1 For a given liquid at atmospheric pressure, which process can occur at any temperature?

A boiling

B evaporation

C melting

D solidification

2 A mass of a liquid of density ρ is thoroughly mixed with an equal mass of another liquid of density 2ρ. No change of the total volume occurs.

What is the density of the liquid mixture?

A $\frac{4}{3}\rho$ **B** $\frac{3}{2}\rho$ **C** $\frac{5}{3}\rho$ **D** 3ρ

3 The hydrostatic pressure p at a depth h in a liquid of density ρ is given by the formula $p = h\rho g$.

Which equation, or principle of physics, is used in the derivation of this formula?

A density = mass ÷ volume

B potential energy = mgh

C atmospheric pressure decreases with height

D density increases with depth

4 Pollen grains are suspended in a liquid and are illuminated strongly. When observed under a microscope they are seen to be in continuous random motion.

What is the reason for this?

A convection currents in the liquid

B evaporation of the liquid

C molecules of the liquid colliding with the pollen grains

D pollen grains colliding with each other

5 The density of mercury is $13.6 \times 10^3\,\text{kg m}^{-3}$.

The pressure difference between the bottom and the top of a column of mercury is 100 kPa.

What is the height of the column?

A 0.75 m **B** 1.3 m **C** 7.4 m **D** 72 m

6 Comparing the properties of solids, liquids and gases, which option is correct?

	property	solids	liquids	gases
A	ordering of molecules	high	not so high	random
B	spacing of molecules	close	far	far
C	translation of molecules	no	no	yes
D	vibration of molecules	no	yes	yes

7 Particles of dust, suspended in water, are viewed through a microscope. The particles can be seen to move irregularly.

This movement is due to

A convection currents in the water.

B evaporation of the water near the dust particles.

C gravitational forces acting on the particles of dust.

D water molecules hitting the dust particles in a random way.

8 Two solid substances P and Q have atoms of mass M_P and M_Q respectively. They have N_P and N_Q atoms per unit volume.

It is found by experiment that the density of P is greater than that of Q.

Which of the following deductions from this experiment must be correct?

A $M_P > M_Q$

B $N_P > N_Q$

C $M_P N_P > M_Q N_Q$

D $\frac{M_P}{N_P} > \frac{M_Q}{N_Q}$

9 Which two substances are normally both crystalline?

A copper and diamond

B copper and glass

C diamond and glass

D diamond and rubber

10 In an experiment to demonstrate Brownian motion, smoke particles in a container are illuminated by a strong light source and observed through a microscope.

The particles are seen as small specks of light that are in motion.

What causes the Brownian motion?

A collisions between the smoke particles and air molecules

B collisions between the smoke particles and the walls of the container

C convection currents within the air as it is warmed by the light source

D kinetic energy gained by the smoke particles on absorption of light

11 Which group of statements applies only to the liquid state?

A atoms separated by many atomic diameters positions of atoms can change atoms vibrate	**B** atoms separated by many atomic diameters atoms are in fixed positions atoms are in continuous, random motion
C atoms can touch each other positions of atoms can change some random motion of atoms	**D** atoms can touch each other atoms are in fixed positions some random motion of atoms

12 Below are four short paragraphs describing the molecules in a beaker of water at 50 °C.

Which paragraph correctly describes the molecules?

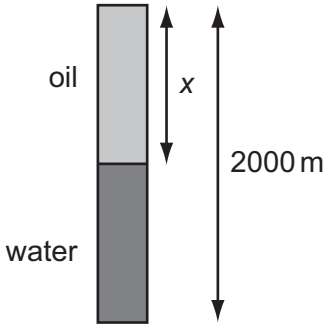
A The molecules all travel at the same speed. This speed is not large enough for any of the molecules to leave the surface of the water. There are attractive forces between the molecules.

B The molecules have a range of speeds. Some molecules travel sufficiently fast to leave the surface of the water. There are no forces between the molecules.

C The molecules have a range of speeds. Some molecules travel sufficiently fast to leave the surface of the water. There are attractive forces between the molecules.

D The molecules have a range of speeds. The fastest molecules are unable to leave the surface of the water. There are attractive forces between the molecules.

13 A bore hole of depth 2000 m contains both oil and water as shown. The pressure at the bottom is 17.5 MPa. The density of the oil is 830 kg m^{-3} and the density of the water is 1000 kg m^{-3}.



What is the depth *x* of the oil?

A 907 m **B** 1000 m **C** 1090 m **D** 1270 m

14 Why does an ideal gas exert pressure on its container?

A The molecules of the gas collide continually with each other.

B The molecules of the gas collide continually with the walls of the container.

C The molecules of the gas collide inelastically with the walls of the container.

D The weight of the molecules exerts a force on the walls of the container.

15 The formula for hydrostatic pressure is $p = \rho gh$.

Which equation, or principle of physics, is used in the derivation of this formula?

A density = mass ÷ volume

B potential energy = *mgh*

C atmospheric pressure decreases with height

D density increases with depth

16 Pollen grains are suspended in a liquid and are illuminated strongly. When observed under a microscope they are seen to be in continuous random motion.

What is the reason for this?

A convection currents in the liquid

B evaporation of the liquid

C molecules of the liquid colliding with the pollen grains

D pollen grains colliding with each other

17 At a depth of 20 cm in a liquid of density 1800 kg m^{-3}, the pressure due to the liquid is p.

Another liquid has a density of 1200 kg m^{-3}.

What is the pressure due to this liquid at a depth of 60 cm?

A $\frac{p}{2}$ **B** $\frac{3p}{2}$ **C** $2p$ **D** $3p$

18 Which line in the table gives approximate ratios of density and molecular spacing for a substance in its solid, liquid and gas phases?

	density	molecular spacing
	solid : liquid : gas	solid : liquid : gas
A	1000 : 1000 : 1	1 : 1 : 10
B	1000 : 100 : 1	1 : 10 : 1000
C	1000 : 1000 : 1	1 : 1 : 1000
D	1000 : 100 : 1	1 : 10 : 100

19 Liquids X and Y are stored in large open tanks. Liquids X and Y have densities of 800 kg m^{-3} and 1200 kg m^{-3} respectively.

At what depths are the pressures equal?

	depth in liquid X	depth in liquid Y
A	8 m	12 m
B	10 m	10 m
C	15 m	10 m
D	18 m	8 m

20 When white sugar granules are heated, they melt. When the melt is cooled quickly, a brittle solid form of toffee is produced.

How does the structure of the sugar change?

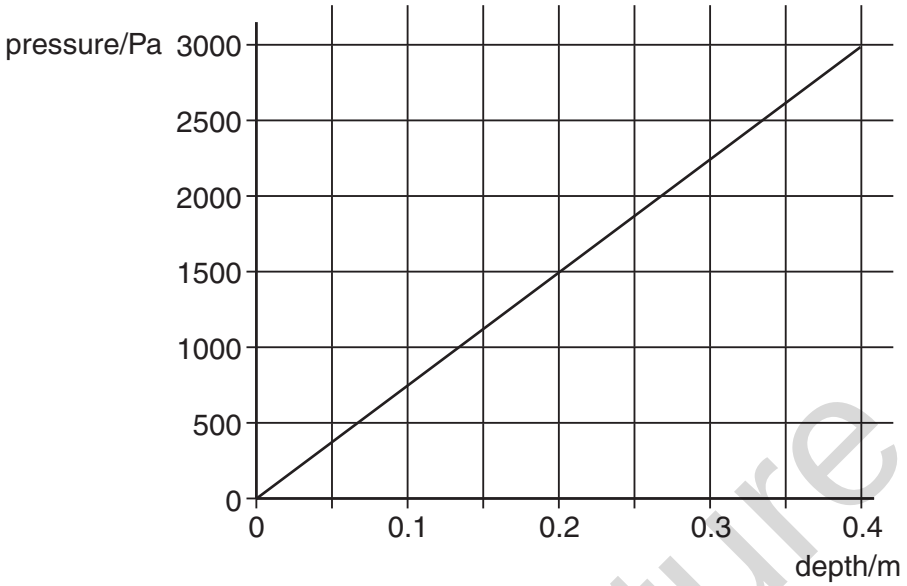
A amorphous to polymeric

B crystalline to amorphous

C crystalline to polymeric

D polymeric to amorphous

21 The graph shows how the pressure exerted by a liquid varies with depth below the surface.



What is the density of the liquid?

A 600 kg m^{-3} **B** 760 kg m^{-3} **C** 5900 kg m^{-3} **D** 7500 kg m^{-3}

22 In an experiment to demonstrate Brownian motion, smoke particles in a container are illuminated by a strong light source and observed through a microscope.

The particles are seen as small specks of light that are in motion.

What causes this motion?

A collisions between the smoke particles and air molecules

B collisions between the smoke particles and the walls of the container

C convection currents within the air as it is warmed by the light source

D kinetic energy gained by the smoke particles on absorption of light

23 Why does the pressure increase when a sealed container of gas is heated?

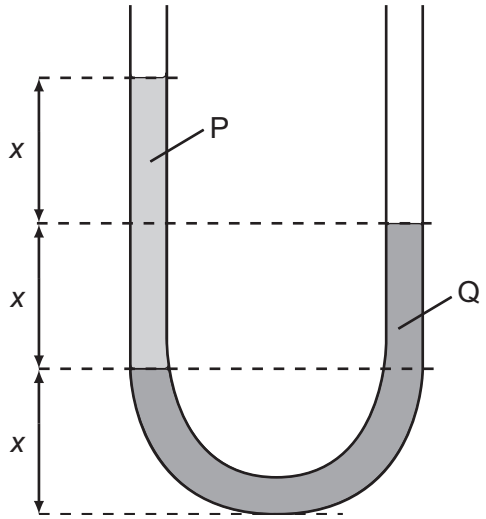
A The gas molecules collide more often with each other.

B The gas molecules expand when they are heated.

C The gas molecules travel faster and hit the walls of the container more often.

D There are more gas molecules present to collide with the walls of the container.

24 The diagram shows two liquids, labelled P and Q, which do **not** mix. The liquids are in equilibrium in an open U-tube.



What is the ratio $\frac{\text{density of P}}{\text{density of Q}}$?

A $\frac{1}{2}$ **B** $\frac{2}{3}$ **C** $\frac{3}{2}$ **D** 2

25 Which statement defines the density of a substance?

A the force per unit area acting on the substance

B the increase in length per unit length of the substance

C the mass per unit volume of the substance

D the work done per unit time by the substance

26 The table summarises some properties of evaporation.

Which row of the table is correct?

	involves a change in state from liquid to vapour	occurs at a fixed temperature	involves a reduction in the average kinetic energy of the remaining atoms
A	true	true	true
B	true	false	true
C	true	false	false
D	false	true	false

27 A submarine carries a pressure meter so that the crew can work out how far they are below the surface of the sea. At the surface, the meter indicates a pressure of 100 kPa. The density of seawater is 1030 kg m^{-3}.

What is the depth below the surface when the meter reads 450 kPa?

A 34.6 m **B** 44.5 m **C** 340 m **D** 437 m

28 Two solid substances P and Q have atoms of mass M_P and M_Q respectively. There are n_P and n_Q atoms per unit volume respectively.

It is found by experiment that the density of P is greater than that of Q.

Which deduction from this experiment must be correct?

A $M_P > M_Q$

B $n_P > n_Q$

C $M_P n_P > M_Q n_Q$

D $\frac{M_P}{n_P} > \frac{M_Q}{n_Q}$

29 Which properties best describe modelling clay?

A brittle and ductile

B ductile and elastic

C elastic and plastic

D plastic and ductile

30 Why does the pressure of a gas increase when the gas is compressed at constant temperature?

A The gas molecules collide more often with each other.

B The gas molecules expand under pressure.

C The gas molecules hit the walls of the container more frequently.

D The gas molecules travel faster.