MEGA LECTURE

IGCSE Mocks 2019

Physics Structured questions

Question P1:

A test-tube containing solid wax is heated by placing it in a beaker of very hot water for several minutes. The solid wax becomes a liquid.

(a) State, in terms of molecules, how a solid differs from a liquid.

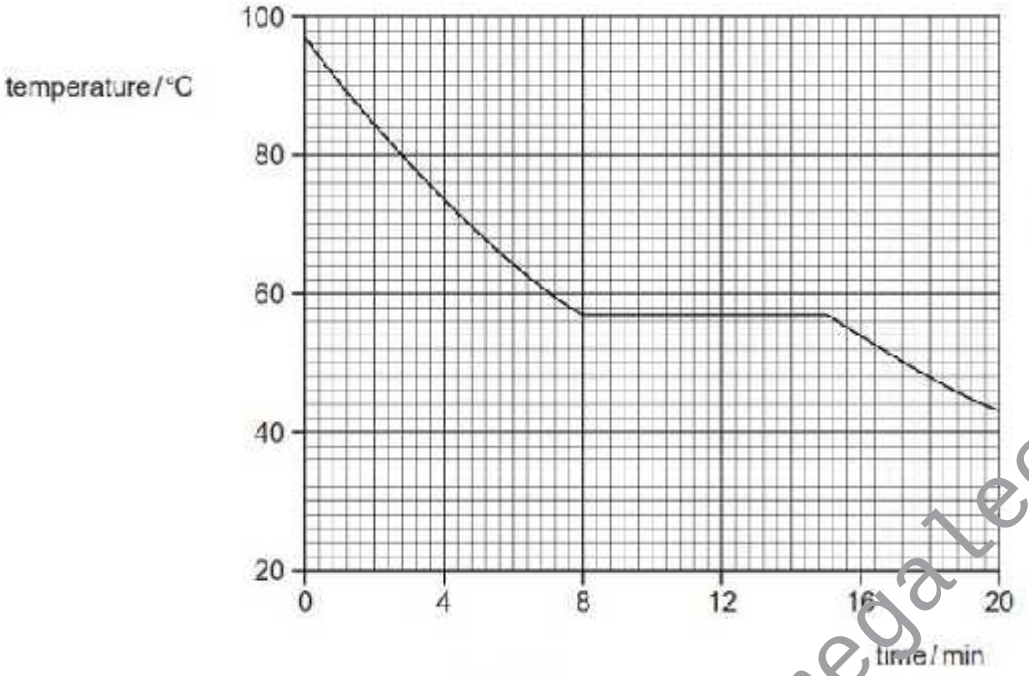
any two from:

- molecules in regular positions / regular structure / fixed shape
- molecules unable to move around / fixed positions / vibrate
- (average) separation of molecules less / closely packed
- more intermolecular bonds / stronger bonds / greater forces

(b) Explain, in terms of molecules, why thermal energy must be supplied for a solid to become a liquid.

work done against forces **or** work done separating molecules **or** energy to break bonds **or** potential energy of molecules increases

Fig. 3.2 is the temperature-time graph for the wax.



(i) Using Fig. 3.2, determine the melting point of the wax.

57 °C

(ii) The specific latent heat of fusion of the wax is 210 J/g. The test-tube contains 50 g of wax.

Using Fig. 3.2, determine the rate at which the wax is losing internal energy as the wax solidifies. Give your answer in J/min.

$Q = P\,t = m\,L$

$P = (mL/t)$

$P = (50g \times 210Jg^{-1}/7min$

$P = 1500$ J/minute

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Question P2 :

(a) Radio waves, ultrasound and visible light are all waves.

(i) State what is meant by *ultrasound* and suggest a value for the minimum possible frequency of ultrasound waves.

(a sound wave with a) frequency above the frequency audible by humans **or** inaudible (to humans)

20000 Hz

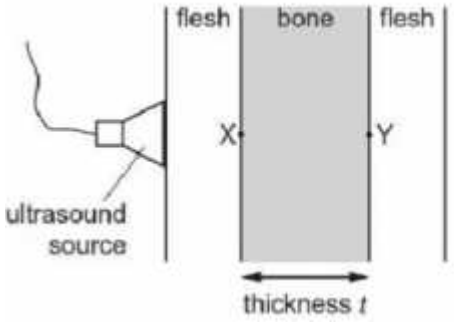
(ii) State which of these waves are

- electromagnetic,

visible light **and** radio

- longitudinal.

ultrasound



The total time taken for ultrasound to travel in the bone from X to Y and back to X is 9.0×10^{-6} s.
The speed of ultrasound in bone is 4100 m/s.

Calculate the thickness t of the bone.

(d =)$vt \div 2$ **or** (d =)vt **or** 0.0369 (m)

(d =)$4100 \times 9.0 \times 10 - 6 \div 2$

0.018(45) m

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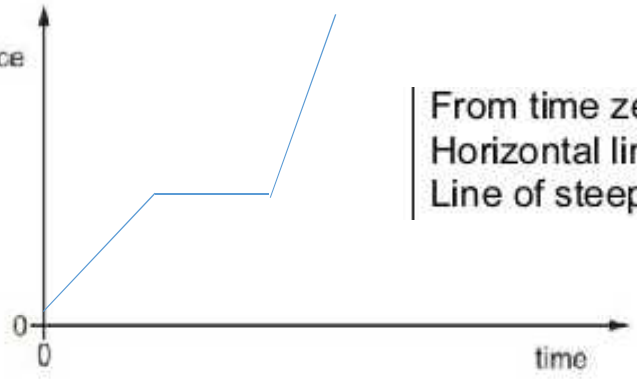
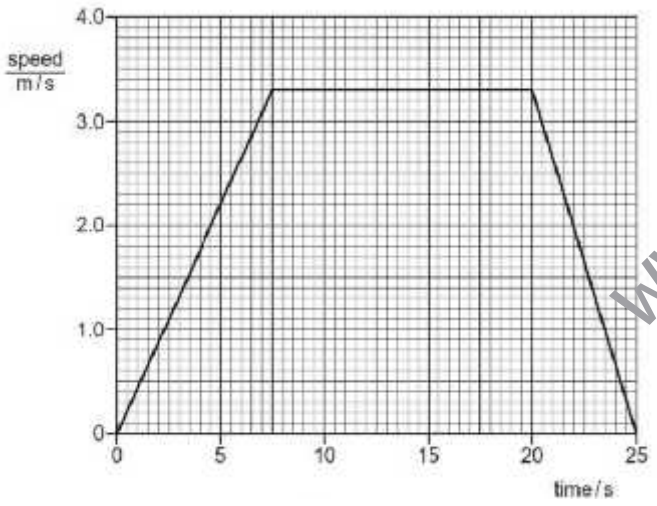
Question P3 :

(a) A bus travels at a constant speed. It stops for a short time and then travels at a higher constant speed.

Using the axes in Fig. 1.1, draw a distance-time graph for this bus journey.



From time zero, line of constant positive gradient, not necessarily from origin
Horizontal line from end of sloping line
Line of steeper positive gradient from end of horizontal line



Use the graph to determine the distance from the ground floor to the top floor of the building.

(distance =) area under graph stated

0.5 × 7.5 × 3.3 (= 12.375)
+ 12.5 × 3.3 (= 41.25)
+ 0.5 × 5 × 3.3 (= 8.25)

OR ½ (a + b)h
= 0.5 × (25 + 12.5) × 3.3

OR (25 × 3.3) – (0.5 × 12.5 × 3.3)

62 m

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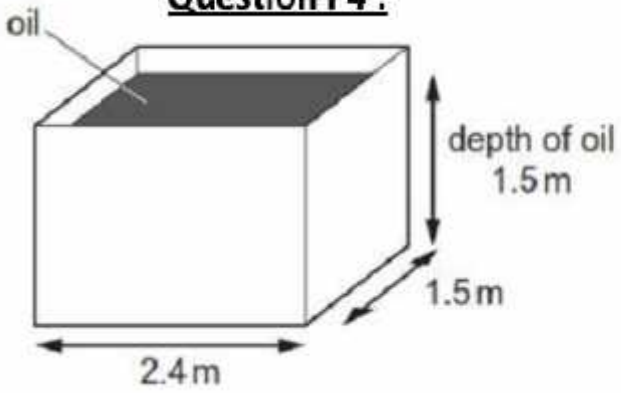
Question P4 :



The tank is filled with oil of density 850 kg/m^3 to a depth of 1.5 m.

(a) Calculate

(i) the pressure exerted by the oil on the base of the tank,

(P =) hdg OR 1.5 × 850 × 10
OR
mg / area of base OR 850 × 2.4 × 1.5 × 1.5 × 10 / (2.4 × 1.5)
13 000 Pa or N/m^2

(ii) the force exerted by the oil on the base of the tank.

P = F/A OR (F =) PA OR 12 750 × 1.5 × 2.4 OR 12 750 × 3.6
46 000 N
OR
(Force =) weight of oil = mg = 2.4 × 1.5 × 1.5 × 850 × 10
46 000 N

(b) The force calculated in **(a)(ii)** is the weight of the oil.

Calculate the mass of oil in the tank.

(46000 / 10 =) 4600 kg
OR m = Vd = (2.4 × 1.5 × 1.5) × 850 = 4600 kg

(c) When he is checking the level of oil in the tank, a man drops a brass key into the oil and it sinks to the bottom of the oil.

(i) State what this shows about the density of brass.

(density of brass) greater than that of oil / 850 kg / m^3
OR brass denser than oil

(ii) Explain how attaching the key to a piece of wood could prevent the key from sinking.

(It won't sink as average) density of wood + key less than density of oil

Question P5 :

(a) The source of solar energy is the Sun.

Tick the box next to those resources for which the Sun is also the source of energy.

X	coal
	geothermal
X	hydroelectric
	nuclear
X	wind

(iii) The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

Efficiency = (power) output / (power) input (× 100)

OR $70 = \frac{(4100/5)\times 100}{\text{power input}}$ OR $\frac{(4100\times 100)}{\text{power input}}$ OR rearranged

Power input = 1200 W

(i) Explain why the tubes are made of copper and are painted black.

Copper is a good conductor of thermal energy / heat

Black surface is a good / the best absorber of radiation / infra red

(ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J / (kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

(Temp rise =) 72 – 20 = 52 (°C)

(Q =) mcΔθ OR 0.019 × 4200 × 52

4100 J

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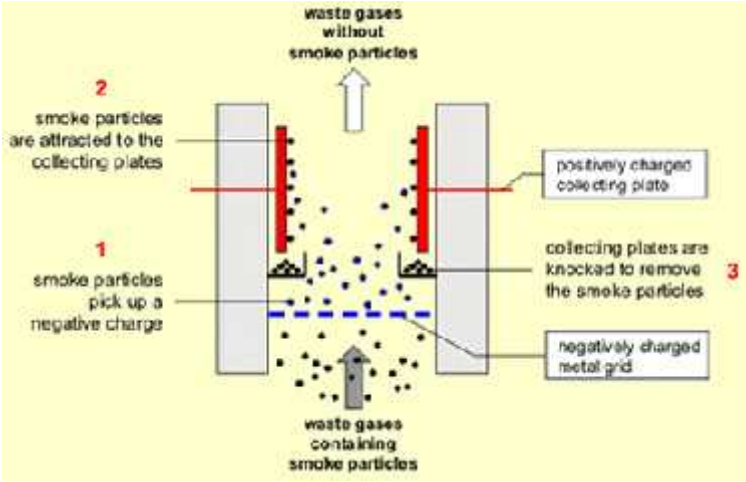
Question P6 :

Describe and explain one use of static electricity.

Pollution control

Static electricity is used in pollution control by applying a static charge to dirt particles in the air and then collecting those charged particles on a plate or collector of the opposite electrical charge. Such devices are often called electrostatic *precipitators*.



Photocopy

Your photocopier or Xerox machine uses static electricity to copy print to a page. This is done through the science of xerography.

One version of this device electrically charges ink so that it will stick to the paper in the designated areas. Another version of a photocopier uses charges to stick the ink to a drum, which then transfers it to the paper.

Defibrillators

A defibrillator is a machine that can be used by paramedics to stabilise an irregular heartbeat. They work by discharging electric charge.Two paddles with insulated handles are charged from a high voltage supply. They are put in good electrical contact with the patient's chest. It is important that only the patient gets a shock.

Painting cars

Some automobile manufacturers use static electricity to help them paint the cars they make. The way this works is that they first prepare the car's surface and then put it in a paint booth. Next, they give the paint an electrical charge and then spray a fine mist of paint into the booth. The charged paint particles are attracted to the car and stick to the body, just like a charged balloon sticks to a wall. Once the paint dries, it sticks much better to the car and is smoother because it is evenly distributed.