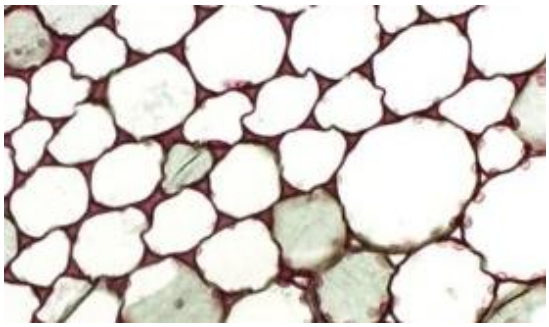
Part I : Each multiple choice Questions (A, B, C, D, E) is worth 2 points.

(Total 30 points.)

1. The micrograph below shows a plant tissue in which the cell walls are unevenly thickened, especially at the corners.



Which statements about this tissue are correct?

1. It provides flexible support to growing parts of the plant.
2. The stone cells that give pear fruit its gritty texture are this type of tissue.
3. The cells of this tissue are generally living at maturity.
4. Most photosynthesis in leaves takes place in this type of tissue.

A. 1 and 2 B. 3 and 4

C. 1 and 3 D. 2 and 4

E. 1 and 4

2. During ventricular systole, which row correctly describes the atrioventricular valves, semilunar valves, and ventricular walls?

Choice	Atrio-ventricular valves	Semilunar valves	Ventricles wall
A.	open	open	relaxes
B.	open	closed	contracts
C.	closed	open	relaxes
D.	closed	closed	contracts
E.	closed	open	contracts

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3. At 20:00 on a particular day, a student observes the Moon in the western part of the sky. Which statement best explains this observation?

A. The Moon normally rises in the west and sets in the east.

B. The Moon changes its rising direction from east to west on different days.

C. A lunar eclipse causes the Moon to appear in the western sky at night.

D. The Moon rises at different times on different days and may have risen well before evening.

E. In tropical regions, the Moon normally remains above the horizon for only four hours.

4. Nano has two identical 5 Ω resistors. The resistors may be connected either in series or in parallel to an ideal battery.

Which battery voltage or voltages could produce a current of 2 A through each resistor?

A. 20 V only

B. 10 V only

C. 20 V or 10 V

D. 5 V or 20 V

E. 10 V or 2.5 V

5. A heater takes 3.0 minutes to heat 400 ml of water from 25 °C to 95 °C. The same heater is then used to heat 1.0 litre of water from 10 °C to 70 °C.

Assume that the heater supplies energy at a constant rate and that heat loss to the surroundings is negligible. Approximately how long will the second heating process take?

A. 4 minutes 30 seconds

B. 6 minutes 26 seconds

C. 7 minutes 30 seconds

D. 9 minutes 00 seconds

E. 12 minutes 00 seconds

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6. Dry ice is solid carbon dioxide. At atmospheric pressure, it sublimates at about -70.5 °C
A small piece of dry ice is placed in water at 25°C in an open container. What will eventually happen to the dry ice?

A. It remains solid while its temperature continues to increase.
B. It melts into liquid carbon dioxide and mixes with the water.
C. It changes into water vapor because it absorbs heat from the water.
D. It sublimates directly from solid carbon dioxide into carbon dioxide gas.
E. It causes all the surrounding water to vaporize completely.

7. Two balloons are prepared. One contains only air, while the other contains some water as well as air. When the air-filled balloon is held over a candle flame, it quickly bursts.
If the flame is placed directly beneath the water-filled part of the second balloon for a short time, what is most likely to happen?

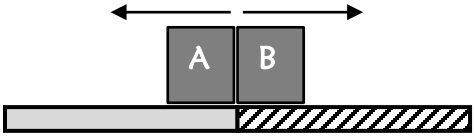
A. The balloon bursts immediately because the rubber becomes thinner.
B. The balloon does not burst because the water puts out the flame.
C. The balloon bursts because the heated water greatly increases the air pressure.
D. The balloon is less likely to burst because the water absorbs much of the heat.
E. The flame immediately makes a hole in the rubber without bursting the balloon.

8. Kaka can exert a maximum force of 500 N. Assume that all pulleys are ideal, the inclined plane is frictionless, and $g = 10\ m/s^2$. Which task cannot be performed using a force of at most 500 N?

A. Lifting a 20 kg object vertically upward
B. Lifting a 60 kg object using a single fixed pulley
C. Lifting a 70 kg object using a single movable pulley
D. Pushing a 100 kg object on a frictionless horizontal surface
E. Pushing a 50 kg object up a frictionless 45° incline

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9. Two small blocks start from the same point and move in opposite directions with initial speeds of 10 m/s.



Block A moves to the left on a frictionless horizontal surface. Block B moves to the right on a uniform rough horizontal surface, where a constant frictional force causes it to stop after 5.0 seconds. How far apart are the two blocks when block B comes to rest?

A. 25 m
B. 50 m
C. 75 m
D. 125 m
E. 150 m

10. Lignin is an important complex substance found mainly in the cell walls of certain plant tissues.

Consider the following statements.

1. Lignin is the most abundant organic compound on Earth.
2. Lignin is stored mainly inside plant cell vacuoles.
3. Lignin strengthens cell walls and makes xylem vessels more resistant to water penetration.
4. Lignin is a soluble carbohydrate used mainly for energy storage in plant cells.

Which statement is correct?

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

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11. Choose the correct statement regarding the hormones associated with men's reproduction!

A. LH secreted by the anterior pituitary stimulates Leydig cells to produce testosterone.

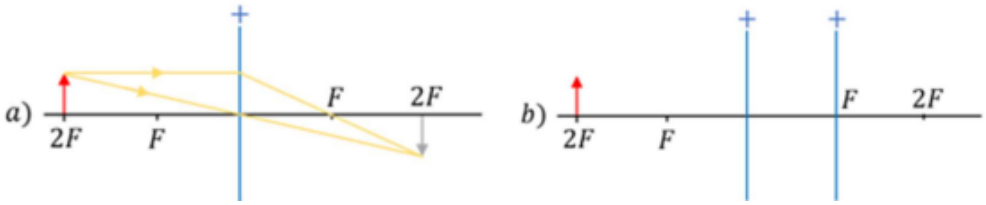
B. Inhibin produced by Sertoli cells inhibits LH production

C. Testosterone produced by Sertoli cells inhibits LH

D. FSH stimulates Leydig cells to produce testosterone

E. FSH produced by Leydig cells stimulates the production of sperm

12. Two identical converging thin lenses, each with focal length f, are placed on the same principal axis.



An object is placed at a distance 2f to the left of the first lens. The optical center of the second lens is placed a distance f to the right of the first lens, at the first lens's right focal point. Compared with the original object, the final image formed by the two-lens system is:

A. virtual, upright, and twice as large

B. real, inverted, and half as large

C. virtual, inverted, and half as large

D. real, upright, and half as large

E. virtual, inverted, and twice as large

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13. Two experiments are carried out using floating ice.

In Experiment 1, a piece of ice containing a small sealed air cavity floats in water. Assume that the mass of the trapped air is negligible.

In Experiment 2, a dense metal piece that would sink in water is completely trapped inside a floating piece of ice.

No water is lost from either container.

After the ice melts completely, what happens to the water level?

A. Experiment 1: unchanged; Experiment 2: unchanged

B. Experiment 1: unchanged; Experiment 2: rises

C. Experiment 1: unchanged; Experiment 2: falls

D. Experiment 1: falls; Experiment 2: rises

E. Experiment 1: rises; Experiment 2: falls

14. A small ball has a density equal to half the density of water. It is launched vertically upward from the water surface and returns to the surface 4.0 seconds later.

Take $g = 10\ m/s^2$. Neglect air resistance and water drag. After the ball re-enters the water, assume that it becomes fully submerged immediately, so that the buoyant force remains constant.

What is the maximum depth reached by the ball below the water surface?

A. 20 m

B. 10 m

C. 40 m

D. 30 m

E. 5 m

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15. Penicillin is an antibiotic that is effective against many bacteria, particularly when the bacteria are actively growing.

What is the main mechanism by which penicillin affects susceptible bacteria?

A. It directly prevents bacterial DNA from being replicated.

B. It directly prevents bacterial genes from being transcribed.

C. It prevents bacterial ribosomes from carrying out protein synthesis.

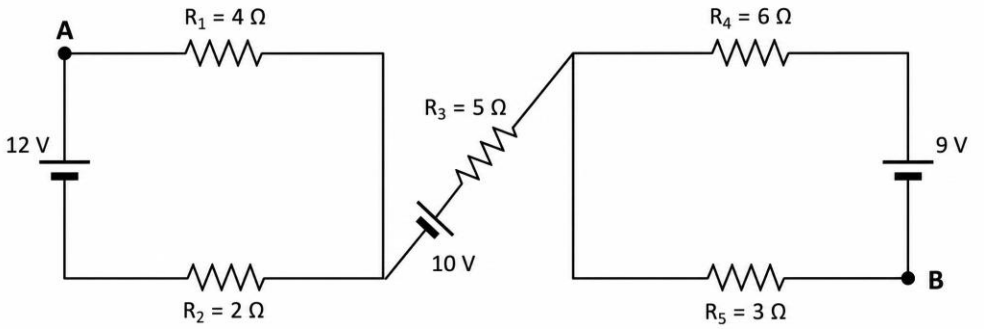
D. It prevents the bacterial cell membrane from being formed normally.

E. It inhibits the formation of the bacterial peptidoglycan cell wall.

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Part II: Each short answer is worth 3 points. (Total 30 points.)

16. Consider the ideal circuit shown below.

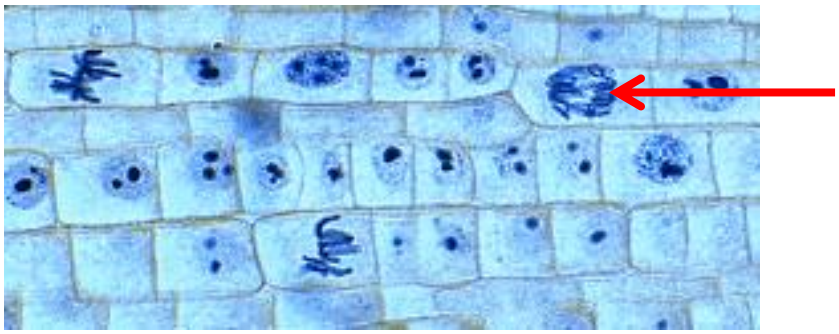


Assume that the batteries have negligible internal resistance and the connecting wires have negligible resistance.

16.1 Determine the magnitude of the current through each resistor R_1, R_2, R_3, R_4, and R_5.

16.2 Determine the potential difference

17. Look at the following diagram.



The above picture shows cells of onion root tip undergo mitosis in different stages.

17.1 What stage of mitosis is pointed by the arrow?

17.2 What is the main characteristic of the stage pointed by the arrow?

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18. The processes which are involved in the protein synthesis are _____(18.1)_____ and ____(18.2)_____

19. A student investigates the effect of a plant hormone, Hormone X, on the germination of seeds from the same plant species. Equal numbers of seeds are used in each group, and all other conditions, including water, oxygen, and temperature, are kept the same.

Treatment	Seeds germinated after 5 days
Group A: Water only	8 out of 20
Group B: Water + Hormone X	18 out of 20

Answer the following questions.

19.1 Based on the results and your knowledge of plant hormones, identify Hormone X.

Answer: _____

19.2 During seed germination, Hormone X stimulates the production of an enzyme that helps mobilize stored starch for use by the growing embryo. Name this enzyme.

Answer: _____

20. A student is given three purified human digestive enzymes labeled X, Y, and Z. The identities of the enzymes are unknown.

Equal amounts of each enzyme are tested with different food substances at 37°C. The results after 15 minutes are shown below.

Enzyme	Substance tested	pH	Observation after 15 minutes
X	Starch suspension	7	A sample gives a yellow-brown color with iodine solution
Y	Protein solution	2	The amount of intact protein decreases greatly
Z	Triglyceride emulsion	8	The pH of the mixture decreases from 8.0 to 6.5

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Answer the following questions. (3 marks)

20.1 Identify enzymes X, Y, and Z.

X = _____

Y = _____

Z = _____

20.2 Predict what would happen to the activity of enzyme Y if it were placed in a solution at pH 8. Explain your answer.

_____

20.3 Explain why the pH decreased in the experiment containing enzyme Z.

_____

21. On a hot day in a desert, a distant area of sand may appear to have water on its surface. This optical phenomenon is called a _____(21.1)_____.The ground heats the air immediately above it, producing a ____(21.2)_____ gradient. This causes the _____(21.3)_____ of the air to vary with height. Near the hot ground, the air has a lower refractive index than the cooler air above it. As light travels from a region of higher refractive index toward a region of lower refractive index, it bends progressively _____(21.4)_____ the normal.

22. Two resistors are connected in series with a battery and a 1.2 A current is flowing in the circuit. If the same resistors are connected in parallel with the same battery, a 5 A current is flowing in the circuit. If the smaller resistor has resistance of 4 Ohm, then the other resistor has resistance of _____(22.1)_____ Ohm and the battery has voltage of _____(22.2)_____ V.

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23. In a simplified model of Mercury, assume that the planet rotates once every 60 Earth days and revolves around the Sun once every 90 Earth days. Its rotation and revolution are in the same direction. At time t = 0, sunrise occurs at a particular location on Mercury.

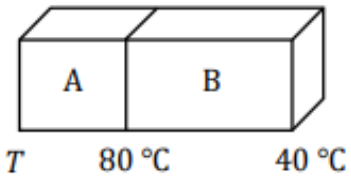
23.1 How many Earth days later will sunset occur at the same location?

23.2 A solar day is the time from one sunrise to the next sunrise at the same location. How many Earth days long is one solar day in this model?

23.3 How many solar days occur during one 90-Earth-day year in this model?

24. Teixobactin is an antibiotic that acts against some Gram-positive bacteria. It binds to essential lipid precursors required for bacterial cell-wall synthesis rather than binding to a single protein target. Explain why bacteria may be less likely to develop resistance rapidly through simple changes in the antibiotic's target.

25. Two metal rods A and B are connected end to end.



They have the same cross-sectional area and are in perfect thermal contact. The system has reached steady state, and heat loss to the surroundings is negligible. The temperature at the junction is 80°C , and the right end of rod B is maintained at 40°C.

The thermal conductivity of B is twice that of A,

$$k_B = 2k_A,$$

and the length of A is half the length of B,

$$L_A = \frac{1}{2}L_B.$$

Determine the temperature **"T"** at the left end of rod A.

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Part III: Essay (Total 40 points.)

26. A scientist wants to determine the depth of a well and the speed of sound in air.

A precise timer is placed at the top of the well. In the first experiment, a rock is released from rest at the top of the well. The timer records 2.70 seconds from the instant the rock is released until the sound of the splash reaches the top of the well.

In the second experiment, another rock is released from rest from a point 5.40 meters above the top of the well. The timer remains at the top of the well and records 2.90 seconds from release until the splash sound reaches the timer.

Assume g = 10.0 m/s^2, neglect air resistance on the rocks, and assume that the speed of sound is constant.

26.1 Determine the depth h of the well. (4 points)

26.2 Determine the speed of sound in air. (3 points)

27. A 32.0 kg block is initially at rest on a frictionless horizontal surface. A constant horizontal force of 5.0 N acts on the block for 3.0 seconds. (9 points)

Determine:

27.1 the acceleration of the block

27.2 its speed after 3.0 seconds

27.3 the distance traveled during this time

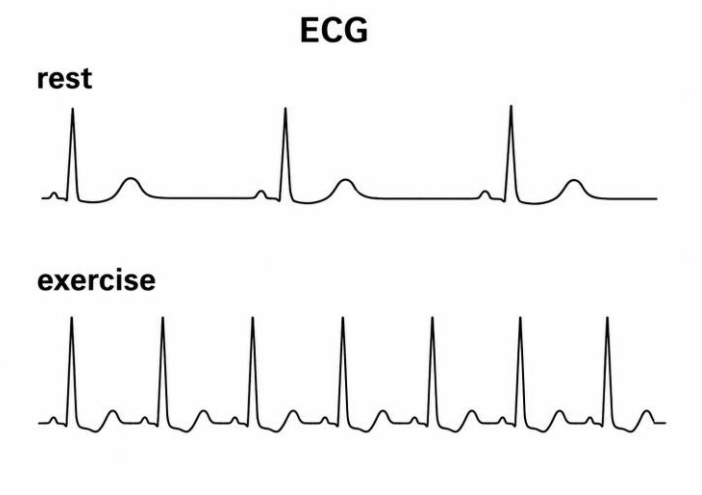
27.4 its final momentum

27.5 its final kinetic energy

27.6 the work done by the 5.0 N force

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28. An electrocardiogram (ECG) records the electrical activity of the heart. The diagram shows one ECG trace recorded at rest and another recorded during exercise.



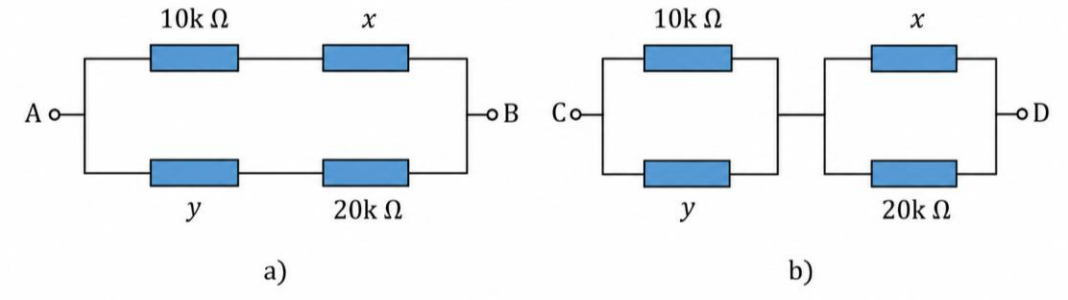
28.1 Explain why the ECG trace during exercise has more closely spaced heartbeats than the trace at rest. (3 marks)

28.2 State one other method that can be used to monitor heart activity. (2 marks)

28.3 During intense exercise, the oxygen supplied to the muscles may temporarily be insufficient to meet their energy demand. After exercise stops, breathing and heart rate remain elevated for some time. Explain why. (3 marks)

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29. Four resistors: 10 kΩ , 20 kΩ , **X** , and **Y** are arranged as in picture a) and picture b).



The equivalence resistance is the same for both arrangements, $R_{AB} = R_{CD} = 12$ kΩ
What is the resistance value of **X** and **Y**? (8 points)

30. A patient reports frequent urination, excessive thirst, unexplained weight loss, and discomfort in the lower abdomen. A urine sample is tested, and some of the results are shown below.

Test	Result
Glucose	Abnormally high
Albumin	Higher than normal
Leukocytes	Higher than normal
Urea	Within the normal range

The doctor recommends further tests rather than making a diagnosis from the urine test alone.

30.1 Give two observations that would support further testing for diabetes. (2 marks)

30.2 Which result may suggest a possible urinary tract infection, and why? **(2 marks)**

30.3 Explain how urea is formed in the human body. (2 marks)

30.4 Describe how Benedict's solution can be used to test the urine sample for the presence of a reducing sugar. (2 marks)

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National Selection : ASMOPSS Thailand 2023 (2nd Round – Science Secondary)

Answers Key :

Part I : Each multiple choice Questions (A, B, C, D, E) is worth 2 points.

No.	Answers	No.	Answers	No.	Answers
1	C	6	D	11	A
2	E	7	D	12	B
3	D	8	B	13	C
4	C	9	C	14	A
5	B	10	D	15	E

Part II : Each short answer is worth 3 points. (Total 30 points.)

No.	Answers
16	16.1 The current flow in every resistor (R_1, R_2, R_3, R_4, and R_5)! $I_{R1} = I_{R2} = 12/(2+4) = 2$ A $I_{R4} = I_{R5} = 9/(3+6) = 1$ A $I_{R3} = 0$ A (no current flows) (each correct answer, if all correct: 2 points) 16.2 The potential difference between Node A and B! $V_{AB} = (I_{R1} \cdot R_1) - 10 + (I_{R5} \cdot R_5) = 8 - 10 + 3 = 1$ V (1 points)
17	17.1 Anaphase (1 points) 17.2 Chromatids separate/move/are pulled to the different (opposite) poles (2 points)
18	18.1 Transcription 18.2 Translation (สลับตำแหน่งกันได้)
No.	**Answers**

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19	19.1 Gibberellin 19.2 Amylase
20	20.1 X= Amylase Y= Pepsin Z= Lipase 20.2 The activity of pepsin would decrease greatly at pH 8 because pepsin works best under strongly acidic conditions. An alkaline environment changes conditions at its active site and greatly reduces its ability to catalyze protein digestion. 20.3 Lipase hydrolyzes triglycerides and produces fatty acids and glycerol. The fatty acids released into the mixture cause the pH to decrease.
21	21.1 mirage 21.2 temperature 21.3 refractive index 21.4 away from
22	22.1 6 Ω 22.2 12 V
23	23.1 90 days 23.2 180 days 23.3 0.5 solar day
24	The lipid precursors targeted by teixobactin are essential and highly conserved components of cell-wall synthesis. Because the target is not a single protein that can easily be altered by a mutation in one gene, changing the target without disrupting cell-wall formation is more difficult. Therefore, resistance caused by simple target modification may develop less readily.
25	120 °C

Part III : Essay (Total 40 points.)

No.	Answers
26	26.1 Determine the depth h of the well. (4 points) First time: $$\sqrt{\frac{2h}{g}}+\frac{h}{v_s}=2.7$$ Second time: $$\sqrt{\frac{2(h+5.4)}{g}}+\frac{h}{v_s}=2.9$$ Subtract the equations: $$\sqrt{\frac{2(h+5.4)}{10}}-\sqrt{\frac{2h}{10}}=0.2$$ Let $$\sqrt{\frac{h}{5}}=2.6$$ Therefore, $$\mathrm{h}=33.8\ \mathrm{m}$$ (4 points)

	26.2 Determine the speed of sound in air. (3 points) Time taken by the sound: $$2.7 - 2.6 = 0.1 \text{ S}$$ Therefore, $$v_s = \frac{33.8}{0.1} = 338 \text{ m/s}$$ (4 points)
27	27.1 The acceleration is force over mass: $$a = \frac{F}{m} = \frac{5}{2} = 2.5 \text{ m/s}^2$$ 27.2 The final velocity is acceleration times time: $$v = at = 2.5(3) = 7.5 \text{ m/s}$$ 27.3 The distance cover is total area under the graph: $$s = \frac{1}{2}at^2 = \frac{1}{2}(2.5)(9) = 11.25 \text{ m}$$ 27.4 The final momentum is its mass times its final velocity: $$p = mv = 2(7.5) = 15 \text{ kg m/s}$$ 27.5 The final kinetic energy is $$K = \frac{1}{2}mv^2 = \frac{1}{2}(2)(7.5)^2 = 56.25 \text{ J}$$ 27.6 The work by force F is F times distance: 5 N x 11.25 m = 56.25 J. W = Fs = 5(11.25) =56.25 J

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28	28.1 Exercise increases the energy demand of muscle cells. The heart rate rises to deliver more oxygen and glucose to the muscles and to remove carbon dioxide and other metabolic products. 28.2 Measure the pulse rate / listen to heart sounds using a stethoscope. 28.3 Breathing and heart rate remain elevated to supply additional oxygen during recovery. This oxygen helps restore energy reserves and process lactate produced during intense exercise, allowing the body to return toward its resting condition.
29	x = 5 kΩ y = 40kΩ
30	30.1 The patient has symptoms such as excessive thirst and frequent urination, and the urine contains an abnormally high level of glucose. 30.2 An increased number of leukocytes may indicate an immune response to microorganisms in the urinary tract and therefore supports further investigation for infection. 30.3 Excess amino acids are deaminated mainly in the liver. The nitrogen-containing waste produced is converted into urea, which is transported in the blood to the kidneys for excretion. 30.4 Add Benedict's solution to the urine sample and heat the mixture in a hot-water bath. A change from blue toward green, yellow, orange, or brick-red indicates the presence of reducing sugar, with the color depending approximately on its concentration.

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