass 60.0 kg), who is standing directly under the chandelier. (Assume that the stuntman's center of mass moves downward 5.0 m.

He releases the rope just as he reaches the villain.) If the coefficient of kinetic friction of their bodies with the floor is 0.25, how far do they slide? Given the acceleration due to gravity is 10 m/s^2

1. 5.7 m
2. 6.7 m
3. 7.2 m
4. 8.2 m

39. Hydrogen peroxide (H_2O_2) is a green oxidant. When hydrogen peroxide decomposes, it produces water (H_2O) and oxygen (O_2). H_2O_2 is widely used in the textile, pulp, paper and leather industries. It is also used in the food, pharmaceutical and chemical industries to treat wastewater. It has been reported that H_2O_2 is used to hydrolyze polysaccharides to produce oligosaccharides.

When H_2O_2 is used to digest cassava pulp with sodium hydroxide (NaOH), H_2O_2 quickly decompose into free radicals such as hydroxyl ions (OH-) and perhydroxyl ions (HOO•). These ions then break down the polysaccharide structure in the cassava pulp into smaller sizes. However, the disadvantage of H_2O_2 is that it can be catalyzed by heavy metals such as copper (Cu), iron (Fe), and manganese (Mn), to result in the formation of O_2 and H_2O. Although it is environmentally friendly, the reaction will be reduced, making it a disadvantage in the production process.

A study on metal in H_2O_2 decomposition was performed by adding 1.0 g of copper (II) oxide to a flask containing 200 cm^3 of H_2O_2. A gas was collected, and its volume was recorded every 10 seconds.

The table shows the volume of gas collected over 90 seconds.:

Time (s)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**
Vol. (cm^3)	0	20	30	40	47	52	58	60	60	60

Consider the following information:

A) 0.5 g of CuO remained after 90 seconds.

B) Rate of reaction was constant after 70 seconds.

C) The concentration of H_2O_2 decreased as the amount of O_2 increased.

D) H_2O_2 decomposed into H_2O and O_2 in the presence of CuO.

What happened as the reaction proceeded?

1. A and B
2. A and C
3. B and C
4. A, B, and D

40. Methanol or methyl alcohol (CH_3OH) is a clear, easily volatile, and toxic liquid. It is commonly used as a solvent and a fuel. In nature, methanol is a product of anaerobic breakdown of nutrients by various bacteria. CH_3OH evaporates into the atmosphere before decomposing into carbon dioxide (CO_2) and water (H_2O).

If methanol is burned, CO_2 and H_2O will be produced as in the equation below.

$$2\ CH_3OH + 3\ O_2 \longrightarrow 2\ CO_2 + 4\ H_2O$$

Mainly, methanol is converted into formaldehyde to make plastics, plywood, paints, and explosives. Substances from methanol are mixed with LPG for household use or with diesel fuel to make biodiesel. Therefore, methanol is quite important. Methanol can be prepared as follows:

$$CO\ (g) + 2H_2\ (g) \leftrightarrow CH_3OH\ (g)$$

If there is a change in the conditions of the above reaction, what effect will it have on methanol production?

A) When the volume of the system increases, the production of CH_3OH also increases.

B) When the concentration of CO increases, the production of CH_3OH increases.

C) If the pressure system is reduced, the CH_3OH production will decrease.

1. A and B
2. B and C
3. A and C
4. A , B, and C

คำตอบวิชาวิทยาศาสตร์ ชั้นมัธยมศึกษาปีที่ 5

ข้อ	คำตอบ	ข้อ	คำตอบ
1	3	21	2
2	4	22	3
3	2	23	3
4	1	24	3
5	4	25	2
6	2	26	2
7	1	27	1 , 3
8	3	28	1
9	4	29	1
10	2	30	1
11	2	31	3
12	3	32	3
13	4	33	2
14	3	34	1
15	2	35	4
16	3	36	3
17	3	37	4
18	2	38	3
19	2	39	1
20	2	40	2