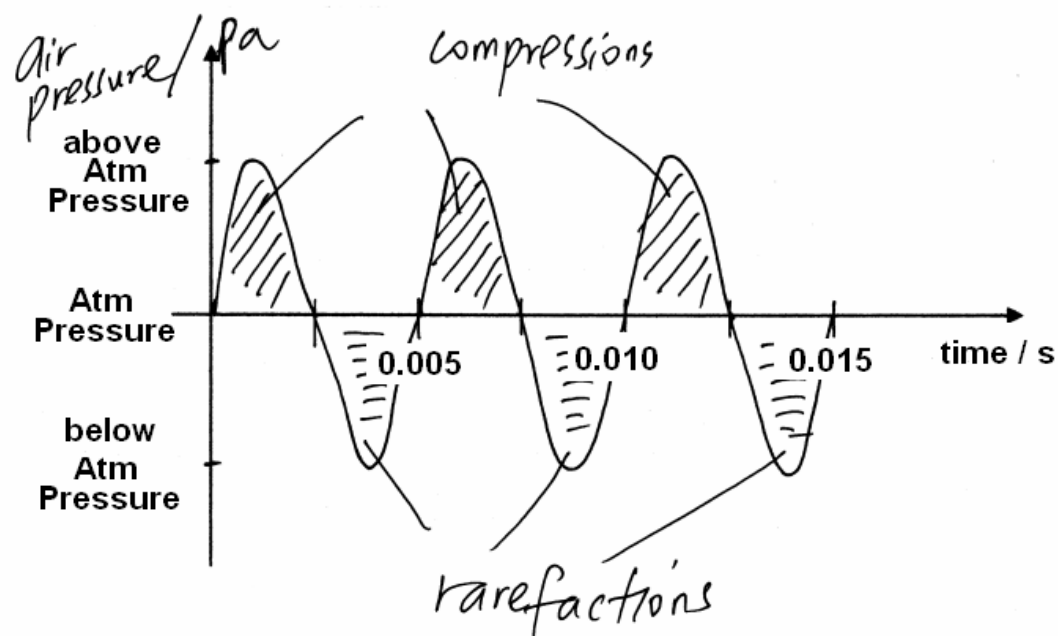
SEONDARY FIVE NORMAL ACADEMIC SCIENCE (PHYSICS) 5116
NOV 2003 GCE 'O' LEVEL PAPER 2
SUGGESTED ANSWERS

Question	Suggested Answer
1a	Velocity is a **vector** quantity that has both direction and magnitude. Speed is a **scalar** quantity that has only magnitude and does not depend on direction.
1b(i)	**CD** *Moving with constant speed means the distance is increasing at a constant rate (or distance is increasing uniformly)*
1b(ii)	**BC** *At rest means not moving, means that it is stationary. Hence, distance remains the same because speed is zero.*
2a(i)	Resultant force = 12.0 N – 5.0 N = 7.0 N **to the left** *Remember to state the direction of the resultant force*
2a(ii)	F = m a 7.0 = (1.4)(a) a = 7.0 / 1.4 = 5.0 ms^{-2} to the left *Remember to use your answer from 2a(i)* *Remember to state the direction of the acceleration*
2b	$a = \frac{v-u}{t} = \frac{8.0-0}{2.0} = 4.0\ ms^{-2}$ *At rest means not moving means stationary means zero speed.*
2b(ii)	The actual acceleration of 4.0 ms^{-2} is smaller than the acceleration of 5.0 ms^{-2} where there was no friction showed evidence that friction was present. Friction present reduced the resultant force, and hence reduced the acceleration.
3a(i)	W = m g m = W / g = 2.6 / 10 = 0.26 kg
3a(ii)	m = 0.26 kg = 0.26 x 1000 g = 260 g
3b	$\rho = \frac{m}{V}$ $m = \rho V = (0.80)(250) = 200\ g$ *250 cm^3 of liquid = 250 cm^3 of paraffin* *Density of paraffin = 0.80 gcm^{-3}*
3c	Total mass = mass of beaker + mass of paraffin 260 = m_B + 200 m_B = 260 – 200 = 60 g *Remember to use your answers to 3a(ii) and 3b.*
4a	$GPE = mgh = \frac{100}{1000} \times 10 \times \frac{8}{100} = 0.080\ J$ *Remember to use kg and m for mass and height.*
4b(i)	0.080 J, since the loss in G.P.E at B is converted to the gain in K.E at A *Remember to use your answers to 4a.* *Give a proper reason since it is 2 marks.*

4b(ii)	**Loss in G.P.E at position B = Gain in K.E. at position A** $0.080 = \frac{1}{2} mv^2$ $0.080 = \frac{1}{2} \times \frac{100}{1000} \times v^2$ $v^2 = 1.6$ $v = \sqrt{1.6} = 1.26\ ms^{-1} \approx 1.3\ ms^{-1}$ *Give a proper sentence since it is 3 marks.* *Give to the proper s.f. (calculate to 3 s.f., and then round down to 2 s.f.)*
5a	3.0×10^8 m/s *Same speed for all electromagnetic waves in vacuum.*
5b	$n = \frac{c}{v}$ $1.5 = \frac{3.0 \times 10^8}{v}$ $v = \frac{3.0 \times 10^8}{1.5} = 2.0 \times 10^8\ ms^{-1}$
5c(i)	Same speed of 3.0×10^8 m/s Same speed for all electromagnetic waves in vacuum.
5c(ii)	Speed of blue light is lower than the speed of red light in glass. Since blue light is refracted through a larger angle, and hence its speed is more affected than that of red light when traveling in glass.
6a	Total resistance = 12 Ω + 8 Ω = 20 Ω I = V / R = 4.0 / 20 = 0.20 A *Note the series connection of the resistors*
6b(i)	Q = I t t = Q / I = 2.0 / 0.20 = 10 s *Remember to use your answers to 6a.*
6b(ii)	E = P t = I V t = (0.20 A) (4.0 V) (10 s) = 8.0 J *Remember to use your answers to 6a and 6b(i).*
6b(iii)	Thermal energy (heat energy) Resistors converted electrical energy into heat energy
7a(i)	P = I V = (0.3) (40) = 12 W
7a(ii)	P = I V = (0.3) (240) = 72 W *The power supplied by the source is the current supplied by the source multiplied by the e.m.f. of the source, since P = I V*
7b	For ideal transformer with no losses, Power in the primary coil = power in the secondary coil I V = 72 (I) (240) = 72 I = 72 / 240 = 0.30 A
7c	In Fig. 7.1, there was energy lost due to the heat energy created by the fixed resistor (72 – 12 = 60 W loss) but there was no such energy lost in Fig. 7.2.
8	Out of syllabus

9a(i)	When the liquid is heated, the molecules move farther apart, the liquid volume increases, and the hence becomes less dense, and rising up above the cooler surrounding liquid that is denser. The cooler surrounding liquid that is denser sinks to be heated up. A convection cycle (due to density difference) where heated liquid rises and carries heat around is formed.
9a(ii)	In A, the heat from the heater is conducted downwards through the water to reach the thermometer, and water is a poor conductor of heat. There is no convection current carrying heat down from the heater to A because heated liquid expands, becomes less dense and rises up, and heated liquid cannot sink down. In B, the heat from the heater is conducted upwards through the water to reach the thermometer. Also, because the thermometer is placed vertically above the heater in B, the convection current of heated liquid is able to reach it as the heated water expands, becomes less dense, and rises up. Convection heat transfer in liquid (in B only) is also much faster than conduction heat transfer in liquid (in A and B).
9b	A polished surface is a poorer emitter of heat radiation than a blackened surface, and hence loses heat at a slower rate. Hence, section AB and CD would be less steep for a polished surface compared to a blackened surface, as the loss of heat through emission by the surface is much slower. AB and CD would take a longer time for the polished surface compared to the blackened surface. However, the freezing point of the liquid remains at 70 ^{0}C, and BC would still be a straight line for the polished surface can at 70 ^{0}C also, but the time taken for BC for the polished surface would be much longer as the loss of heat though emission by the surface is much slower.
10a	As the prong of the tuning fork vibrates, it collides with the layer of air particles nearest to it, and transfer the kinetic energy to this layer of air particles so that they in turn vibrate faster. This layer of air particles in turn vibrate faster, collide with neighbouring layer of air particles and transfer the kinetic energy upon collision. Also, as the layers of air particles vibrate, they move closer together to form a region of higher pressure (compression), and also move farther apart to form a region of lower pressure (rarefaction). The layers of air particles vibrate in a series of compressions and rarefactions, in a direction parallel to the direction of travel of sound.

10b(i)	Sine curve Mean value is atmospheric pressure Region above atmospheric pressure is a compression Region below atmospheric pressure is a rarefaction Period = 1 / f = 1 / 200 = 0.0050 s = time between two consecutive compressions 
10b(ii)	Same frequency means the frequency remains at 200 Hz, having the same pitch and the same period, so the Period remains at 0.050 s. A louder sound would have larger amplitude, so the maximum pressure above atmospheric pressure increases. The minimum pressure below atmospheric pressure is now lower.
11	Out of syllabus

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Question	Answer	Suggested Explanation
1	A	Constant speed, followed by uniformly decreasing speed (decelerates uniformly). Key word here is the brakes, and braking means slowing down.
2	B	W = m g m = W / g = 8.5 / 1.7 = 5.0 kg
3	D	For water Density of water = mass of water ÷ volume of water We need to measure mass, and we also need to measure volume of water
4	A	Taking moments about pivot P, for equilibrium, by Principle of Moments, Macw = Mcw (F) (20 + 20 cm) = (5 N) (20 cm) F = 2.5 N upwards
5	B	Loss of G.P.E = Gain in K.E. (dropping down from a higher height) Water from the mountains fall to the bottom of the mountain.
6	A	E = P t t = E / P = 3000 / 2 = 1500 s = (1500 / 60) minutes = 25 minutes
7	D	Weight of a fixed mass of air will NOT vary with temperature.
8	B	To make a metal tank with the LEAST heat loss, the metal must gain heat slowly (which means it also loses heat slowly), and the insulation must also gain heat slowly (which means it also loses heat slowly).
9	D	For a transverse wave (transverse water wave), if the energy is traveling from left to right, the water surface moves up and down, and the ball also moves up and down.
10	A	Angle of incidence = 45^0 (air to glass, so bends towards normal axis) $n = \frac{\sin(\text{bigger angle})}{\sin(\text{smaller angle})}$ $1.41 = \frac{\sin(45)}{\sin r}$ $r = \sin^{-1}\left(\frac{\sin 45}{1.41}\right) = 30.1^0$ Change in angle = $45 - 30.1 = 15^0$
11	C	Air to glass: light bends towards normal axis Glass to air: light bends away from normal axis
12	B	Sound energy is traveling from left to right Layers of air particles vibrate left and right also (longitudinal sound waves)
13	B	Only nickel, cobalt, iron and steel are magnetic. The other metals are non magnetic.
14	B	If we close switch 3, then there will be short circuit across the 4.5 Ω. Hence, we open switch 3, and then close switch 1 and close switch 2. $R = \left(\frac{1}{3} + \frac{1}{3}\right)^{-1} + 4.5 = 6.0\,\Omega$
15	C	Current in Z = current in Y (due to equal splitting) Current in X = current in Z + current in Y

16	D	E = P t = (60) (1 x 60) = 360 J Time must be in seconds, and power in Watts
17	A	Fuse must be in the live wire and not the neutral wire. This is to make sure that the appliance is not charged at a high voltage when the fuse blows.
18	A	Out of syllabus
19	C	Out of syllabus
20	C	2 more neutrons (each has 10 protons)