1. Which biological molecules always contain the element nitrogen?
   (A) amino acids, cellulose, mRNA　　　　　(B) amino acids, DNA, lipids
   (C) enzymes, mRNA, tRNA　　　　　　　　(D) membrane proteins, starch, tRNA

2. Two enzymes, X and Y, were used in an experiment. Enzyme X was from bacteria that live in rivers and lakes at temperatures from 5°C to 20 °C. Enzyme Y was from bacteria that live in hot water springs at temperatures from 40°C to 85°C. The experiment measured the concentration of product produced by each enzyme at temperatures between 0°C and 100°C after 5 minutes. Which graph shows the results?
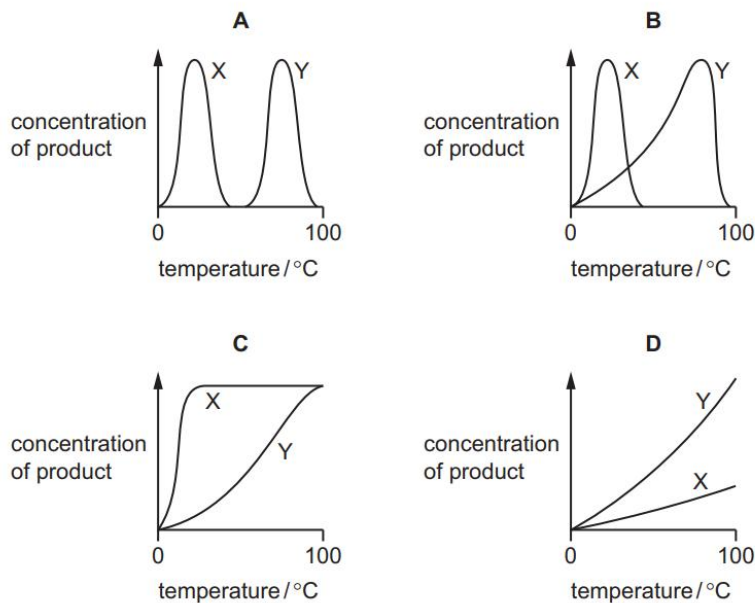
3. There is a high concentration of molecule X outside the cell, which enters the cell by facilitated diffusion. The results of measuring the concentration of X inside the cell at 30 s intervals are shown by the graph.
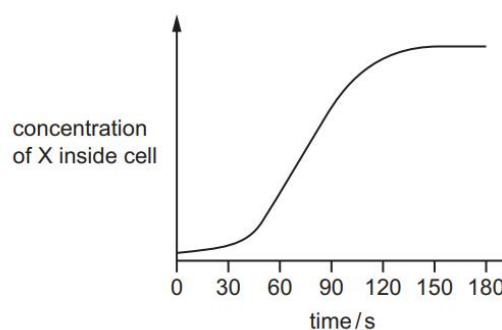
Why does the concentration of X inside the cell remain constant after 150 s?
   a. There is no more of X outside the cell.
   b. The number of carrier proteins is limiting.
   c. There is no net movement of X.

A. a and b only　　　　　B. a and c only　　　　　C. b and c only　　　　D. c only

1

4. Mitosis is an important process for organisms. Which features of mitosis are important for single-celled organisms?
    a. asexual reproduction
    b. growth
    c. production of genetically identical cells

    A. a, b and c   B. a and c only   C. b and c only   D. a only

5. Which components of blood are present in tissue fluid?

	phagocytes	proteins	sodium ions
A	✓	✓	✓
B	✓	✗	✗
C	✗	✓	✓
D	✗	✓	✗

key
✓ = present
✗ = absent

6. The diagrams show the structures of two amino acids, each of which has two carboxylic acid (–COOH) groups.
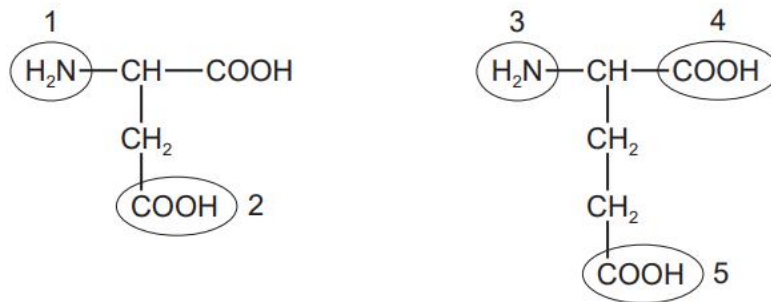
A peptide bond is formed between the two amino acids. Which groups form the peptide bond?

A. 1 and 4   B. 1 and 5   C. 2 and 3   D. 2 and 5


7. Some babies are born with a hole between the right and left atria. These babies are found to have an increased number of red blood cells. What is the reason for this increase?
    A. More blood is needed because it is pumped faster.
    B. More blood is needed because the pressure is lower.
    C. Their haemoglobin has a higher affinity for oxygen.
    D. There is less oxygen available to the newly born baby.


8. The diagram shows a plant cell.

The plant cell is put into a solution with a water potential less negative than the cell contents. What will happen to the appearance of the cell?
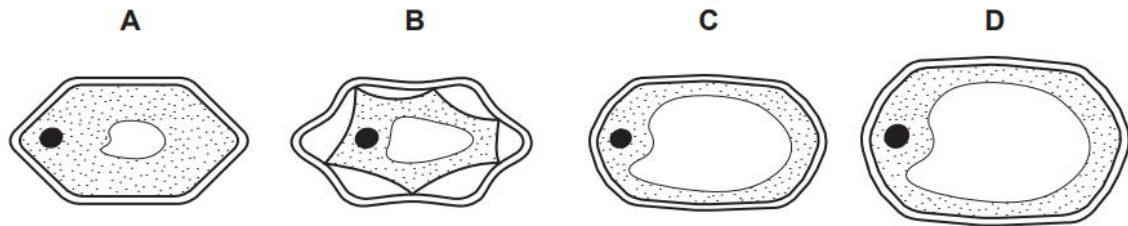
9. Which xerophytic adaptations reduce the water potential gradient?
    a. rolled leaves
    b. hairy leaves
    c. sunken stomata
    d. fewer stomata
    e. fleshy leaves

    A. a, b, c, d and e   B. a, b and c only   C. a, c and d only   D. b and e only

10. What is not a factor influencing blood pressure?
    A. the diameter of the blood vessels
    B. the number of red blood cells in circulation
    C. the systolic pressure of the heart ventricles
    D. the volume of blood returning to the heart each heartbeat.

11. Which feature of a plant cell is an adaptation for water uptake from the soil solution?
    A. waxy cuticle
    B. large numbers of mitochondria
    C. long, thin extension to the cell
    D. thick cellulose cell wall

12. The malarial parasite, *Plasmodium,* infects red blood cells and breaks down haemoglobin. Free haem groups are toxic to *Plasmodium*, and the parasite converts them into non-toxic, crystalline haematozoin, using an enzyme, HDP, which is found in all species of *Plasmodium*. What will be the long-term result of giving patients with malaria a drug which inhibits HDP?

    A. a decreased concentration of free haem groups in infected red blood cells
    B. a decreased concentration of haemoglobin in infected red blood cells
    C. more rapid reproduction of some species of Plasmodium in infected red blood cells
    D. slower reproduction of all species of Plasmodium in infected red blood cells

3

13. The flow of nutrients in an ecosystem is shown in the diagram. Which letter represents decomposers?
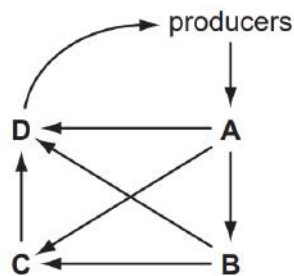
14. An insect eats only the leaves of grass. This insect is eaten by carnivorous beetles. Which ecological terms are described in this information about the insect?
    a. habitat
    b. niche
    c. trophic level

    A. a, b and c   B. b and c only   C. b only   D. c only

15. A gardener has a waterlogged garden showing poor growth. He decides to drain it to reduce the number of some harmful bacteria. Which type of bacteria would he be attempting to reduce in number?
   A. decomposing   B. denitrifying   C. nitrifying   D. nitrogen fixing

16. What compound of the following does not cause permanent hardness in water?
    A. $CaCl_2$ B. $MgSO_4$ C. $Ca(HCO_3)_2$ D. $Mg(NO_3)_2$

17. Which of the following compounds have both ionic and covalent bonds?
    A. H_2O B. C_2H_5OH C. NH_4Cl D. KCl

18. How many structures (except the given structure) can be written for the given molecule by changing the position of the double bond?

$$CH_2=CH\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_3$$
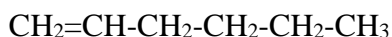
    A. 1   B. 2   C. 3   D. 4

19. How many structures with $CH_2=CH\text{-}$ group (except the given structure) can be written for the above molecule in question 18 by branching the hydrocarbon chain?
    A. 1   B. 2   C. 3   D. 4

20. When $CuSO_4 \cdot 5H_2O$ heats at 120 ^0C for 2 hours, all the bound water evaporates to give $CuSO4$. What is the loss of weight when 0.50 g of $CuSO_4 \cdot 5H_2O$ was heated at 120 ^0C for 2h? (Atomic weights: Cu = 63, S = 32, O = 16, H=1)

    A. 0.360 g   B.   0.036 g   C. 0.180 g   D. 0.136 g

21. A disaccharide was formed by combining two molecules of glucose and removing a water molecule. What is the chemical formula of the disaccharide formed?
    A. $C_{12}H_{24}O_{12}$ B. $C_{12}H_{22}O_{11}$ C. $(C_6H_{12}O_6)_2$ D. $C_{12}H_{24}O_5$

22. What is the correct electron arrangement of the phosphorus atom?

    A.   B.   C.   D.

23. Isotopes of an element have the same number of protons and different numbers of neutrons. Atomic mass is expressed in atomic mass units (amu). The atomic mass of an element with many isotopes is given by the following equation.

$$M1 \times P1 + M2 \times P2 + \ldots\ldots..$$

M1 = Atomic mass of isotope 1 (amu)   P1 = Mass percentage of isotope 1
M2 = Atomic mass of isotope 2 (amu)   P2 = Mass percentage of isotope 2

An element has three isotopes with atomic mass (amu) 24, 25, and 26. The mass percentage of each of the three isotopes 24, 25, and 26 is 60/100, 25/100, and 15/100 respectively. What is the atomic mass in amu of this element?

    A. 25.55   B. 24.35   C. 24.75   D. 24.55

24. Contents of carbon and oxygen in two compounds X and Y containing only carbon and oxygen, are given below. The molecular weight of Y compound is larger than that of X.

	Mass of the compound	Mass of Carbon	Mass of Oxygen
X	22 g	6 g	16 g
Y	33 g	9 g	24 g

What is the correct statement about the two compounds?
   A. Compound X converts to compound Y
   B. Compound X may be a dimer of compound Y
   C. Compound Y may be a dimer of compound X
   D. Both compounds are hydrocarbons

25. In an experiment, O_2 gas was collected over water at 25 ^{0}C to a container with a volume 0.10 L. During the collection of O_2 over water, water vapor mixes with O_2 to give a mixture of O_2 (gas) and H_2O(gas). The pressure of this gas mixture is 745.8 mmHg. Pressure of water vapor at 25 ^{0}C is 23.8 mmHg. Calculate the number of moles of pure O_2 gas in the container. Equation: PV =nRT (P=pressure of a gas, V=volume, n= number of moles, T = temperature in Kelvin)
   1 atm = 760 mmHg;   Gas Constant R = 0.0821 L.atm/K.mol

   A. 4.2 x 10^{-3} B. 2.5 x 10^{-4} C. 3.9 x 10^{-3} D. 3.9 x 10^{-4}

26. How many oxygen atoms are there in 9 g of glucose ($C_6H_{12}O_6$)?
   (Atomic weights: C = 12, H = 1, O = 16)

   A. 1.80×10^{23} B. 3.61 x 6.023×10^{23}
   C. 3.25×10^{24} D. 7.22×10^{24}

27. When the concentration of colored solutions increases, color intensity also increases. A researcher noticed that the color intensity of copper sulphate solutions increases with the concentration and the following quantitative observations were made.

Concentration	0.001M	0.002M	0.003M	0.004M
Color intensity	0.0100	0.0200	0.0300	0.0400

   A solution containing an unknown amount of copper sulphate has the color intensity 0.025

   What is the concentration of this solution?

   A. 0.0200 M   B. 0.0025 M   C. 0.032   D. 0.003

28. The percentage yield (% yield) of a chemical reaction is defined as below.

$$\frac{\text{Actual yield}}{\text{Theoritical yield}} \times 100 = \% \text{ yiled}$$

   Actual yield is the amount of the product formed by a reaction from a given amount of a reactant. Theoretical yield is the amount of the product formed according to the chemical equation from a given amount of reactant.
   Acetylene (C_2H_2) was produced according to the following equation. The reaction gave 11.5 kg of acetylene when 32 kg of CaC_2 was reacted with excess water. What is the % yield of the reaction? (Atomic weights: Ca = 20, C = 12, O = 16, H = 1)

   A. 100 %   B. 50 %   C. 78 %   D. 88%

29. Concentrated hydrochloric acid (Conc. HCl) is a 11 M (11 mol L^{-1}) solution. What is the volume of Conc. HCl needed to make 500 mL of 5 M HCl?

     A. 2.500 L   B. 0.409 L   C. 227.0 mL   D. 454.0 mL

30. What is the correct statement about air?

     A. Air is a heterogenious mixture at room temperature
     B. Air is a homogenious mixture at room temperature
     C. Air is homogenious at all the temperatures
     D. Air can be heterogeneous if the temperature is increased to 85 ^{0}C

31. Due to applying break, A vehicle traveling at a speed of 72 km/hour gains deacceleration of 2 m.s^{-2}. What is the distance the vehicle moves after applying the break?

     A. 25 m   B. 50 m   C. 100 m   D. 200 m

32. P and Q trollies are connected by a spring. A string is fixed so as to compress the spring. and spring. The mass of P is *m,* and the mass of Q is *2m.*
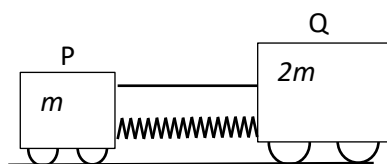
If the P moves at a speed of 1 m.s^{-1} left -side when the sting is cut off,

     A. Q moves at a velocity of 1 m.s^{-1} left.
     B. Q moves at a velocity of 1 m.s^{-1} right.
     C. Q moves at a velocity of 2 m.s^{-1} right.
     D. Q moves at a velocity of 0.5 m.s^{-1} right.

33. 4V potential difference is applied between XY in the circuit shown below.
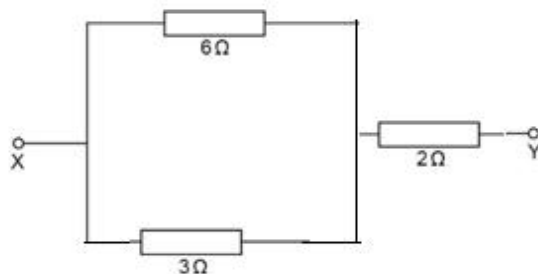
     What is the current flowing through 2 Ω resistor?

   A. 0.1 A   B. 0.2 A   C. 0.5 A   D. 1 A

34. Four forces are acting on a circular object as shown in the following figure.

40 N

50 N

40 N

50 N
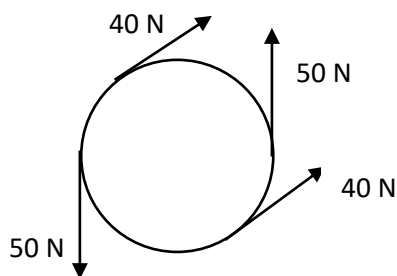
Which of the following statements is correct regarding the resultant force acting on the object and the resultant moment acting on the object?

    A. The resultant force is zero and the resultant moment is also zero.
    B. The resultant force is zero and the resultant moment is not zero.
    C. resultant force is not zero and resultant moment is zero.
    D. The resultant force is not zero and the resultant force is also non-zero.

35. A trolley moves from P to Q. The potential energy of the trolley at Q is 40 kJ less than the potential energy at P. The kinetic energy of the trolley at Q is 70 kJ and the work done against friction during the motion P to Q is 15 kJ.
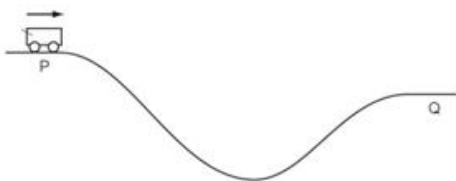
What is the kinetic energy of the trolley at P?

   A. 8 kJ   B. 12 kJ   C. 15 kJ   D. 45 kJ

36. 1 kg of a material in a solid state at room temperature is uniformly supplied with 3000 J of heat per minute and its temperature change with time was observed and the following graph was drawn.
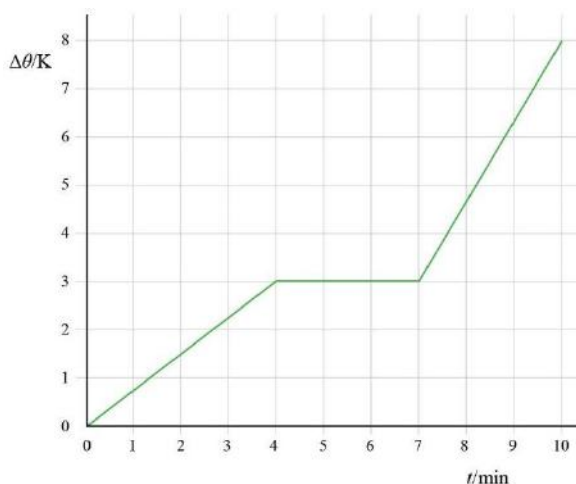
What can be concluded from this graph?

A. After 4 minutes the solid becomes completely liquid.

B. The specific heat capacity in the solid state is less than the specific heat capacity in the liquid state.

C. The latent heat of fusion of the substance is 9000 J/kg.

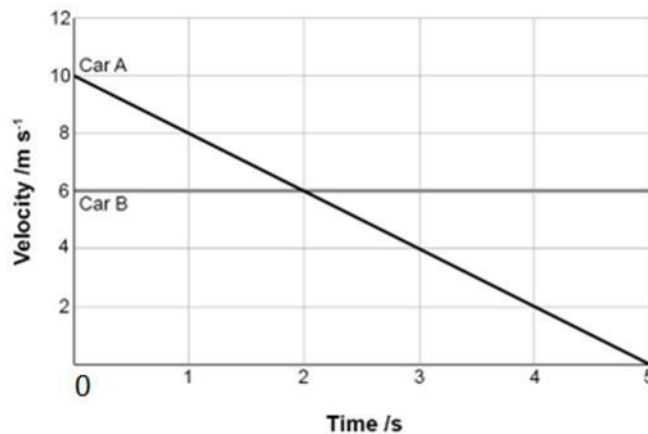D. After 10 minutes the solid has completely changed to the gas phase.

37. After reflecting by two plane mirrors a light ray passes as shown in the following figure.
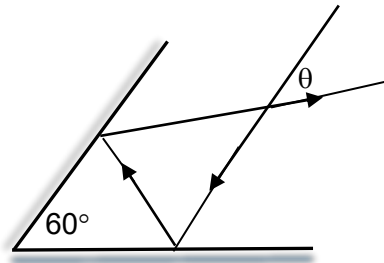
If the angle between mirrors is $60°$, what is the angle (θ)shown in the figure?

A. $25°$ B. $35°$ C. $45°$ D. $60°$
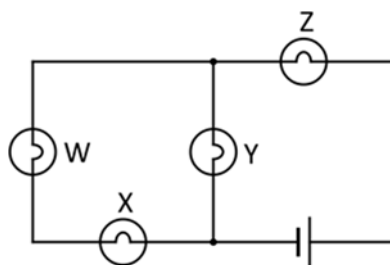
38. The graph below shows the velocity–time graphs of two cars, A and B.

At time $t = 2$ s how far away car A is from car B?

A. 4 m   B. 10 m   C. 12 m   D. 16 m

39. A battery and four identical light bulbs are connected as shown in the figure below.

Consider the following statements.
(I) W and X glow with the same intensity.
(II) Y and Z glow with the same intensity.
(III) Y shines brighter than X.
Which of these statements is true?

A. I only   B. II only   C. I and II only   D. I and III only

40. An object between the center of curvature and the focal point of a concave mirror forms what type of image?

A. Inverted, small, real   C. Inverted, magnified, real

B. None-Inverted, small, virtual   D. Non-Inverted, large, virtual

41. If the frequency of a sound wave is doubled, the wavelength:

A. halves and the speed remain unchanged.
B. doubles and the speed remains unchanged.
C. halves and the speed also halves.
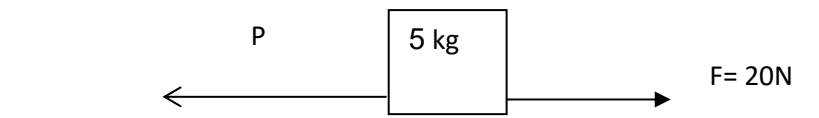D. doubles and the speed also doubles.

42. A ray of light travels parallel to the optical axis of a thin concave lens whose focal point is f.
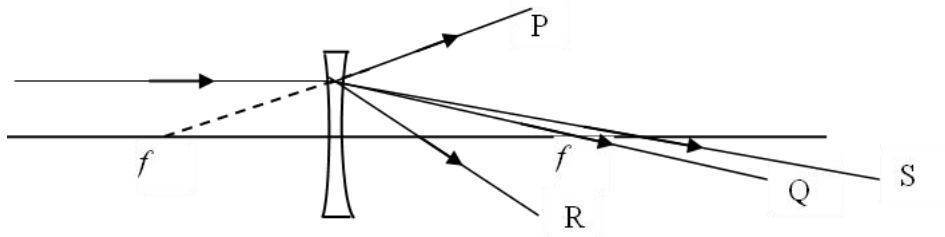
Immerging ray is represented by,

A. P   B. Q   C. R   D. S

43. A mass of 5 kg rests on a smooth horizontal plane and two forces P and F=20 N act on it. When the force P is doubled, the mass moves with uniform velocity.

What is the acceleration of the mass when the force P is halved?

A. 2 m.s^{-2} B. 3 m.s^{-2} C. 4 m.s^{-2} D. 5 m.s^{-2}

44. Density of liquid Q is twice that of liquid R. At a depth x in the liquid R the pressure due to the liquid is 4 kPa. At what depth in liquid Q is the pressure due to liquid Q equals 5 kPa?

A. $\dfrac{2X}{5}$　　　　　B. $\dfrac{5X}{8}$　　　　　C. $\dfrac{8X}{5}$　　　　　D. $\dfrac{5X}{2}$

45. P and Q are two conductors. The cross section of conductor Q is greater than the cross section of conductor P. A charge of 2 C flows through a any cross section given in each conductor in 20 seconds.

Which of the following statements is true?
A. Current through conductor P is greater than current through conductor Q.
B. Current through conductor P is less than current through conductor Q.
C. Equal current flows through both the conductors and is 0.1 A.
D. Currents flowing through conductors P and Q depend on their lengths.

46. A solid cube of wood floats in a liquid of density ρ. The height of the cube outside the liquid is   one-fourth of the height of the cube.
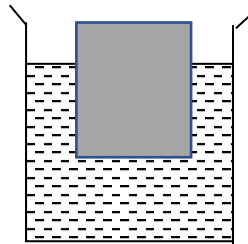
The density of the wooden cube is,

A. $\dfrac{1}{4}\rho$　　　　　　　B. $\dfrac{1}{2}\rho$　　　　　　　C. $\dfrac{4}{3}\rho$　　　　　　　D. $\dfrac{3}{4}\rho$

47. What is the equation of the line parallel to the line whose equation is y = 5x + 3 and whose y-intercept is 4 ?

A. y = 5x + 4　　　　　　B. y = (-1/5)x + 4　　　C. y = (1/5)x + 4　　　D. y = 5x - 7

48. If $\dfrac{3^{2x+2}}{9} = 3^{3x-1}$, then x is

A. 3　　　　　　　　　B. -3　　　　　　　　　C. 1　　　　　　　　　D. 2

49. If a man 60 kg is replaced with another man, then the average weight of 25 men were increased by 1kg. What is the weight of the new person?

       A. 61 kg   B. 72 kg   C. 85 kg   D. 90 kg

50. If $T = \dfrac{V}{a}\sqrt{\dfrac{A\rho}{2F}}$ then F is,

    A. $F = \dfrac{V^2 A\rho}{2Ta^2}$ C. $F = \left(\dfrac{Va}{T}\right)^2 \dfrac{A\rho}{2}$

    B. $F = \left(\dfrac{V}{aT}\right)^2 \dfrac{A\rho}{2}$ D. $F = \dfrac{1}{2}\left(\dfrac{V\rho A}{Ta}\right)^2$

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