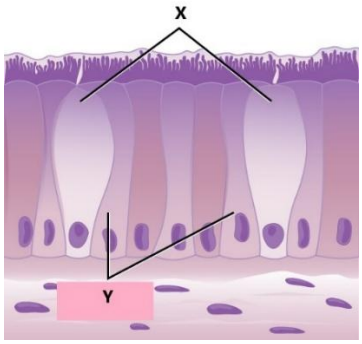
Part I : Each multiple choice Question (A, B, C, D, E) is worth 2 points.

1. Which of the following body parts is affected the most by microgravity?

A. brain
B. liver
C. kidney
D. bone
E. blood

2. The following diagram shows tissue at the surface of the human intestine.

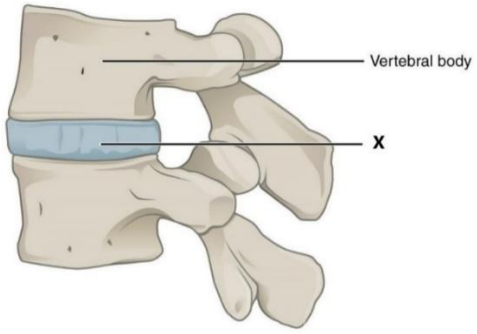


Which of the following is/are correct?

1) Cell X produces mucus.
2) Cell Y absorbs nutrients.
3) Both X and Y have microvilli.
4) Both X and Y belong to connective tissue.

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

3. Which statement is correct about the part labelled X below?



Lateral view

A. Part X is composed of cells called osteocytes.
B. The external ear has the same structure as part X.
C. Part X is made of elastic fibres.
D. The fetus skeleton is also made of part X.
E. Part X consists of thick layers of dense collagen fibres.

4. Alex measures the diameter of the circular pipe by using a vernier calliper.

The result is 10.00 cm. What is the area of the cross-sectional area of the pipe?

Note: Use pi = 3.14 and use significant number rules.

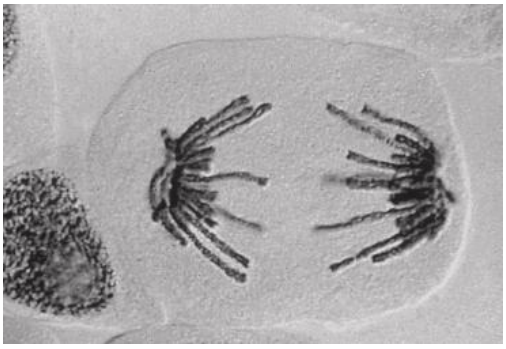
A. $3.14 \times 10^2\ \text{cm}^2$
B. $3.140 \times 10^2\ \text{cm}^2$
C. $3 \times 10^2\ \text{cm}^2$
D. $3.1 \times 10^2\ \text{cm}^2$
E. $0.314 \times 10^3\ \text{cm}^2$

5. Which of these statements could describe the effect of carbon monoxide in cigarette smoke?

1) It binds irreversibly to hemoglobin.
2) It causes mucus to accumulate in the bronchioles.
3) It results in more carbon dioxide being transported in the blood.
4) It temporarily increases the heart rate.

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

6. The photomicrograph shows a cell during mitosis.

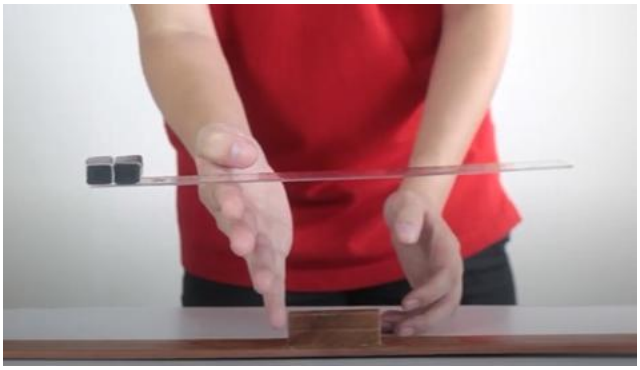


What is happening in this cell?

1. Centrioles are replicating.
2. Spindle microtubules are shortening.
3. Chromatin is condensing.

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

7. Tommy wants to balance a ruler and two erasers that are put on one end of the ruler. See picture:



(source: YouTube SIPS – SI for the promotion of science)

It balances when the finger (fulcrum) is not at the middle of the ruler but closer to the end of the end with the erasers.

Which statement is correct?

A. The total mass on the left side (eraser and ruler) and the finger (fulcrum) is equal to the right side.

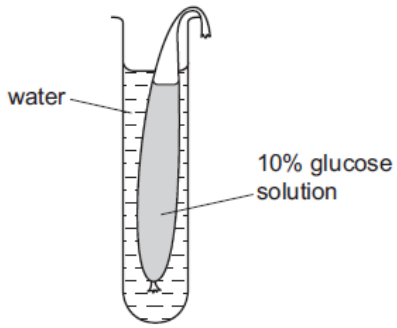
B. If an eraser is taken off, the fulcrum is moved to the right.

C. The fulcrum position is always the same if the erasers are added.

D. A ruler's mass is the same as the mass of two erasers.

E. If the erasers move slightly to the right, the fulcrum does not move, as long as the erasers are still on the left side of the fulcrum.

8. The diagram shows the apparatus set up to investigate the effect of putting a 10 % glucose solution in a selectively permeable bag (Visking tubing) and surrounding it with water.



Samples from the surrounding water were tested with Benedict's solution after 10 minutes and after 20 minutes. The change in volume of the glucose solution was observed after 20 minutes.

Which row is correct?

	Result of Benedict's test		Volume of glucose solution in visking tubing / cm^3
	After 10 minutes	After 20 minutes	
A.	green	blue	Increased
B.	green	orange	Increased
C.	red	orange	Decreased
D.	yellow	green	Decreased
E.	red	blue	Increased

9. Which analogy best fits the concept of a "photosystem" in photosynthesis?

A. An "up" escalator beside a "down" escalator.

B. A windmill that harnesses the energy from moving air to turn a wheel.

C. A basketball team which passes the ball to a well-positioned player, who can then gain points for the team.

D. The sound that comes from a compact disc.

E. A contraption which converts sound into the physical movement of a mechanical arm, which then pushes a button.

10. Betty wants to make a warm drink. Betty mixes some boiling water and cold water (20°C). Which one will make 200 ml of warm drink with 40°C temperature?

A. 50 ml boiling water and 150 ml cold water.

B. 66.67 ml boiling water and 133.33 ml cold water.

C. 80 ml boiling water and 120 ml cold water.

D. 100 ml boiling water and 100 ml cold water.

E. 120 ml boiling water and 80 ml cold water.

11. Beside Asteroid belt, there is also Kuiper Belt in the solar system. The location of the Kuiper Belt is...

A. Between the Earth and Mars orbit.

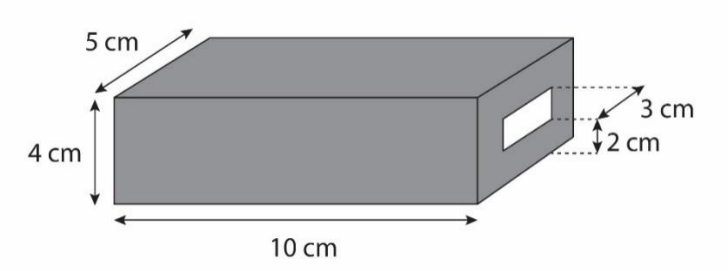
B. Between the Mars and Jupiter orbit.

C. Between the Jupiter and Saturn orbit.

D. Between the Saturn and Neptune orbit.

E. Outside the Neptune orbit.

12. A hollow rectangular metal block has the dimensions shown.



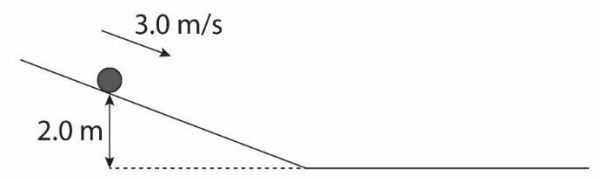
The hole in the middle goes all the way through the block.

The density of the metal is 10g/cm^3.

What is the mass of the block?

A. 14 g
B. 400 g
C. 1400 g
D. 2000 g
E. 2500 g

13. A ball of mass 0.40 kg rolls down a hill. 2.0 m above the bottom of the hill, the speed of the ball is 3.0 m/s.



The gravitational field strength g is 10 N/kg.

Ignoring the effects of friction and air resistance, what is the kinetic energy of the ball at the bottom of the hill?

A. 1.8 J
B. 8.0 J
C. 8.6 J
D. 9.8 J
E. 12.5 J

14. Some students climb a set of stairs at school, and each student is timed. Their weights and times are recorded in the table.

Which student develops the most power?

	weight/N	time/s
A.	300	10
B.	390	12
C.	420	15
D.	490	16
E.	550	18

15. Three objects X, Y and Z are metal spheres, each on an insulated stand.

Objects X and Y experience a force of attraction. Objects X and Z experience a force of attraction.

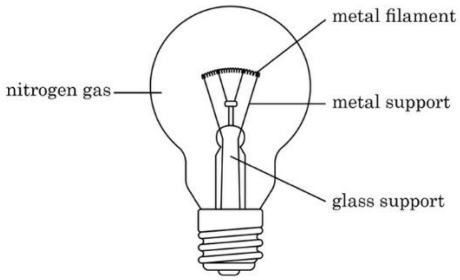
Which set of charges cannot be correct?

	charge on X	charge on Y	charge on Z
A.	positive positive	negative	negative
B.	uncharged	negative	positive
C.	uncharged	positive positive	negative
D.	negative	positive	positive
E.			positive

Part II : Each short answer is worth 3 points.

16. A group of insects that brings pollen from red-flowered plants pollinates plants in an area that is populated by all white-flowered plants. The next generations have white and red flowers. This phenomenon is called ..... **(**3 points)

17. When switched on, the filament lamp shown in figure loses energy by conduction, convection and radiation.



The radiation emitted is part of the electromagnetic spectrum.

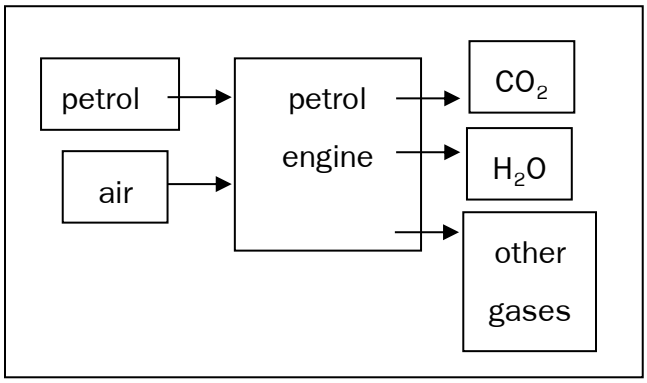
17.1 State one property of electromagnetic waves that distinguishes them from all other types of waves. **(**1 point)

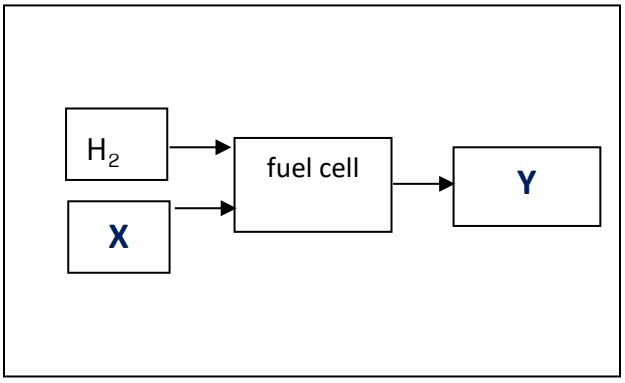
17.2 State two components of the electromagnetic spectrum emitted by the filament in the lamp. **(**1 point)

17.3 The current in the lamp is reduced. The colour of the filament changes from white to red. Describe the changes in the radiation emitted by the lamp. **(**1 point)

18. Most vehicles have petrol or diesel engines, but some use fuel cells.

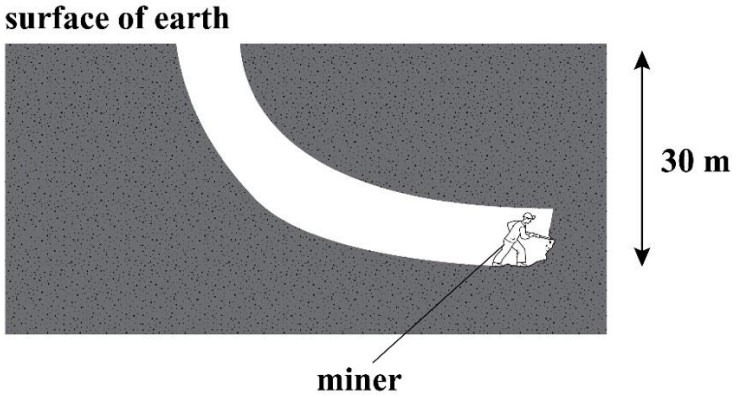
The flow charts show the substances entering and leaving a petrol engine and cell.





Complete the flow chart for the fuel cell by filling in the empty boxes. (3 points)

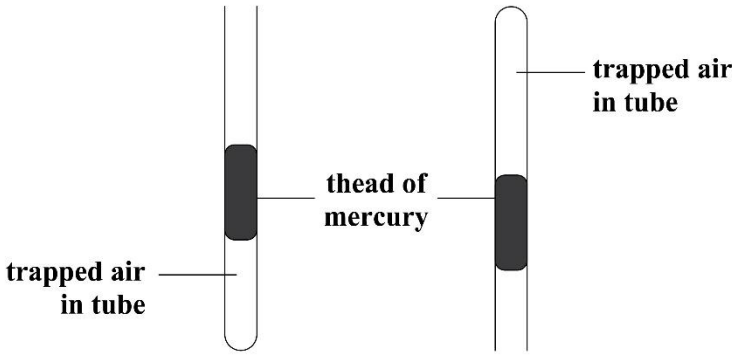
19. The figure shows a miner below the surface of the Earth.



(not to scale)

The atmospheric pressure 30 m below the surface of the Earth is almost the same as at the surface. The pressure in water at a depth of 30 m is very different from that at the surface. Explain this. (3 points)

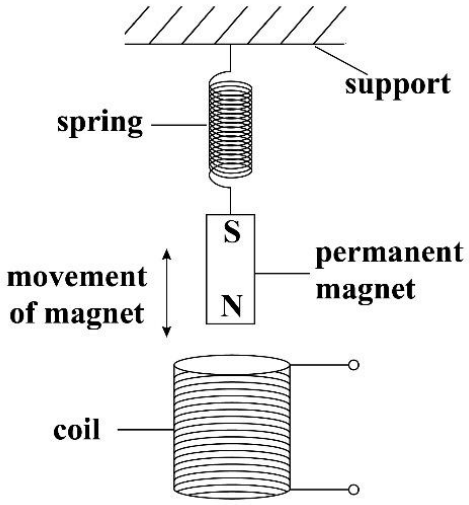
20. A thin tube contains a thread of mercury which traps air at the end of the tube. The other end of the tube is open to the atmosphere.



When the tube is turned upside down, the volume of the trapped air increases.

Explain the result of the experiment. (3 points)

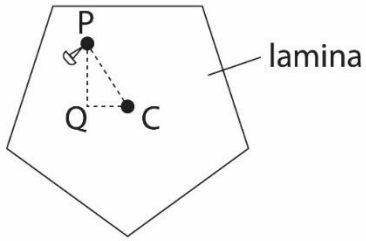
21. A permanent magnet moving up and down on the end of a spring induces an e.m.f. in a coil.



What would **decrease** the maximum value of the induced e.m.f.? (3 points)

22. A lamina is freely suspended from point P. The weight of the lamina is 2.0 N and the centre of gravity is at C.

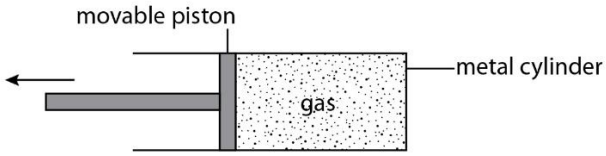
PC = 0.50 m
PQ = 0.40 m
QC = 0.30 m



The lamina is displaced to the position shown.

What is the moment about P due to the weight of the lamina? (3 points.)

23. A fixed mass of gas is trapped in a metal cylinder by a movable piston.



The piston is moved outwards slowly. The volume of the gas increases but the internal energy is unchanged.

What happens to the pressure and to the temperature of the gas? (3 points.)

24. The data table shows how the destruction of the ozone layer in Earth's atmosphere has affected the amount of ultraviolet radiation reaching Earth's surface beneath the areas of ozone destruction.

Ozone Loss and Ultraviolet Radiation

Ozone Destruction (%)	Average Increase in Ultraviolet Radiation Reaching Earth's Surface (%)
0	0
5	5
10	12
15	20
20	28
25	36
30	47
35	60
40	76

24.1 Ozone destruction was estimated to be 22% in the atmosphere above a Lake Ontario beach. Based on the pattern shown in the data table, predict the average increase in ultraviolet radiation reaching that beach. **(**1 point)

24.2 The ozone layer is mostly concentrated between 20 and 25 kilometers above Earth's surface. State the name of the atmospheric temperature zone layer where this ozone concentration can be found. **(**1 point)

24.3 Ozone closer to Earth's surface has been identified as a greenhouse gas. Identify two other gases in Earth's atmosphere that are considered major greenhouse gases. **(**1 point)

25. Calcium oxide, CaO, also known as lime, is an important industrial chemical. Lime can be obtained by the heating of limestone, which is mainly calcium carbonate, $CaCO_3$. An equation representing the reaction for the production of lime is shown below.

$$CaCO_3\ (s) + \text{heat} \rightarrow CaO\ (s) + CO_2\ (g)$$

25.1 State the solubility of limestone in water. **(**1 point.)

25.2 State evidence from the equation that the reaction to form lime is endothermic. **(**1 point.)

25.3 State the type of chemical bonding in a sample of CaO. **(**1 point.)

Part III : Essay (Total 40 points.)

26. Some information about pollutants, their sources and their effects on the environment is shown in the following table. (9 points.)

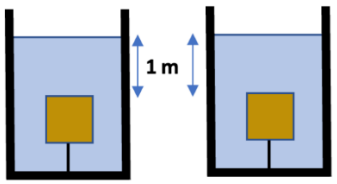
Pollutants	Sources	Effects on the environment
Heavy metals in chemical waste	1	Disrupts functioning of plants, and causes brain damage
Phosphate	2	Eutrophication of streams, rivers, and lakes
Sulfur dioxide	3	Damage to trees, e.g., and death of leaves
DDT	Pesticide sprays	Accumulates in the tissue of animals

26.1 Complete the above table. (3 points)

26.2 Explain what happens in streams, lakes, and rivers when eutrophication occurs. (3 points)

26.3 Sulfur dioxide dissolves in rainwater to form acid rain. Describe two things that can be taken to reduce the effects of acid rain. (3 points)

27. Two identical wooden blocks are tied by a string and dipped in the liquid on the container. The volume of the wooden block is 1 litre and the mass is 0.5 kg. **(**8 points.)



Container A Container B

Container A is filled with water (ρ_{water} = 1000 kg/m^3) and container B is filled with ethanol ($\rho_{ethanol}$ = 750 kg/m^3).

27.1 What is the tension of the string in both containers? (4 points)

27.2 Then the strings are cut. What is the time needed by each block (in container A and container B) to reach the surface at the same time? (4 points)

Note: The block reaches the surface when the top side of the block reaches the surface.

28. Answer the following questions. (8 points)

28.1 The revolution of the Moon orbiting the Earth is about 27 days and 8 hours, and the Lunar cycle from the new moon until the next new moon is about 29 days and 12 hours. Why is the time of both conditions is different? (4 points)

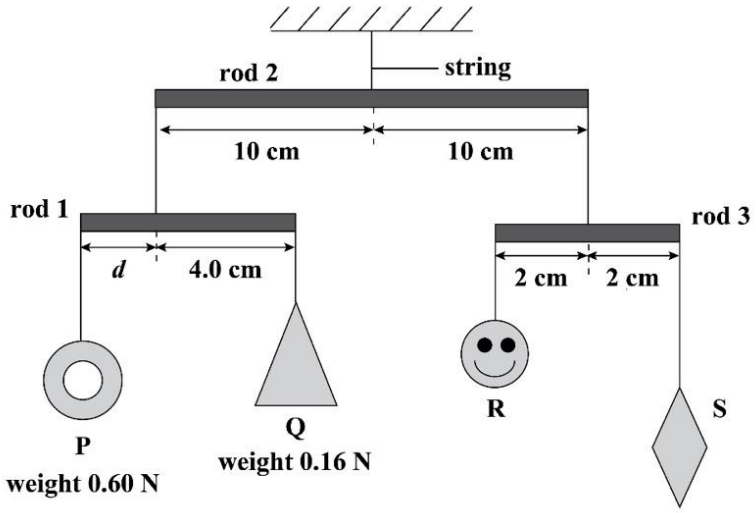
28.2 A hollow metal ball has an outer diameter is 22 cm, and an inner diameter is 20 cm. Then the ball is heated. How about the outer and inner diameters? Do they increase, decrease or stay the same? Explain your answer. **(**4 points.)

29. A student observing a small object using a magnifying glass. She saw that the image is 5 times bigger than the object. The focal length of the magnifying glass is 10 cm. (6 points.)

29.1 Draw the light ray diagram from the object until the image is formed (3 points)

29.2 Where is the object placed? (3 points)

30. The figure shows a decoration that hangs by string from the ceiling in a toyshop. Four objects P, Q, R and S hang by string from rods 1 and 3. These two rods hang by string from rod 2. The decoration is completely stationary and the rods are horizontal. The weights of the rods and the strings may be neglected. (9 points.)



(not to scale)

Object P weighs 0.60 N and object Q weighs 0.16N.

30.1 Calculate the value of the distance d (4.5 points)

30.2 Determine the weight of object R and of object S. (4.5 points)

National Selection : ASMOPSS Thailand 2022 (2nd Round – Science Secondary)

Answers Keys :

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

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

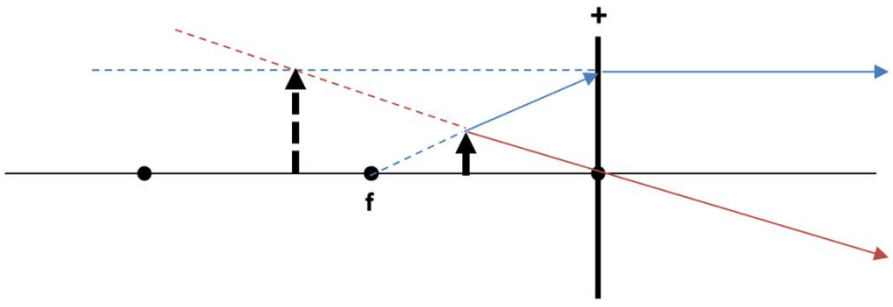
Part II : Each short answer is worth 3 points. (Total 30 points.)

No.	Answers
16.	Gene flow
17.	17.1 Electromagnetic waves do not require any meto travel from one point to another. 17.2 Infra-red and visible light 17.3 Red is a better emitter of heat than white, thus the radiation emitted by the lamp decreases.
18.	X = O_2 Y = H_2O
19.	The pressure in water is the sum of the atmospheric pressure and the pressure exerted by the water. According to the calculation in (i), the pressure exerted by the water at a depth of 30 m is much greater than the atmospheric pressure. Therefore, the pressure in water at a depth of 30 m is very different from that at the surface.
20.	The pressure in the trapped air is reduced.

21.	- decreasing the number of turns in the coil - decreasing the strength of the magnet - raising the support of the spring
22.	0.60 Nm clockwise
23.	Pressure: decreases Temperature: unchanged
24.	24.1 29% to 33% 24.2 stratosphere 24.3 [1] Allow 1 credit for two correct responses. Acceptable responses include, but are not limited to: — carbon dioxide/CO_2 — water vapor/H_2O — methane/CH_4 — nitrous oxide/N_2O — chlorofluorocarbons/CFC
25.	25.1 [1] Allow 1 credit. Acceptable responses include, but are not limited to: $CaCO_3$ has very low solubility. Limestone is not soluble in water. Insoluble 25.2 [1] Allow 1 credit. Acceptable responses include, but are not limited to: The energy term is on the reactant side of the equation. Heat is on the left side of the equation. Heat must be added to decompose limestone and form lime. 25.3 [1] Allow 1 credit for ionic bonding or ionic.

Part III : Essay (Total 40 points.)

No.	Answers
26.	26.1 **Source** 1. factories / industries / mining or exhaust from transport/chemical or plants / sewage (sludge) : 2. fertilizer /detergents /sewage 3. (combustion of) coal / oil / factories / power stations/chemical plants / exhaust from transport
	26.2 Explain what happens in streams, lakes, and rivers when eutrophication occurs. (3 points.) • growth of algae/ algal bloom; • light blocked (by algae) so there will be reduced/no photosynthesis; • Less/no oxygen released by plants; • Low level of oxygen cause death/ suffocation/ migration ,of, (named) fish / animals / invertebrates / (aquatic) creatures / organisms / consumers;
	26.3 Sulfur dioxide dissolves in rainwater to form acid rain. Describe two things that can be taken to reduce the effects of acid rain. (3 points.) - add lime(stone) / calcium carbonate / $CaCO_3$ / alkali to lakes / rivers /soils - use less fossil fuels • use low sulfur fuels or stop using sulfur fuels • use desulfurization of coal / oil or flue gas desulfurization / 'use (wet) scrubbers' neutralize waste gases with lime; • use catalytic converters / use electric cars • idea of international treaty for reducing emissions;

27.	27.1 Tension in container A = 5 N Tension in container B = 2.5 N
	27.2 container A : a = 10 m/s2 , t = $\sqrt{\frac{1}{5}}$ container B : a = 5 m/s2 , t = $\sqrt{\frac{2}{5}}$
28.	28.1 The revolution of the Moon is the period of Moon to make one full circle rotating the earth. (1 points) Earth also move rotating the Sun while the Moon rotating the Earth (1 points). So make one Lunar cycle according to the observer on Earth, the Moon rotating more than one full circle, so the Lunar cycle period is longer than the period revolution of Moon. (2 points)
	28.2 Both inner and outer diameter will increase. (1 points) Object (metal) will expand when it heated. If the object is hollow sphere, the outer surface will expand and the diameter is increase. (1.5 points) The inner surface will also expand when it heated. So the diameter of inner surface is increase. (1.5 points)
29.	29.1 
	29.2 The object is 8 cm from the magnifying glass

30.	30.1 $0.6 \times d = 0.16 \times 4.0$ $d = (0.16 \times 4.0) / 0.6$ $d = 1.066666$ cm. $= 1.07$ cm. หรือ 1.07^{-2} m
	30.2 object R = 0.38 N object S = 0.38 N