2011 SMSS PRELIM ANSWER SCHEME (This replaces the last answer scheme given, which was wrongly photocopied)

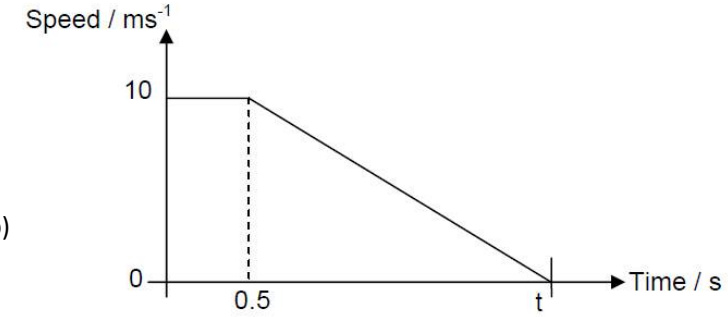
Paper 1

1	**C**	**11**	**C**	**21**	**A**	**31**	**B**
2	**A**	**12**	**D**	**22**	**B**	**32**	**A**
3	**D**	**13**	**B**	**23**	**B**	**33**	**D**
4	**A**	**14**	**C**	**24**	**B**	**34**	**B**
5	**D**	**15**	**B**	**25**	**B**	**35**	**C**
6	**C**	**16**	**B**	**26**	**A**	**36**	**A**
7	**B**	**17**	**D**	**27**	**D**	**37**	**D**
8	**A**	**18**	**C**	**28**	**B**	**38**	**C**
9	**C**	**19**	**C**	**29**	**B**	**39**	**C**
10	**C**	**20**	**C**	**30**	**A**	**40**	**D**

Paper 2

Section A

1. a)



[2]

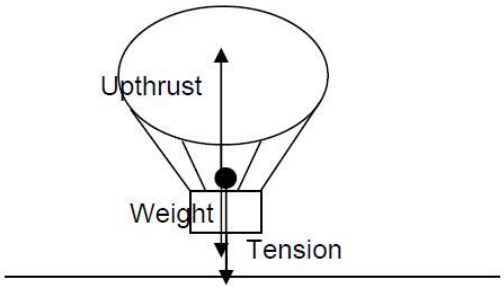
b)

-5 = (0 - 10) / t [1]

Hence, t = 2.5 s (in the diagram)

Least Distance = (0.5 x 10) + ½ x 10 x 2 = **15 m** [1]

2. a)



b) Resultant force = Upthrust – Weight – Tension = 0 N
Tension = Upthrust – Weight
Tension = 4 800 – 4200 = 600 N [1]
At constant speed, acceleration is zero and hence, resultant force is zero. [1]

c) If there is wind, a force will be exerted on the balloon to the side. Hence, the tension in the string will increase. [1]

3 a) Work is equal to the product of the force and the distance moved in the direction of the force.[1] SI unit is Joule or J[1]

b) $KE = \frac{1}{2}mv^2 = \frac{1}{2}(4.20 \times 10^{-3})(1500)^2$
KE = 4725 J
KE = 4730 J (3 sf) [1]

c) W = F.s = 3000 (1.00)
W = 3,000 J [1]

d) the bullet passes through. Since 4725J is larger than 3000 J [2] (dun compare energy with force, some said bullet force is greater than resistive force, how do you know?)

e) Loss in KE of bullet to thermal energy. [1]

4 a) Evaporation of water occurs below boiling point. [1] When energetic water molecules are near the surface of the liquid, they may escape from the liquid surface and become water vapour. (density change, mass remains the same)

b) E = 0.128 W x 1000 x 3600 s = 460800 J (forgot to change kwh to J)
Mass of water vapourized = 0.846 kg - 0.712 kg = 0.134 kg
L = E / M
= 460800J / 0.152 kg
$= 3.44 \times 10^6$ Jkg^{-1}

c) Heat loss by conduction through the bottom of the beaker to the balance.
Place an insulating slab under the beaker to reduce the heat transferred.
(should not talk about evaporation, think of other ways of heat loss)

5 a) $R = \frac{5}{2} = 2.5\,\Omega$ [1] (Show all your workings!)

b) $V = 12 - 5 = 7\,V$ [1]

c) $I = 4A$ [1]

6 a) i) Terminal C
ii) Terminal B

iii) Terminal A 2m for 3 correct answers, 1m for 2 correct answers

b) To indicate whether the current if flowing through the heater. [1]

c) Cost = (1500/1000 + 50/1000) x 0.5 x 0.50 = $0.39 [2]

d) If there is a circuit fault, a large current will surge through the circuit and if the current is higher than the fuse rating, the fuse will blow and cut the current supply. [2]

7 Pressing the bell button complete the circuit and current flows. ½
Electromagnet is magnetized as the current flows through it. ½
Soft iron armature is attracted to the electromagnet and causes the hammer to strike the gong. ½
The circuit is broken as soon as the hammer moves towards the gong. ½
The electromagnet loses its magnetism and allows the springy metal strip to pull back the iron armature to its original position. ½
Pulling the armature back complete the circuit again and the cycle repeats for as long as the bell button is pressed down. ½

8 a) Circular paths drawn with correct directions. ½ each

b) i) clockwise [1]

ii) To provide an electrical contact for between the external circuit and the coil. [1]

iii) Use a soft iron core instead of a wooden frame. [1]
Soft iron core is able to concentrate the magnetic field lines and enables the motors to rotate faster. [1]

iv) If the current is an a.c. supplied, the magnetic field and the current direction will reverse simultaneously, and hence there will be no effect to the direction of rotation of the motor. [2]

9 a) i) Vs/Vp = 800/1600,
Vs = 120 V [1]

ii) I = V/R = 120/500 = 0.24 A [1]

iii) Ip/Is = Ns/Np = 800/1600
Ip= 0.12 A [1]

b) Some energy is lost as heat produced in the soft iron core due to eddy current OR
from the resistance of the coil itself. OR Some energy is lost as not all the magnetic lines of force link the primary and secondary coils.

c) There is no emf induced in the secondary coil continuously,
because there is no change of magnetic flux linkage between primary & secondary coils. OR
Momentary induced emf because of momentary change in flux linkage. Subsequently, nofurther induced emf because no further change in flux linkage.

Section B

10 a) P1 = 76 cmHg [1]
P2 = 76 + 8 = 84 cmHg [1]
P3 = 76-8 = 68 cmHg [1]

b) i) The flask expanded first and hence, the pressure will decrease first. [1]

ii) When heat is supplied to the flask, the air particles in the flask will **gain more KE**.[1]. This causes a **greater frequency in collision** of the particles [1/2] and hence a **greater pressure** [1/2] in the flask.

iii) Pressure in the flask = hpg + atm P
= 0.1(13600)(10) + 1.013 x 10^5 [1]
= 114,900 Pa [1]

c) As the air bubble rises, the pressure acting on it decreases. [1]
The volume of the air will increase so that the pressure will decrease so as to maintain the constant pressure with its surrounding. [1]

11 a)

[2]

Type of Thermometer	**Thermometric Substance**	**Thermometric Property**
constant-volume gas thermometer	Gas	pressure of a fixed mass of gas at constant volume
Thermocouple	**Two wires made of different metals**	electrical voltage or electromotive force
Mercury-in-glass	Mercury	**Volume of a fixed mass of liquid**

b) i) Steam point is the temperature of steam from boiling water at one atmospheric pressure. (100 ºC) [1]

ii) The manometer is to ensure that the pressure inside the apparatus is the same as the atmospheric pressure outside. [1]

iii) The bulb of the thermometer should be above the boiling water instead of being submerged in the boiling water. [1]

c) i) This thermocouple is not suitable for measuring low temperature as the values of the voltage near the ice point cannot be differentiated – same voltage for 0 ºC to 53 ºC. [1]
This thermocouple can measure high temperature as there is a specific voltage for temperatures near the steam point. [1]

ii) The thermocouple is robust, compact, fairly accurate and able to measure a large temperature range of -200 ºC to 1500 ºC by choosing suitable types of metals for the two wires.

As the wire junctions are very small, the thermometer can be used to measure temperatures at a point (localised temperature).

It is very responsive to rapidly changing temperatures due to its small mass and because metals are good conductors of heat.

As the output is an electrical signal (e.m.f. reading), it can be connected to suitable electrical equipment for checking rapid or sudden temperature changes. ANY 3

d) □=kv
(25-5)= k [110-(-10)]
K = 0.167 [1]
10-5 = 0.167[x-(-10)]
X = 20 ^{o}C [1]

12

EITHER

a) High frequency so that it has high penetrating power and reflect from seabed. [1]
High amplitude to transfer more energy to detect the depth of the seabed. [1]
High percentage of reflected energy so that the depth of sea can be determined accurately. [1]
Rate absorption of sound energy by water is low to reduce the loss of energy due to the reflected wave. [1]
Therefore, wave D is the best choice. [1]

b) i) wavelength = v/f = 1500/500000 = 0.0030 m [2]
ii) depth = 1500 x 1.2 = 1800 m [2]

c) To monitor the development of the foetus. [1]

OR

a) i) 1.5 = sin 60 / sin X [1]
X = 35.3^{0} [1]
ii) 1.5 = 1/sin C
C = 41.8^{0} [1]
Angle of incidence at RS = 35.3 [1]
Since angle of incidence is less than critical angle, total internal reflection will not occur at surface RS, hence ray will be refracted.[1]

b) i) image gets larger [1]
ii) where u=v, u = 15cm. [1]
Focal length = 7.5 cm [1]
iii) The object is less than the focal length. [1]
Since the image is **virtual**, the image cannot be formed on the screen.[2]