Topic B

Multiple choice questions

1 The side of a solid cube of mass M is d. The density of the cube is ρ. The side of another cube of the same material is $2d$. What is the mass and density of this cube?

	Mass	Density
A	$2M$	$\frac{\rho}{2}$
B	$2M$	ρ
C	$8M$	$\frac{\rho}{2}$
D	$8M$	ρ

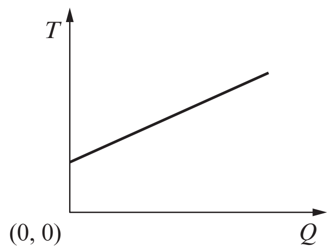
2 The temperature of a substance is changed from −32 °C to −46 °C. What is the change in the temperature of the substance in degrees kelvin?

A 14
B −14
C 259
D 287

3 Molecules of mass of order 10^{-26} kg are kept at temperature 300 K. What is an order of magnitude estimate of the average speed of the molecules?

A $10\ \text{m s}^{-1}$
B $10^2\ \text{m s}^{-1}$
C $10^3\ \text{m s}^{-1}$
D $10^4\ \text{m s}^{-1}$

4 The graph shows the variation of the temperature T of a solid as it is being heated with energy Q.



In order to determine the specific heat capacity of the solid, it is suggested that the following quantities be measured:

I the mass of the solid
II the gradient of the graph
III the vertical intercept of the graph.

What is needed in order to determine the specific heat capacity?

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

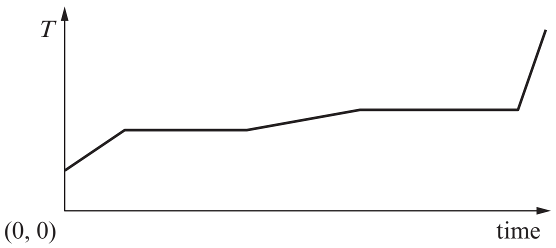
5 Body X, with temperature 0 °C, is brought into thermal contact with body Y of equal mass and of temperature 100 °C. The only exchanges of heat that take place are between X and Y. The specific heat capacity of X is greater than that of Y. Which statement about the final equilibrium temperature T of the two bodies is correct?

A $T = 50$ °C
B $0 < T < 50$ °C
C 100 °C $> T > 50$ °C
D Answer depends on value of mass.

6 Energy is provided to a liquid at its boiling point at a rate of P joules per second. The rate at which mass is boiling away is μ kg per second. What is the specific latent heat of vaporisation of the liquid?

A μP
B $\frac{P}{\mu}$
C $\frac{\mu}{P}$
D $\frac{1}{\mu P}$

7 The graph shows the variation with time of the temperature T of a material as it is brought from the solid state into the liquid state and then into the vapour state. Energy is provided at a constant rate.



Which is the correct comparison of the specific heat capacities c_S, c_L and c_V in the solid, liquid and vapour states?

A $c_V > c_S > c_L$
B $c_S > c_L > c_V$
C $c_V > c_L > c_S$
D $c_L > c_S > c_V$

8 5 kg of water at 10 °C are mixed with 2 kg of water at 80 °C. What is the final temperature of the water?

A 30 °C
B 45 °C
C 55 °C
D 70 °C

9 Equal quantities of liquids X and Y are mixed. X is at 20 °C, and Y is at 80 °C. The specific heat capacity of X is double that of Y. What is the final temperature of the mixture?

A 40 °C
B 50 °C
C 60 °C
D 70 °C

10 Water of mass m at 10 °C is poured onto a mass M of ice at 0 °C. The temperature of the water is reduced to 0 °C. The specific heat capacity of water is c, and the specific latent heat of fusion of ice is L. What is the fraction of the mass of ice that melted?

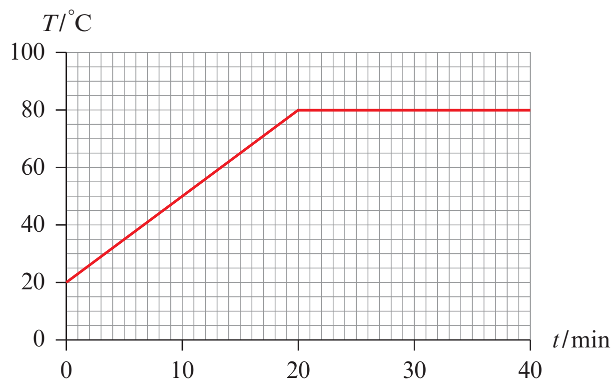
A $\frac{10mc}{ML}$

B $\frac{10Mc}{mL}$

C $\frac{10mL}{Mc}$

D $\frac{10ML}{mc}$

11 Energy is provided to a solid of mass 5 kg at a constant rate. The specific heat capacity of the solid is 400 J kg^{-1} K^{-1}. The specific latent heat of fusion is 3×10^4 J kg^{-1}.



What mass of solid has melted at 40 minutes?

A 2 kg

B 3 kg

C 4 kg

D 5 kg

12 The specific latent heat of vaporization is L. Energy is being provided to a liquid at its boiling point at a rate of P joules per second. What is the rate at which mass boils away?

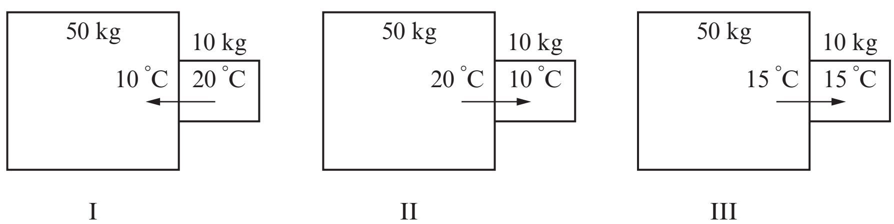
A PL

B $\frac{P}{L}$

C $\frac{L}{P}$

D $\frac{1}{PL}$

13 Two blocks of different material are in contact as shown in three different states of temperature:



When does the arrow correctly show the net transfer of heat from one body to the other?

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

14 A solid is melting at constant temperature. What is correct about equal numbers of molecules in the solid phase and molecules in the liquid phase?

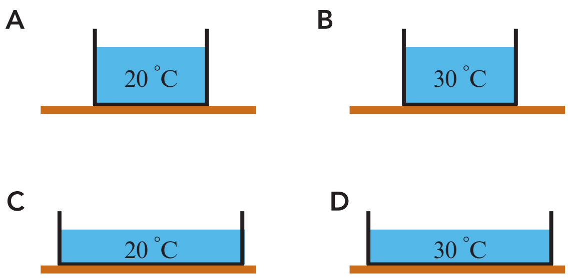
	Average kinetic energy	Internal energy
A	Same	Same
B	Same	Different
C	Different	Same
D	Different	Different

15 A plastic ruler and a metallic ruler are in the same room. The metallic ruler 'feels' colder when touched. What is the reason for this?

A Plastic has a lower specific heat capacity than metal.
B Plastic has a higher specific heat capacity than metal.
C Plastic is a better conductor of heat than metal.
D Plastic is a worse conductor of heat than metal.

16 Four containers contain the same kind of liquid. The temperature of the surroundings is the same for all four cases.

In which case will the rate of evaporation be the largest?



17 A hot part of some metallic equipment is ejected from a spacecraft far from the Earth. The thermal energy transferred by the metallic piece takes place through:

A radiation
B conduction
C convection
D evaporation.

18 A room is transferring energy to the outside through a wall. Which combination of wall area and wall thickness results in the smallest rate of heat transfer?

	Area	Thickness
A	S	d
B	$2S$	$\frac{d}{2}$
C	S	$2d$
D	$2S$	$2d$

19 A quantity of water transfers 8.0×10^5 J for every degree it cools down. What is the rate of change of the temperature of the water when energy is transferred away at a rate 4.0×10^6 J per hour?

A 0.5 °C h^{-1}

B 5 °C h^{-1}

C 0.5 °C0 min^{-1}

D 5 °C min^{-1}

20 The ends of an insulated pipe of length L are kept at constant temperatures of 70 °C and 10 °C.

What is the temperature at point P in the pipe a distance of $L/3$ from the left end?

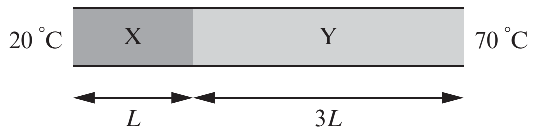
A 50 °C

B 40 °C

C 35 °C

D 30 °C

21 Two insulated pipes, X of length L and Y of length $3L$, of the same cross-sectional area are joined together. The left end of X is kept at 20 °C and the right end of Y at 70 °C. The thermal conductivity of Y is double that of X.



What is the temperature at a point where the pipes join?

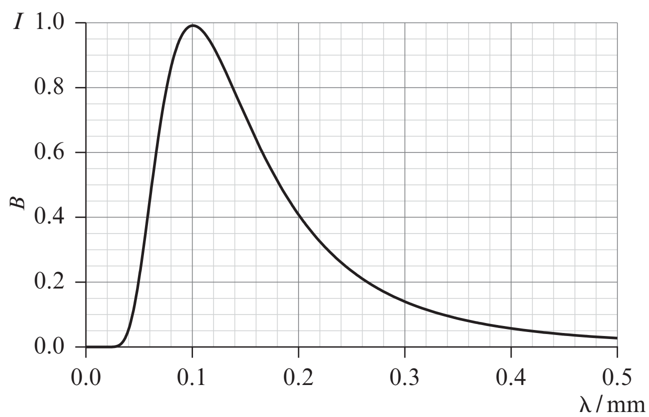
A 50 °C

B 45 °C

C 40 °C

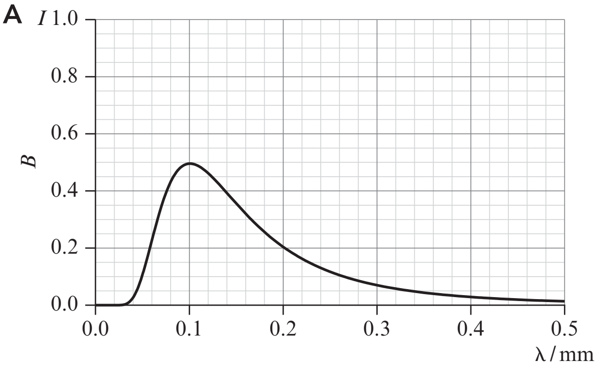
D 30 °C

22 The graph shows the variation with wavelength of the spectral intensity of a black body. The scale on the vertical axis on all graphs in this question is the same, and the units are arbitrary.

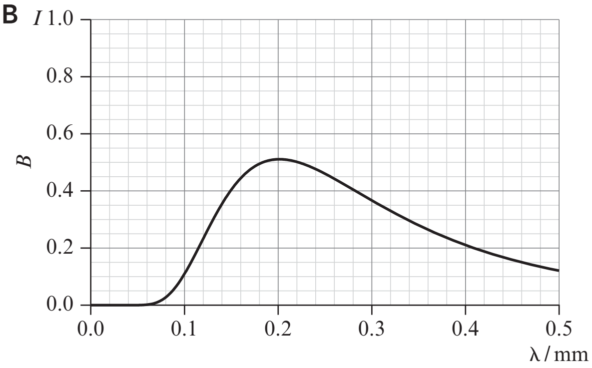


The area of the black body is halved. Which graph now shows the correct variation with wavelength of the spectral intensity?

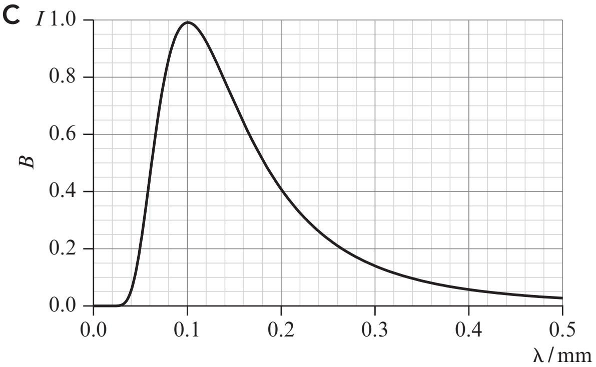
A



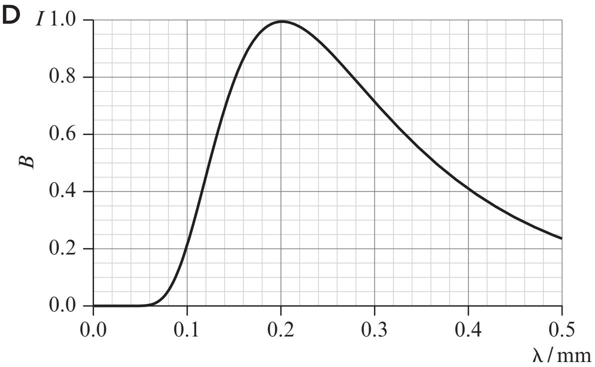
B



C



D



23 A black body radiates power P. What power would the same black body radiate when its kelvin temperature is doubled?

A $2P$

B $4P$

C $8P$

D $16P$

24 Body X has emissivity e and kelvin temperature T. The surroundings of X radiate as a black body of kelvin temperature θ. What is the intensity of radiation **absorbed** by X?

A $e\sigma(T - \theta)^4$

B $\sigma\theta^4$

C $e\sigma\theta^4$

D $e\sigma(T^4 - \theta^4)$

25 A black body X has kelvin temperature T. The surroundings of X radiate as a black body of kelvin temperature θ. What is the intensity of radiation **reflected** by X?

A zero

B $\sigma\theta^4$

C σT^4

D $\sigma(T^4 - \theta^4)$

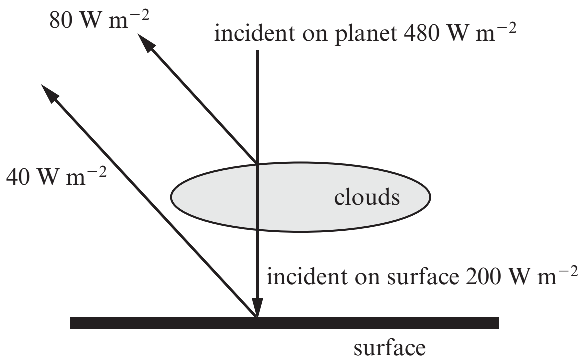
26 The power emitted per unit area of a spherical black body is S. The radius and kelvin temperature of the body are both doubled. What is the new power emitted per unit area of the black body?

A $4S$
B $8S$
C $16S$
D $64S$

27 Radiation of intensity S is incident on a sheet of ice of surface area 1 m^2 at its melting point. The albedo of ice is α. The specific latent heat of fusion of ice is L. What mass of ice melts in time T?

A $\frac{\alpha TS}{L}$
B $\frac{(1-\alpha)TS}{L}$
C $\frac{\alpha LT}{S}$
D $\frac{(1-\alpha)LT}{S}$

28 The diagram represents the energy balance of a planet. The upward arrows represent reflected intensities.



What is the albedo of the planet, and what is the total radiated intensity into space?

	Albedo	Radiated intensity into space /W m^{-2}
A	0.20	280
B	0.20	360
C	0.25	280
D	0.25	360

29 Apparent brightness is a measure of:

A the total power radiated by a star
B the power radiated by a unit area of the surface of the star
C how bright a star appears
D the distance to the star.

30 Star X has apparent brightness 2.0×10^{-8} W m^{-2}. Star Y has apparent brightness 8.0×10^{-8} W m^{-2}. The stars have the same luminosity. What is the ratio of the distance of X to the distance of Y?

A $\frac{1}{4}$
B $\frac{1}{2}$
C 2
D 4

31 Star X has surface temperature T and radius R. The power per unit surface area radiated by X is P. What is the power radiated per unit surface area of a star Y with surface temperature $2T$ and radius $2R$?

A $4P$

B $16P$

C $32P$

D $64P$

32 The apparent brightness of a star is b, its distance from Earth is d and its luminosity is L. What is the luminosity of a star whose apparent brightness is $3b$ and its distance is $3d$?

A L

B $3L$

C $9L$

D $27L$

33 How many grams of ${}^{24}_{12}\text{Mg}$ contain the same number of particles as 24 g of ${}^{48}_{22}\text{Ti}$?

A 12 g

B 24 g

C 48 g

D 96 g

34 What is the mass of an atom of ${}^{40}_{20}\text{Ca}$?

A $\frac{40}{6.02 \times 10^{23}}$ kg

B $\frac{40 \times 10^{-3}}{6.02 \times 10^{23}}$ kg

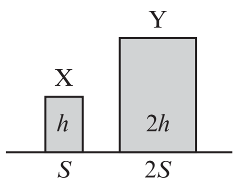
C $\frac{60}{6.02 \times 10^{23}}$ kg

D $\frac{60 \times 10^{-3}}{6.02 \times 10^{23}}$ kg

35 The molar mass of substance is μ (in g mol^{-1}). A pure sample of the substance contains m grams. N_A is the Avogadro constant. How many moles and how many particles of the substance are there in the sample?

	Number of moles	Number of particles
A	$\frac{m}{\mu}$	N_A
B	$\frac{\mu}{m}$	N_A
C	$\frac{m}{\mu}$	$\frac{m}{\mu}N_A$
D	$\frac{\mu}{m}$	$\frac{\mu}{m}N_A$

36 Two solid cylinders, X and Y, of the same material, rest on a horizontal surface. The cross-sectional areas and heights of each are indicated on the diagram.



What is the ratio $\frac{P_Y}{P_X}$ of the pressure exerted by Y to the pressure exerted by X?

A $\frac{1}{2}$

B 1

C 2

D 4

37 A cylinder (in vacuum) exerts a pressure of 3.0 kPa on a horizontal surface. The height of the cylinder is 50 cm. What is the density of the cylinder?

A 150 kg m^{-3}

B 600 kg m^{-3}

C 1500 kg m^{-3}

D 6000 kg m^{-3}

38 The following are all assumptions of the kinetic theory of gases, **except** which one?

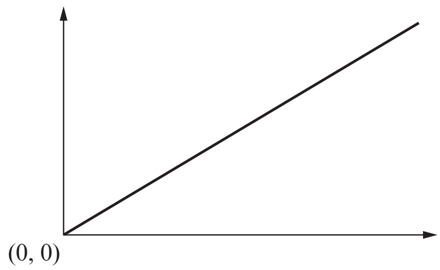
A The duration of a collision is very small compared to the time in between collisions.

B The collisions are elastic.

C The average kinetic energy of molecules is proportional to temperature.

D The volume of molecules is negligible compared to the volume of the gas.

39 In the context of a fixed mass of an ideal gas, the graph could represent the variation of:



A pressure with volume at constant temperature

B volume with Celsius temperature at constant pressure

C pressure with Celsius temperature at constant volume

D pressure with inverse volume at constant temperature.

40 The temperature of an ideal gas of pressure 200 kPa is increased from 27 °C to 54 °C at constant volume. Which is the best estimate for the new pressure of the gas?

A 400 kPa

B 220 kPa

C 180 kPa

D 100 kPa

41 The volume of an ideal gas is reduced quickly so that the temperature increases. Why does the pressure increase?

A Molecules are moving faster.

B Molecules collide with each other more frequently.

C Molecules collide with the walls more frequently.

D Molecules collide with the walls more frequently and are moving faster.

42 Box X has volume V and contains n moles of an ideal gas at pressure P. Box Y has volume $2V$ and contains $\frac{n}{3}$ moles at pressure $\frac{P}{2}$. What is the ratio of temperatures $\frac{T_X}{T_Y}$?

A $\frac{1}{12}$

B $\frac{1}{3}$

C 3

D 12

43 Box X has volume V and contains n moles of an ideal gas at kelvin temperature T. Box Y has volume $3V$ and contains $2n$ moles at temperature $T/3$. What is the ratio of pressures $\frac{P_X}{P_Y}$?

A $\frac{2}{9}$

B $\frac{2}{3}$

C $\frac{3}{2}$

D $\frac{9}{2}$

44 Gas leaks from a container of fixed volume. The pressure in the container is reduced from P_1 to P_2 at constant temperature. What is the ratio $\frac{\Delta N}{N}$, where ΔN is the number of molecules that escaped and N is the initial number of molecules?

A $\frac{P_1 - P_2}{P_1}$

B $\frac{P_1 - P_2}{P_2}$

C $\frac{P_1}{P_2}$

D $\frac{P_2}{P_1}$

45 The kelvin temperature of a fixed quantity of an ideal gas is T. The pressure is quadrupled and the volume is halved. What is the new temperature of the gas?

A $\frac{T}{4}$

B $\frac{T}{2}$

C $2T$

D $4T$

46 The density and kelvin temperature of an ideal gas are both doubled. By what factor does the pressure of the gas increase?

A 2

B 4

C 8

D 16

47 Gas X has pressure P, volume V and temperature T. Gas Y has pressure $2P$, volume $3V$ and temperature $4T$. What is the ratio $\frac{\text{number of moles in X}}{\text{number of moles in Y}}$?

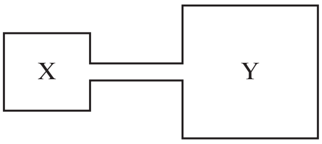
A $\frac{1}{24}$

B $\frac{2}{3}$

C $\frac{3}{2}$

D 24

48 Two containers, X and Y, are filled with an ideal gas. X and Y are connected by a tube of negligible volume. X has volume V and is kept at a constant temperature 300 K. Y has volume $2V$ and is kept at a constant temperature 600 K.



What is the ratio $\frac{\text{number of molecules in X}}{\text{number of molecules in Y}}$?

A $\frac{1}{4}$

B $\frac{1}{2}$

C 1

D 4

49 A container of an ideal gas that is isolated from its surroundings is divided into two parts. One part has double the volume of the other. The pressure in each part is P, and the temperature is the same. The partition is removed; the temperature is unchanged. What is the pressure in the container now?

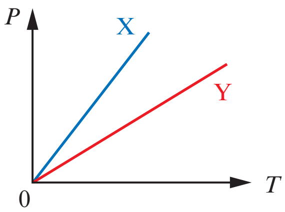
A P

B $2P$

C $\frac{3P}{2}$

D $4P$

50 The graph shows the variation of pressure with kelvin temperature for two ideal gases X and Y when the volume of each gas is kept constant.



What can be said about the volume of gas X and that of gas Y?

A $V_X > V_Y$

B $V_X = V_Y$

C $V_X < V_Y$

D Any of the above can be correct depending on the quantity of each gas.

51 Different quantities of two ideal gases are kept at the same temperature. Which of the following is a correct comparison of the average kinetic energy and internal energy of the two gases?

	Average kinetic energy	Internal energy
A	Same	Same
B	Same	Different
C	Different	Same
D	Different	Different

52 What is a correct comparison of the composition of the internal energy of a real gas and an ideal gas?

	Real gas	Ideal gas
A	Random kinetic energy only	Random kinetic energy only
B	Random kinetic energy only	Random kinetic energy plus intermolecular potential energy
C	Random kinetic energy plus intermolecular potential energy	Random kinetic energy only
D	Random kinetic energy plus intermolecular potential energy	Random kinetic energy plus intermolecular potential energy

53 An ideal gas undergoes a change in which the average speed of the molecules stays the same. What else must stay the same in this process?

A temperature
B pressure
C volume
D density.

54 The temperature of an ideal gas is doubled. By what factor does the average speed of the molecules increase?

A $\sqrt{2}$
B 2
C $2\sqrt{2}$
D 4

55 Two ideal gases X and Y are kept at the same temperature. Gas X has molar mass μ_X, and gas Y has molar mass μ_Y. What is the ratio of average speeds of the molecules of gas X to that of gas Y?

A $\frac{\mu_X}{\mu_Y}$
B $\frac{\mu_Y}{\mu_X}$
C $\sqrt{\frac{\mu_X}{\mu_Y}}$
D $\sqrt{\frac{\mu_Y}{\mu_X}}$

56 What is the average kinetic energy of the molecules of an ideal gas proportional to?

A the density of the gas
B the mass of the gas
C the Celsius temperature
D the kelvin temperature.

57 Two ideal gases X and Y are kept at the same temperature. Gas X has molar mass μ_X and contains n_X moles. Gas Y has molar mass μ_Y and contains n_Y moles. The ratio of the average kinetic energy of the molecules of gas X to that of gas Y is:

A $\frac{n_X \mu_X}{n_Y \mu_Y}$
B $\frac{n_Y \mu_Y}{n_X \mu_X}$
C $\frac{n_Y \mu_X}{n_X \mu_Y}$
D 1

58 The pressure of a fixed quantity of ideal gas is doubled. The average speed of the molecules is also doubled. The original density of the gas is ρ. Which is the new density of the gas?

A $\frac{\rho}{2}$

B ρ

C 2ρ

D 4ρ

59 The rms speed of the molecules of a fixed quantity of an ideal gas is c. The pressure is doubled, and the density is halved. What is the new rms speed of the gas molecules?

A $\frac{c}{4}$

B $\frac{c}{2}$

C $2c$

D $4c$

60 The pressure of a fixed quantity of an ideal gas is P. The density and kelvin temperature of the gas are both doubled. What is the new pressure of the gas?

A $\frac{P}{4}$

B $\frac{P}{2}$

C $2P$

D $4P$

61 A gas is compressed adiabatically from a state X to a new state Y. An equal quantity of another ideal is compressed isothermally from the same state X to a new state Z. States Y and Z have the same volume. What is a correct comparison of the pressure and temperature of states Y and Z?

	Pressure	Temperature
A	$P_Y > P_Z$	$T_Y > T_Z$
B	$P_Y > P_Z$	$T_Y < T_Z$
C	$P_Y < P_Z$	$T_Y > T_Z$
D	$P_Y < P_Z$	$T_Y < T_Z$

62 A gas expands adiabatically. Three statements are made for this expansion:

I The gas does work in expanding.

II The pressure of the gas decreases.

III The internal energy of the gas decreases.

Which are correct?

A I and II

B I and III

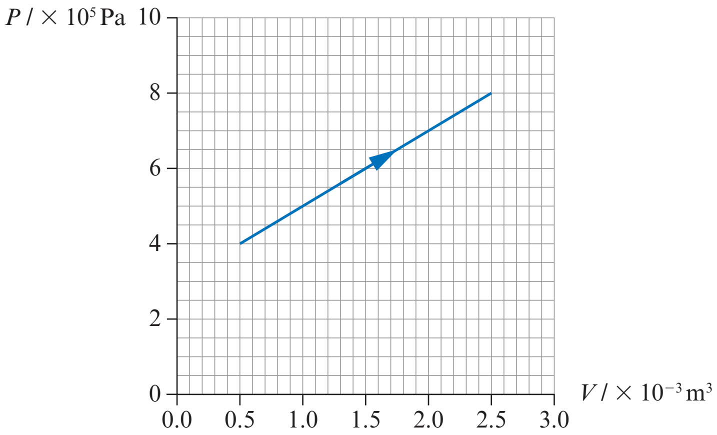
C II and III

D I, II and III.

63 Two equal quantities of an ideal gas have the same state X. One gas expands isothermally to state Y. The other gas expands adiabatically to state Z. Y and Z have the same volume. What is correct about the work done, W, and the change in internal energy, ΔU?

	W	ΔU
A	$W_{\text{adiabatic}} < W_{\text{isothermal}}$	$\Delta U_{\text{adiabatic}} > \Delta U_{\text{isothermal}}$
B	$W_{\text{adiabatic}} < W_{\text{isothermal}}$	$\Delta U_{\text{adiabatic}} < \Delta U_{\text{isothermal}}$
C	$W_{\text{adiabatic}} > W_{\text{isothermal}}$	$\Delta U_{\text{adiabatic}} > \Delta U_{\text{isothermal}}$
D	$W_{\text{adiabatic}} > W_{\text{isothermal}}$	$\Delta U_{\text{adiabatic}} < \Delta U_{\text{isothermal}}$

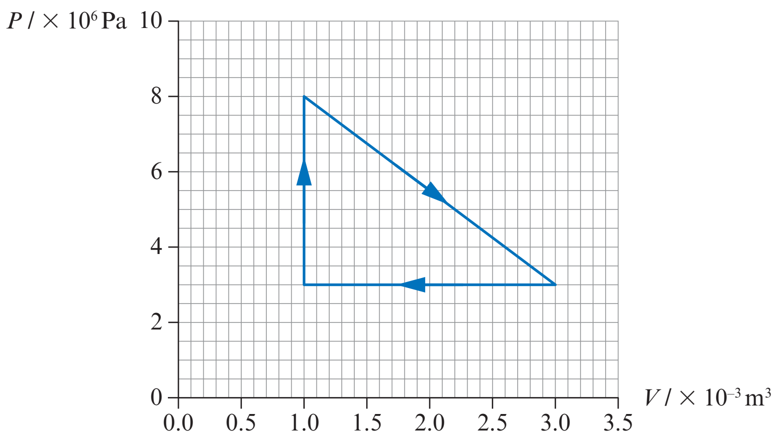
64 The graph shows how the pressure P varies with the volume V of an ideal gas.



What is the work done by the gas as it expands?

A 12 J
B 24 J
C 1200 J
D 2400 J

65 The graph shows a cycle of an ideal gas.



What is the net work done in one cycle?

A 0
B 5 kJ
C 6 kJ
D 11 kJ

66 An amount 500 J of work is done on an ideal gas, and 500 J of heat is taken out of the gas. What is the change in the internal energy of the gas?

A 0
B 250 J
C −1000 J
D 1000 J

67 A gas expands adiabatically performing 80 J of work. The gas is then heated at constant volume by the addition of 60 J of thermal energy. What is the total change in the internal energy of the gas?

A −20 J
B +20 J
C −140 J
D +140 J

68 An ideal gas is heated at constant pressure P so that the volume changes by ΔV. What is the heat provided to the gas?

A $\frac{1}{2}P\Delta V$
B $P\Delta V$
C $\frac{3}{2}P\Delta V$
D $\frac{5}{2}P\Delta V$

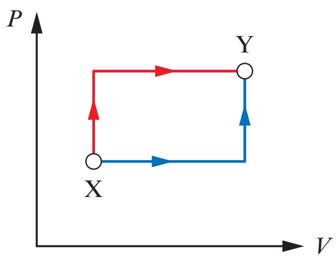
69 A fixed quantity of an ideal gas is compressed isothermally. What is correct for this compression?

	Work done	Thermal energy transferred
A	By the gas	Into the gas
B	By the gas	Out of the gas
C	On the gas	Into the gas
D	On the gas	Out of the gas

70 A fixed quantity of an ideal undergoes four separate changes. In which one is the change in entropy of the gas the least?

A an isothermal expansion
B an adiabatic expansion
C an isobaric expansion
D heating at constant volume.

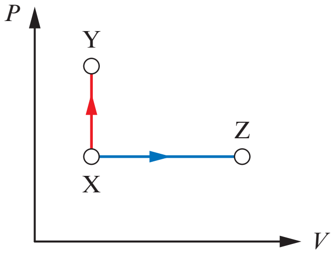
71 The state of an ideal gas is changed from state X to state Y along two different paths as shown on the P-V diagram.



What is a correct comparison of the heat supplied Q, work done W and change in internal energy ΔU for each path?

	Q	W	ΔU
A	Different	Different	Same
B	Same	Same	Same
C	Same	Same	Different
D	Different	Different	Different

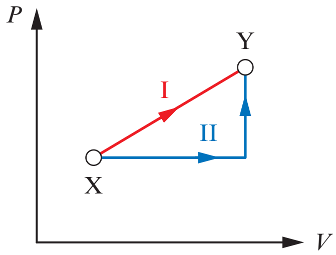
72 The state of an ideal gas is changed from state X to state Y and on another occasion from state X to state Z. States Y and Z have the same temperature.



What is a correct comparison of the heat supplied Q and change in internal energy ΔU for each change?

	Q	ΔU
A	$Q_{XY} = Q_{XZ}$	$\Delta U_{XY} = \Delta U_{XZ}$
B	$Q_{XY} = Q_{XZ}$	$\Delta U_{XY} > \Delta U_{XZ}$
C	$Q_{XY} < Q_{XZ}$	$\Delta U_{XY} = \Delta U_{XZ}$
D	$Q_{XY} < Q_{XZ}$	$\Delta U_{XY} > \Delta U_{XZ}$

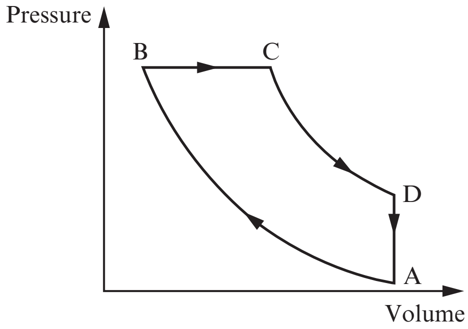
73 The state of an ideal gas is changed from state X to state Y along two different paths, I and II, as shown on the P-V diagram.



What is correct about the heat supplied, Q, and the work done, W, along the two paths?

	Q	W
A	$Q_{I} > Q_{II}$	$W_{I} > W_{II}$
B	$Q_{I} > Q_{II}$	$W_{I} < W_{II}$
C	$Q_{I} < Q_{II}$	$W_{I} > W_{II}$
D	$Q_{I} < Q_{II}$	$W_{I} < W_{II}$

74 In the following P-V diagram, AB and CD are adiabatics. In which leg(s) is heat given to or taken out of the gas?



	Heat in	Heat out
A	BC and CD	DA and AB
B	DA	BC
C	DA and AB	BC and CD
D	BC	DA

75 An ice cube at 0 °C floats in water at 0 °C in a perfectly insulated container. What is a correct observation a long time later?

	Amount of ice that melted	Total entropy
A	All	Increases
B	All	Stays the same
C	None	Increases
D	None	Stays the same

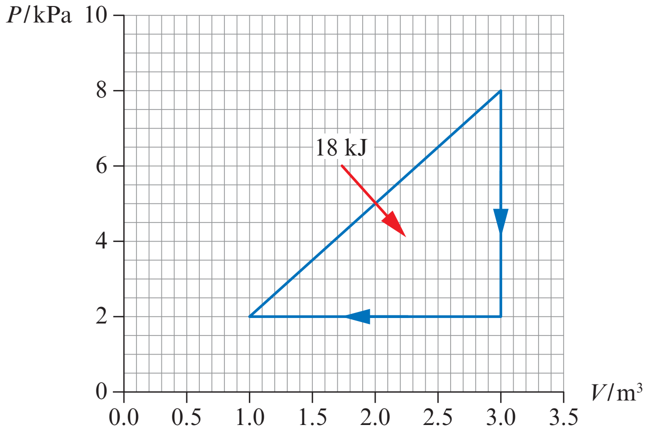
76 An ice cube at 0 °C is dropped into a swimming pool whose temperature is 25 °C. Which is correct for the isolated system of the ice cube and the swimming pool?

	Total internal energy	Total entropy
A	Stays the same	Stays the same
B	Stays the same	Increases
C	Increases	Stays the same
D	Increases	Increases

77 Two large bodies, X at temperature 400 K and Y at temperature 300 K, are brought into contact. An amount of heat equal to 10 J is exchanged between X and Y without an appreciable change in the temperature of either body. What is the change in entropy ΔS of X and of Y?

	ΔS of X / J K^{-1}	ΔS of Y / J K^{-1}
A	$+\frac{1}{40}$	$+\frac{1}{30}$
B	$+\frac{1}{40}$	$-\frac{1}{30}$
C	$-\frac{1}{40}$	$+\frac{1}{30}$
D	$-\frac{1}{40}$	$-\frac{1}{30}$

78 An ideal gas undergoes the cycle shown. The heat provided to the gas is 18 kJ.



What is the efficiency of the cycle?

A $\frac{2}{9}$

B $\frac{1}{3}$

C $\frac{5}{9}$

D 1

79 A Carnot engine operates between the temperatures of 600 K and 400 K. The work done by the engine is 900 J. How much heat is rejected by the engine?

A 300 J

B 450 J

C 1800 J

D 2700 J

80 A Carnot engine operates between a hot reservoir of temperature T_H and a cold reservoir of temperature T_C. The efficiency of the engine is e. The cold reservoir temperature is reduced to $\frac{T_C}{2}$.

What is the **change** in the efficiency of the engine?

A $\frac{1-e}{2}$

B $\frac{1+e}{2}$

C $-\frac{1-e}{2}$

D $-\frac{1+e}{2}$

81 The efficiency of a Carnot engine with cold and hot reservoir temperatures T_C and T_H will **definitely** increase if

A T_C and T_H both increase

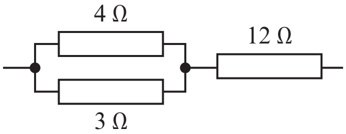
B T_C and T_H both decrease

C T_C increases and T_H decreases

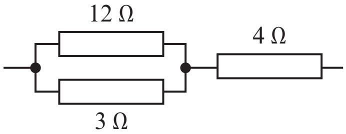
D T_C decreases and T_H increases.

82 In which of the following arrangements is the total resistance 6 Ω?

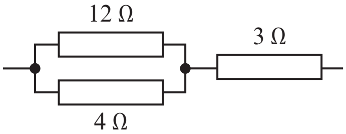
A



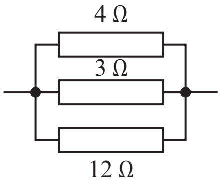
B



C



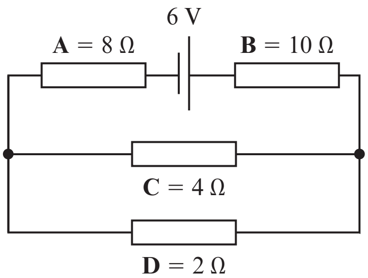
D



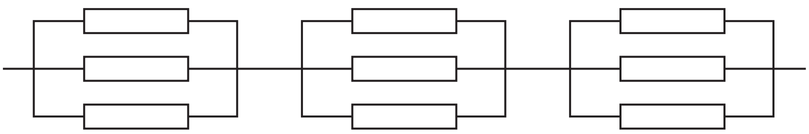
83 The potential difference across a resistor is 24 V, and the current through it is 4.0 A. A charge of 2.0 C passes through the resistor. What is the energy dissipated in the resistor, and how long does the charge take to move through the resistor?

	Energy	Time
A	12 J	0.5 s
B	12 J	8.0 s
C	48 J	0.5 s
D	48 J	8.0 s

84 In which of the resistors in the following circuit is the power dissipated the least?



85 Each of the nine resistors has resistance R.



The total resistance of the arrangement shown is 24 Ω. What is R?

A 8 Ω
B 24 Ω
C 36 Ω
D 72 Ω

86 A wire has resistance R. The wire is cut into two pieces of equal length. The two pieces are connected in parallel. What is the resistance of the parallel combination?

A $\frac{R}{4}$

B $\frac{R}{2}$

C $2R$

D $4R$

87 A cylindrical conductor X has resistance R. X is melted, and all the material is used to make another cylindrical conductor Y of double the length of X. What is the resistance of Y?

A R

B $2R$

C $4R$

D $8R$

88 Three identical resistors each of resistance 6.0 Ω are connected together. Which of the following is **not** a possible value of the total resistance of the connected resistors?

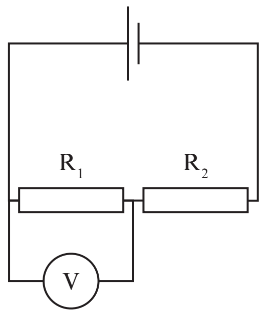
A 2.0 Ω

B 4.0 Ω

C 9.0 Ω

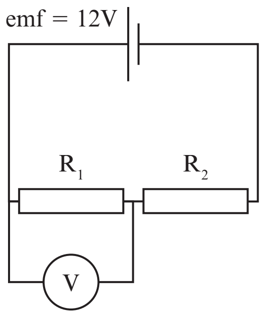
D 12 Ω

89 In the circuit shown, what changes to the resistances will definitely result in an increase in the reading of the voltmeter V?



	R_1	R_2
A	Increase	Increase
B	Increase	Decrease
C	Decrease	Increase
D	Decrease	Decrease

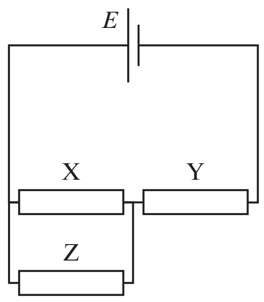
90 The resistors have resistances R_1 = 50 kΩ and R_2 = 10 kΩ. The voltmeter is ideal, and the internal resistance of the cell is negligible.



What is the reading of the voltmeter?

A 2 V
B 6 V
C 8 V
D 10 V

91 Three identical resistors are connected as shown. The cell has no internal resistance.



Resistor Z burns out. What happens to the current in X and the current in Y?

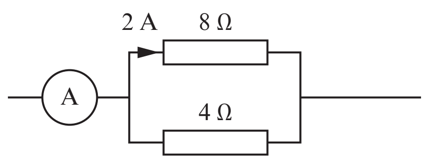
	Current in X	Current in Y
A	Increases	Stays the Same
B	Increases	Decreases
C	Decreases	Stays the Same
D	Decreases	Decreases

92 A device D operates normally at a voltage of 24 V and a current of 2.0 A. The device is at a large distance from the cell. The total resistance of the cables joining the cell to the device is 4.0 Ω.

What is the least value of the emf E of the cell?

A 16 V
B 24 V
C 28 V
D 32 V

93 The diagram shows part of an electric circuit.



What is the reading of the ammeter?

A 3 A
B 4 A
C 5 A
D 6 A

94 A resistor is connected to a cell of negligible internal resistance. The total power dissipated in the circuit is P. A second identical resistor is connected in series with the first resistor. What is the total power dissipated in the new circuit?

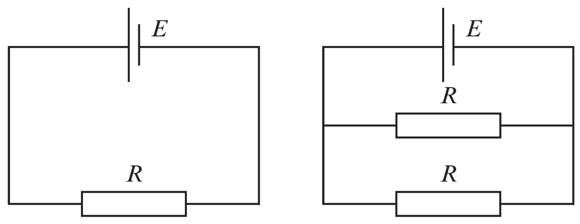
A $\frac{P}{4}$

B $\frac{P}{2}$

C $2P$

D $4P$

95 The power dissipated in the circuit on the left is 20 W. What is the total power dissipated in the circuit on the right? Both cells have emf E and no internal resistance.



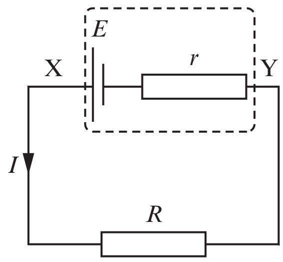
A 5 W

B 10 W

C 40 W

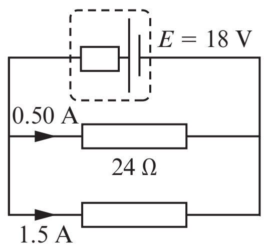
D 80 W

96 What is the potential difference across the resistor R and across the terminals X and Y of the cell?



	Across R	Across X and Y
A	E	E
B	$E - Ir$	$E - Ir$
C	E	$E - Ir$
D	$E - Ir$	E

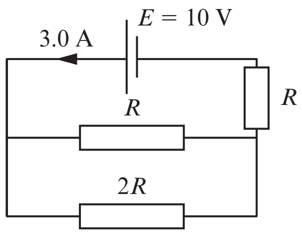
97 A source of emf 18 V provides currents of 0.50 A and 1.5 A to two external resistors. The resistance of one resistor is 24 Ω.



What is the internal resistance of the source?

A 3.0 Ω
B 4.0 Ω
C 6.0 Ω
D 9.0 Ω

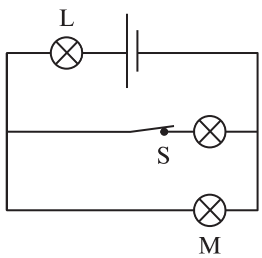
98 The cell has emf 10 V and no internal resistance. It is connected to three resistors as shown. The current leaving the cell is 3.0 A.



What is the power dissipated in the resistor of resistance $2R$?

A 3.0 W
B 4.0 W
C 8.0 W
D 18 W

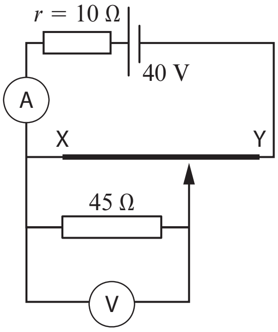
99 The three lamps are identical and have constant resistance. The cell has no internal resistance. The switch S is closed.



What happens to the brightness of L and M when the switch is opened?

	L	M
A	Increases	Increases
B	Increases	Decreases
C	Decreases	Increases
D	Decreases	Decreases

100 The source in the circuit has emf 40 V and internal resistance 10 Ω. XY is a uniform wire of resistance 90 Ω. An external resistor of 45 Ω is connected as shown.



What is the **minimum** reading of the ammeter and the **maximum** reading of the voltmeter as the slider moves from X to Y?

	Ammeter /A	Voltmeter /V
A	0.4	30
B	0.4	40
C	1.0	30
D	1.0	40