DENSITY-MASS-VOLUME-QP-MS

1 **(a)** A list of metals is shown below.

aluminium copper iron lead uranium

From the list of metals choose **one** to match each description.

Each metal can be used once, more than once or not at all.

(i) It may be easily magnetised. .....[1]

(ii) It is used as a fuel in nuclear power stations. .....[1]

(iii) It is used in the core of a transformer. .....[1]

(b) Copper has a boiling point of 2562 °C.

(i) State the meaning of the term *boiling point*.

.....

.....[1]

(ii) When a liquid boils, energy is required but the temperature remains the same.

Explain what is happening in terms of molecules.

Use the term *latent heat* in your answer.

.....

.....

.....

.....[2]

(c) An isotope of copper has a nuclide notation $^{64}_{29}Cu$ and decays by the emission of β-particles to produce an isotope of zinc.

Use the correct nuclide notation to write a symbol equation for this decay process.

$^{64}_{29}Cu \rightarrow$ ..... + ...

[3]

(d) A block of copper has a mass of 44.8 g and a volume of 5.0 cm^3.

(i) Calculate the density of the block of copper.

State the formula you use and show your working.

formula

working

density = ... g/cm^3 [2]

(ii) State the weight of the block of copper.

(g = 10 N/kg)

..... N [1]

(iii) The block of copper is resting on a desk. The area of the block in contact with the desk is 0.01 m^2.

Calculate the pressure exerted by the block on the desk.

State the formula you use and show your working.

formula

working

pressure = ... N/m^2 [2]

MARKING SCHEME

(a)(i)	iron ;	**1**
(a)(ii)	uranium ;	**1**
(a)(iii)	iron ;	**1**
(b)(i)	temperature at which all of a liquid turns to a gas ;	**1**
(b)(ii)	latent heat of vapourisation ; to break bonds / to overcome attractive forces ; between the molecules / intermolecular bonds ; to increase potential energy of the molecules ;	**max 2**
(c)	${}^{64}_{30}Zn$;; ${}^{0}_{-1}\beta$;	**3**
(d)(i)	density = mass / volume or 44.8 / 5.0 ; = 8.96 (g / cm^3) ;	**2**
(d)(ii)	0.448 (N) ;	**1**
(d)(iii)	pressure = force / area or 0.448 / 0.01 ; = 44.8 (N / m^2) ;	**2**

2 **(a)** In a cartoon, a mouse is being chased by a cat.

The mouse accelerates constantly from rest for 1 second and reaches a speed of 3 m/s and then moves at a constant speed of 3 m/s for 8 seconds.

(i) On the grid in Fig. 6.1 draw the speed-time graph to show the motion of the mouse.

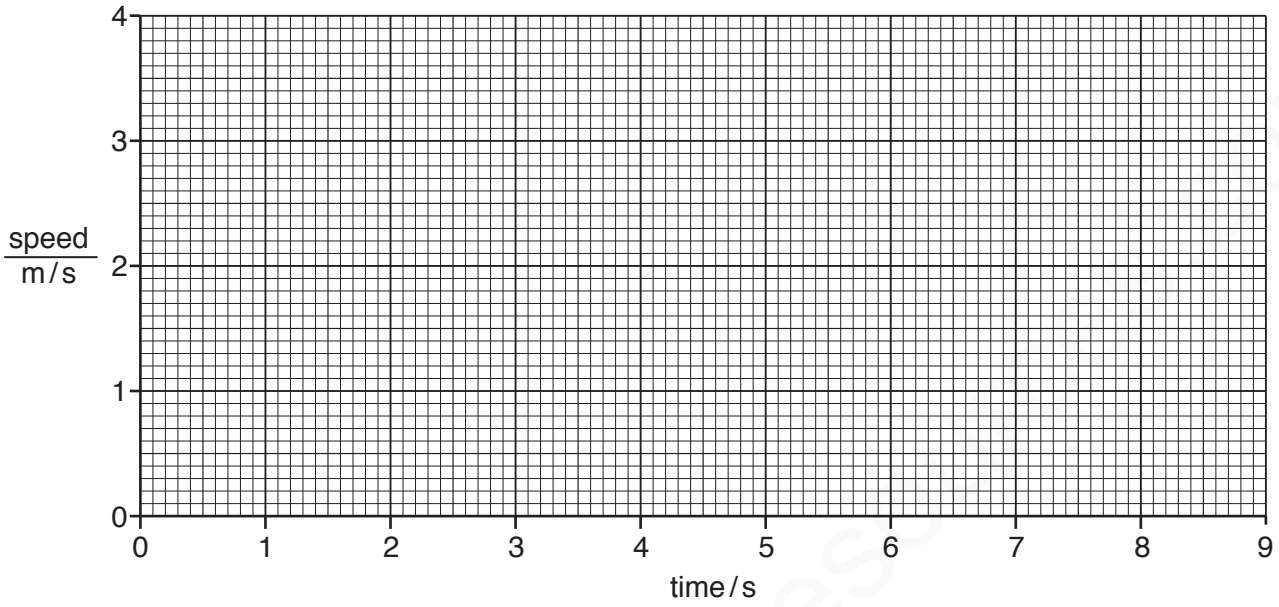


Fig. 6.1

[2]

(ii) The cat accelerates constantly from rest for 9 seconds and reaches a speed of 2 m/s.

Calculate the acceleration of the **cat**.

acceleration = ...m/s^2 [2]

(b) Fig. 6.2 shows the mouse sitting on a cube of cheese, which is on a wooden beam pivoted in the middle.

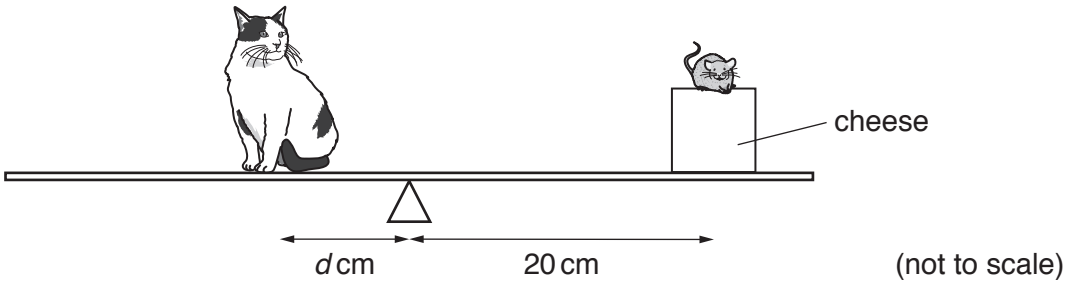


Fig. 6.2

The cat sits on the other end of the beam and balances it.

The weight of the cat is 50 N and the combined weight of the mouse and cheese is 21 N.

Calculate the distance *d* when the beam is balanced.

distance *d* = ... cm [2]

(c) Each side of the cube of cheese is 12 cm.

The weight of the cube of cheese is 20.5 N.

Calculate the density of the cube of cheese in g/cm^3.

gravitational field strength = 10 N/kg

density = ... g/cm^3 [4]

(d) Water evaporates from the cat's bowl.

Liquid water turns into water vapour when it evaporates. Water also turns into water vapour when water boils.

State two differences between the processes of evaporation and boiling.

1 .....

.....

2 .....

.....

[2]

[Total: 12]

MARKING SCHEME:

(a)(i)	acceleration section ; constant speed section ;	**2**
(a)(ii)	acceleration = change in speed / time **OR** 2 / 9 ; = 0.2 (m / s^2) ;	**2**
(b)	$f_1d_1 = f_2d_2$ **OR** 50 □ d = 21 □ 20 ; d = 8.4 (cm) ;	**2**
(c)	volume = 1728 (cm^3) / use of 12^3 ; mass = 20.5 / 10 **OR** 2.05 kg ; 2.05 □ 1000 **OR** 2050 g ; (density =) 1.2 (g / cm^3) ;	**4**
(d)	evaporation can occur at any temperature / boiling only happens at the boiling point ; evaporation happens at the surface / boiling occurs throughout the liquid ; during boiling all / most molecules have enough energy to leave / evaporation lets only the molecules with most kinetic energy out ; evaporation can occur using the internal energy of the system / boiling a(n external) source of heat ; evaporation produces cooling / boiling does not produce cooling ; evaporation is a slow process / boiling is a rapid process ; **max 2**	**2**

3

(a) The volume of the Sun is $1.4 \times 10^{27}\,m^3$.

The average density of the Sun is $1410\,kg/m^3$.

Calculate the mass of the Sun.

mass = ... kg [2]

(b) Explain why the Sun transfers energy to the Earth mainly by radiation and not by conduction or convection.

.....

..... [1]

(c) The Sun emits γ-radiation and visible light. Both of these radiations are part of the electromagnetic spectrum.

(i) Place γ-radiation and visible light in their correct places in the incomplete electromagnetic spectrum shown in Fig. 6.1.

radio waves		infrared		ultraviolet		

[1]

Fig. 6.1

(ii) State why both these radiations take the same time to travel from the Sun to the Earth.

.....

.....

..... [1]

(d) Visible light from the Sun can be reflected, refracted and diffracted.

Describe what happens to a wave when it is:

reflected .....

.....

refracted .....

.....

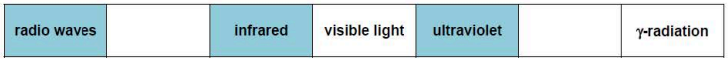
diffracted. .....

.....

[3]

[Total: 8]

MARKING SCHEME

(a)	mass = density × volume or 1410 × 1.4 x 10^{27}; = 2.0 × 10^{30} (kg);	**2**
(b)	only radiation can travel through a vacuum / conduction and convecti on need a medium;	**1**
(c)(i)	 ;	**1**
(c)(ii)	both travel at same speed / 3 × 10^{8} m/s;	**1**
(d)	**reflection** involves a change in direction of waves when they travel back from a barrier; **refraction** of waves involves a change in the direction of waves as they pass from one medium to another; **diffraction** of waves involves a change in direction of waves as they pass through an opening or around a barrier in their path;	**3**