

**Revision for the 1<sup>st</sup> small test on:.....**

1. Give three Essentials according to the kinetic theory:
2. Molecules have kinetic energy (because of their .....).
3. Molecules have potential energy (their ..... keeps them separated despite the attractions which are trying to ..... them together).
4. Solids:  
strong forces of ..... hold the molecules close together in a ..... structure  
the molecules vibrate to and fro, but they are ..... to change positions  
a solid has a definite ..... and .....  
crystalline substance (.....)  
amorphous substances (.....)
5. Liquids:  
the molecules are ..... together  
the molecules vibrate .....  
the molecules have enough ..... to prevent the attractions from holding them in fixed positions  
a liquid has a definite ..... but no fixed .....  
a liquid can .....
6. Gas:  
the molecules are well .....  
the molecules have enough energy to be virtually ..... of any attraction between one another  
the molecules travel at high ..... and may also spin  
unlike the molecules of a solid or liquid, they do not occupy a fixed .....  
the molecules quickly ..... any space available
7. Plasma:  
electric ..... particles (..... ) and neutral particles (flash, .....)
8. Brownian motion – caused by ..... molecules bumping into the ..... grains
9. Diffusion: the ink molecules wander at ..... through the water as they are bumped and jostled by the water molecules around them
10. The higher ..... of matter, the higher speed the molecules are moving at.
11. Celsius scale:  
The lower fixed point – ..... of pure ice (zero degrees Celsius – 0°C)  
The upper fixed point – ..... of pure water (water is boiling under standard pressure – hundred degrees Celsius – 100°C)
12. The hotter the object, the more ..... energy its molecules have and the faster they .....
13. If a hot object is placed next to a cold object, there is a transfer of thermal energy. One group of molecules ..... KE by slowing down, the other group ..... KE by speeding up.
14. The transfer of energy stops only when molecules of both objects have the ..... KE on average. The objects are then at the same .....
15. Temperature – a measure of average .....

16.  $-273^{\circ}\text{C}$  – they do have the ..... possible amount of energy – this temperature is called **absolute** ..... – **no object can reach a temperature** ..... **than this**.
17. .... point of water: pure ice, water and saturated steam (273,16K).
18.  $t = (T - 273.15)^{\circ}\text{C}$   $T = (t + 273.15)\text{K}$   $\Delta T = \Delta t = (T_2 - T_1) = (t_2 - t_1)$
19. Liquid-in-glass thermometer - Use the fact that most liquids expand slightly when they are heated (alcohol, .....)
20. Give advantage and disadvantage of alcohol and mercury thermometer.
21. The clinical thermometer - ..... (narrowing) – stops mercury thread ..... back into the ....., so the temperature reading can be taken after the thermometer has been removed from the patient's mouth.
22. Resistance thermometer - Based on the principle that resistance of conductors ....., so less current can flow through them.
23. Thermistor thermometers - A thermistor is a small device which offers ..... and ..... resistance to a flow of electricity as its temperature rises.
24. Thermocouple thermometers - Two different types of ..... are joined together at two ..... A temperature difference between the junctions makes the metals produce a small electric ....., which makes the meter needle across the scale.
25. Convert the following temperatures into kelvin:  
 $-253^{\circ}\text{C}$ ,  $0^{\circ}\text{C}$ ,  $77^{\circ}\text{C}$ ,  $100^{\circ}\text{C}$
26. Convert the following temperatures into  $^{\circ}\text{C}$ :  
 $273\text{K}$ ,  $0\text{K}$ ,  $27\text{K}$ ,  $100\text{K}$
27. **Internal energy** – sum of total ..... energy of all particles moving at chaotic motion (molecules, atoms and ions) and of total ..... energy (due to the positions between the particles).
28. Internal energy can be changed by:  
..... ([friction between two objects](#), [compressing of gas](#))  
..... (heating)
29. Change of internal energy by doing work written mathematically:.....
30. A body of a mass of 2kg is falling from height of 15 metres. What is the change of sand it is falling into?
31. A car of a mass 900kg moving at a speed of  $80\text{km}\cdot\text{h}^{-1}$  brakes suddenly. What is the change of internal energy of its brakes after braking?
32. A tennis ball with a mass of 50g is falling from a height of 1 metre and bounces into 0.6m. Calculate change of its internal energy after the bounce.
33. Change of internal energy by transfer of heat written mathematically: .....
34. The first law of thermodynamics:
35. The thermal energy needed to produce a temperature rise depends on three factors:.....
36.  $Q =$  .....
37. Give definition of Specific heat capacity, heat capacity and give the formulas we can calculate them according to.
38. A 10 kg block of aluminium cools from  $100^{\circ}\text{C}$  to  $50^{\circ}\text{C}$ . How much thermal energy does it give out? (specific heat capacity of aluminium is  $900\text{ J}/(\text{kgK})$ )
39. 4kg of copper at  $25^{\circ}\text{C}$  are heated and increase in temperature to  $80^{\circ}\text{C}$ . How much heat energy is required to do this? (specific heat capacity of copper is  $380\text{ J}/(\text{kgK})$ )
- 40.

41. A 210 W heater is placed in 2kg of water. What temperature rise is produced if the heater is switched on for 200s? (specific heat capacity of water is 4200 J/(kgK) )
42. An electric kettle has a power rating of 2kW. The kettle is filled with 1kg of water at temperature of 20°C. How long after the kettle is switched on will the water start to boil? (specific heat capacity of water is 4200 J/(kgK) )
43. Give Calorimetric equation.
44. A lump of metal of mass 0.2 kg and temperature 100°C is placed in water of mass 0.4kg and temperature 16°C. If the final temperature of the metal and water is 20°C, what is the specific heat capacity of the metal?

45. Ideal gas:

46.  $v_k = \sqrt{3kT / m_0}$

47.  $p V = \dots\dots\dots KE$

**48.  $pV = N k T$**

N – number of molecules

k – Boltzman´s constant

$k = 1.38 \times 10^{-23} \text{ J.K}^{-1}$

$n = N / N_A$

n – number of moles

$N_A$  – Avogadro constant ( $6 \times 10^{23} \text{ mol}^{-1}$ )

$n = m / M_m$

m – mass (kg)

$M_m$  – molar mass (kg)

**49.  $p V = n R T$**

R – molar gas constant ( $R = 8.31 \text{ J.K}^{-1}$ )

50. Gas in an isolated tank:

**$p V / T = \text{constant.}$**

51. Isothermal change -  $T = \text{const.}$  -  $p V = \text{constant}$  (Boyle´s law)

52. Izochoric change -  $V = \text{const.}$ , p and T is changed -  $p / T = \text{const}$  (Charle´s law)

53. Izobaric change -  $P = \text{const.}$ , V and T is changed -  $V / T = \text{constant}$  (Gay – Lussac´s law – the pressure law)

54. Adiabatic process - There is no transfer of thermal energy between the system and surrounding. The system is ..... isolated.

$Q = 0 \text{ J}$

$\Delta U = Q + W = 0 + W = W$

There is work done on the system when the gas is compressed ( $\Delta T > 0$ ).

There is work done by the system when it expands ( $\Delta T < 0$ ).

Poisson´s law:

$p V^x = \text{const.}$

Where  $x = c_p / c_v$  – is Poisson´s constant

$c_p > c_v$ ,  $x > 1$  – depends on ..... of gas used

55. What is the work done by the gas at constant pressure 0,15 MPa if its volume increases by 2,0l.

56. What is the work done by the gas if its initial volume 0,2 m<sup>3</sup> at constant pressure 0,5 MPa increases three-times?

57. Mass of hydrogen is 5 kg and its temperature is 0°C. How is its temperature at isobaric process changed if the gas does a work of 37,4 kJ?

58. The first law of thermodynamics implies that the amount of work done by the engine cannot be greater than the heat drawn in from the hot reservoir.

59. The second law of thermodynamics requires that the engine can not be 100% efficient – which is the same as saying that some energy must be dumped into the low-temperature reservoir.
60. efficiency of heat engine  $< \frac{\text{useful work out of engine}}{\text{heat absorbed from hot reservoir}}$   
 efficiency of heat engine  $< 1 - \frac{T_{\text{cold reservoir}}}{T_{\text{hot reservoir}}}$
61. Work done by a gas at isobaric process:  
 What is the maximum efficiency of a heat engine with a hot reservoir of  $100^{\circ}\text{C}$  and a cold reservoir of  $20^{\circ}\text{C}$ ? The heat engine works at a rate of 1 kW. What is the rate at which energy is absorbed from the hot reservoir?
62. A piston of volume  $1000\text{ cm}^3$  contains a gas at a pressure of  $1.1 \times 10^5\text{ Pa}$ . The gas expands at constant temperature increasing the volume of the piston by 10%.
- Calculate the work done by the gas.
  - How much energy must be absorbed by the gas from the surroundings in order to maintain the constant temperature?
63. A piston contains 0.05 mol of an ideal gas at  $27^{\circ}\text{C}$ . The pressure of the gas is  $10^5\text{ Pa}$ .
- What is the volume of the cylinder?
  - What is the internal energy of the gas?
- The gas is now warmed to  $77^{\circ}\text{C}$ , causing the piston's volume to increase. The pressure remains constant.
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