FORM 3 PHYSICS 232/1
MARKING SCHEME

SECTION A: 25 MARKS

1. Reading = 650mmHg √1

2. Force on springs = $\frac{200g}{1000}$ x 10 = 2N
   Extension $e_1 = \frac{F}{K_1} = \frac{2}{50} = 0.04m$
   Extension e_2 $\frac{F}{K_2} = \frac{2}{100} = 0.02m$
   Total extension = 0.04 + 0.02 = 0.06m √1
   Combined constant = $\frac{\text{total force}}{\text{Total extension}} = \frac{20}{0.06}$
   = 333N/M √1

3. $P = \frac{F}{A}$ √1 = $\frac{30}{1.0 \times 10^{-7} m^2}$
   = 3.0×10^8pa √1

4. This is the movement of particles from regions of high concentration to regions of lower concentration√1

5. $P_1V_1 = P_2V_2$ √1
   $P_1 = 4.2 \times 10^5$P
   $V_1 = 0.024m^3$
   $V_2 = 0.019m^3$
   $P_2 = \frac{4.2 \times 10^5 \times 0.024}{0.018}$ √1
   = 5.6×10^5pa √1

6. In a balanced condition, the sum of clockwise moments is equal to the sum of the anticlockwise moments√1

7. Cohesive forces of water molecules are higher than adhesive forces between water and grease molecules. √1

8. At max height KE = PE
   KE = mgh √1
   = 0.1 x 10 x 5
   = 5 joules √1

9. Linear expansivity of concreted steel is almost equal (equal) √1

10. A absorbs more coldness and shrinks more and becomes smaller in size. Black bodies lose heat more easily. √1

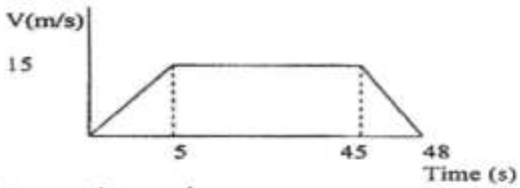
11. When piston is pulled backwards √1air rushes in and fills the gun when the piston is pushed forward √1air is forced out at <u>high velocity</u> √1which reduces pressure at the mouth of the bottle. This makes the paint to rise is expelled out√1 together with the air as spray.

12. Volume of drop = volume of patch
    = $\pi r^2 \times d$√1
    $5.0 \times 10^{-3} = \pi \times 17.5^2 \times d$ √1
    $d = 5.197 \times 10^{-6}cm = 5.197 \times 10^{-8}$√1

13. 50 70 90 M Sketch √1
    20 x m = 20 x 100g √1
    M = 100g = 0.1kg√1

14. (a) Distance – length from one point to another/scalar quantity
    Displacement – distance covered in a given direction/vector quantity

    (b) (i)



    (ii) Distance = Area under curve
    = ½ x 15 (48 + 40)
    = 660m

(iii) Speed = $\frac{\text{Distance covered}}{\text{Total time}}$

$= \frac{660}{48}$

$= 13.75m/s$

(c) (i) Change in momentum = m(v – u)

$= 1.4\,(1.7 - 0.8)$

$= 1.26kgms^{-1}$ or 1.26Ns

(ii) Change in momentum = impulse

$= 1.26 = F \times t$

$= 0.7 \times t$

$t = \frac{1.26}{0.7}$

$= 1.8S$

(iii) $a = \frac{v - u}{t}$

$= \frac{1.7 - 0.8}{1.8} = 0.5ms^{-2}$

15. (i) W = weight of load x height raised

= 50 x 10 x 12

= 6000J

(ii) W = force x distance along plane

= 300 x 30

= 9000J

(iii) Efficiency = $\frac{\text{Work output}}{\text{Work input}}$

$= \frac{6000}{9000}$

= 66.67%

(iv) (i) Smoothening to reduce friction

(ii) Making the inclined plane longer

SECTION B

16. (a) $A_1v_1 = A_2v_2$

where A_1 and A_2 are the cross-sectional areas of the pipes and v_1 and v_2 are the speeds of the fluid in the respective pipes.

(b) (i) The gas moves at a high speed inside the barrel. This causes a reduction in pressure inside the barrel. The atmospheric pressure outside the barrel is higher and forces in air.

(ii) To control the amount of air entering into the barrel.

(c) (i) From the equation of continuity, $A_1v_1 = A_2v_2$.

$A_1 = \pi \times (7.5)^2 \times 10^{-4}\,m^2$

$v_1 = 1.2\,m\,s^{-1}$

$v_2 = ?$

$A_2 = \pi \times (3.8)^2 \times 10^{-4}\,m^2$

From the above expression, $v_2 = \frac{A_1v_1}{A_2}$

$= \frac{\pi \times 7.5 \times 7.5 \times 10^{-4}\,m^2 \times 1.2\,m\,s^{-1}}{\pi \times 3.8 \times 3.8 \times 10^{-4}\,m^2}$

$= 4.7\,m\,s^{-1}$. This is the speed of the water in the narrow section.

(ii) Rate of discharge = Av

$= \pi \times (3.8 \times 10^{-2}\,m)^2 \times 4.7\,m\,s^{-1}$

$= 0.0213\,m^3\,s^{-1}$.

17. (a) (i) By principle of moments,

$F_{piston} \times 0.1\text{ m} = 100\text{ N} \times 1.0\text{ m}$

$$F_{piston} = \frac{100\text{ N} \times 1\text{ m}}{0.1\text{ m}} = 1\,000\text{ N}.$$

(ii) Pressure, $p = \frac{F_{piston}}{A_{piston}}$

$$= \frac{1\,000\text{ N}}{3.14 \times (\frac{5}{2} \times 10^{-2}\text{m})^2} = 5.1 \times 10^5\text{ N m}^{-2}.$$

(iii) Let the height be h.

Pressure, $p = \rho gh$

$$h = \frac{p}{\rho \times g}$$

$$= \frac{5.1 \times 10^5\text{ N m}^{-2}}{1.0 \times 10^3\text{ kg m}^{-3} \times 10\text{ N kg}^{-1}}$$

$= 51.0$ m.

(b) $p = \rho gh$

$= 1.36 \times 10^4\text{ kg m}^{-3} \times 10\text{ N kg}^{-1} \times 0.58\text{ m}$

$= 78\,880$ Pa

or

7.888×10^4 Pa.

18. (a) (i) Fast-moving air molecules move continuously and randomly thus colliding with the smoke particles.

(ii) Larger particles may not be moved much on collision with fast-moving air particles.

(iii) Increase in temperature would increase the speed of air molecules and hence the number of collisions would be more. Faster random movement would be observed.

(b) (i) Volume of the oil drop

$$= \frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.14 \times 0.035^3\text{ cm}^3$$

Let the thickness of the patch be x

Volume of the patch $= \pi r^2 x$

$= 3.14 \times (37.5)^2\text{ cm}^2 \times x.$

Volume of the patch = volume of the oil drop.

$3.14 \times (37.5)^2\text{ cm}^2 \times x = \frac{4}{3} \times 3.14 \times (0.035)^3\text{ cm}^3$

$$x = \frac{4}{3} \times (0.035)^3\text{ cm}^3 \times \frac{1}{(37.5)^2\text{ cm}^2}$$

$$= \frac{4 \times (3.5 \times 10^{-2})^3\text{ cm}^3}{3 \times (3.75 \times 10^1)^2\text{ cm}^2}$$

$= 4.065 \times 10^{-8}$ cm

$= 4.065 \times 10^{-10}$ m

$= 4.1 \times 10^{-10}$ m.

(ii) – The oil does not evaporate.

– The oil spreads to a one-molecule thick layer.