Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2011

Physics

Assessment Unit AS 1

assessing
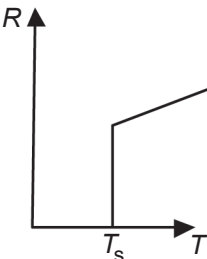
Module 1: Forces, Energy and Electricity

[AY111]

WEDNESDAY 12 JANUARY, MORNING

MARK
SCHEME

					AVAILABLE MARKS

1 **(a)** **(i)** Scalars have magnitude (only) [1]

   (ii) Vectors have magnitude and direction [2]

(b) Velocity [1]
   Force [1] [2]
   [–1] per omission/error

(c) **(i)** Horizontal component = 9.8(2) N [1]
   Vertical component = 6.88 N [1] [2]

   (ii) Weight (29.4 N) – vertical component (6.88 N) ecf [1]
   Force = 22.5 N (231 N if g = 10 N kg^{-1}) [1] [2]   **8**

2 **(a)** **(i)** Eqn. $v^2 = u^2 + 2as$ and subs [1]
   Maximum height = 1.27 m [1] [2]

   (ii) Eqn. $s = ut + \frac{1}{2}at^2$ and subs [1]
   Flight time = 1.02 s [1] [2]
   S.E. 0.51 s → [1]

(b) **(i)** t_1 to t_2 *constant* (positive) acceleration
   t_2 to t_3 zero or constant velocity
   t_3 to t_4 *constant* retardation or deceleration or negative
   acceleration
   All three correct [2]
   [–1] per omission/error

   (ii) (Area under the curve) [1] (from $t = 0$ to $t = t_4$) [1] [2]   **8**

3 **(a)** The rate of change of momentum of a body is directly
   proportional to the (applied) force and acts in the *direction*
   of the force [2]
   or a $\propto$ F and a $\propto \frac{1}{m}$ with symbols defined.

(b) **(i)** Eqn. $R - mg = ma$ and subs [1]
   Reading = 622 N [1] [2]

   (ii) Reading = 540 N [1]

   (iii) Eqn. $mg - R = ma$ and subs [1]
   Reading = 485 N [1] [2]   **7**

				AVAILABLE MARKS

4 **(a)** X + Y = 48 N [1]
18 × 0.5 + 1.5 Y = 30 × 1.0 (or equivalent) [1]
Y = 14 N and X = 34 N [1] [3]

(b) Takes moments about X with Y = 0
30 × 1 = ? × 0.5 [1]
Increase in weight = 60 – 18 = 42 N   (ecf **(a)**) [1] [2] **5**

5 **(a)** **(i)** KE = $\frac{1}{2}$ mv^2 = 309 000 (J) [1]

(ii) Power = KE/time = 22 900 (W)   (ecf **(i)**) [1]

(iii) Chemical energy × 0.29 = KE [1]
Chemical energy = 1 066 000 (J)   (ecf **(i)**) [1] [2]

(b) Uses v^2 = 2 gh to find vertical height risen [1]
h = 39.4 m [1]
Distance up slope = h/sin (8) = 283 m [1]

⎡ **or** Work done = change in KE [1] ⎤
⎢ (800 × 9.81 × sin 8°) S = 309 000   (ecf (a)(i)) [1] ⎥
⎣ S = 283 (m) [1] ⎦

⎡ **or** v^2 = u^2 + 2as [1] ⎤
⎢ o^2 = 27.8^2 + 2 (–9.81 sin 8°)s [1] ⎥
⎣ s = 283 [1] ⎦ [3] **7**

6 **(a)** **(i)** Vertical arrangement:
- ceiling
- 2 wires (If single wire, scores [0]/[3])
- Load on one wire
- Tensioner (load) on other wire
- Vernier scale or scale and pointer
- ruler

[$\frac{1}{2}$] each, round up [3]

(ii) Thickness or diameter + micrometer (screw gauge)
(Initial) length + *metre* rule
Extension + suitable instrument (marker may be on diagram)
[$\frac{1}{2}$] each and round down [3]

(b) **(i)** Extension = 1.95 (mm) [1]

(ii) Area = Force /(Young modulus × strain) [1]
5.5/(1.2 × 10^{11} × 7.8 × 10$^{–4}$) [1]
= 5.88 × 10$^{–2}$ mm^2 [1] [3] **10**

7 **(a)** e.g. any metal *at constant temperature* or named metal at constant temperature [1]
Straight line through origin [1] [2]

(b) **(i)** The (abrupt) drop of the resistivity of a conductor to zero when a material is cooled below its critical or transition temperature, T_s [1]

Zero between $T = 0$ and $T = T_s$ [1]

Step and linear, positive gradient [1] [3]

(ii) (Production of) (powerful) (electro)*magnets* (with no generation of heat energy)
Allow mag-lev   not MRI [1]

6

8 **(a)** **(i)** Charge = 43.2 (C) [1]

(ii) Number of electrons = 2.7×10^{20} (ecf **(i)**) [1]

(b) **(i)** Potential difference = 4.8 (V) [1]

(ii) $E = Vit = i^2 Rt$ [1]
Energy = 207 (J)   (ecf **(b)(i)** or **(a)(i)** or 60 mA) [1] [2]

5

6456.01 **4**

9 (a) Working circuit diagram: Cell, (load) variable resistor [1]
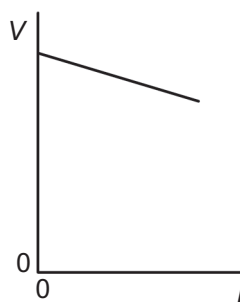
Ammeter, voltmeter [1] [2]
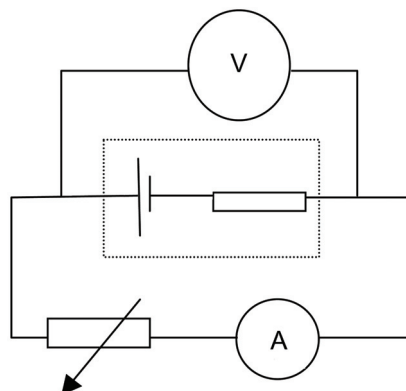
Experiment: independent marks

Vary load [1]

Read V, A [1] [2]

(b) (i) Analysis: Graph of V against I [1]

Sketch [1]

(ii) r = −gradient (negative essential) [1] [3]

(r from one set of values, [1] only)

Quality of written communication

2 marks

The candidate expresses ideas clearly and fluently, through well-linked sentences and paragraphs. Arguments are generally relevant and well structured. There are few errors of grammar, punctuation and spelling.

1 mark

The candidate expresses ideas clearly, if not always fluently. There are some errors in grammar, punctuation and spelling, but not such as to suggest weakness in these areas.

0 marks

The candidate expresses ideas satisfactorily, but without precision. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the passage. [2]

(c) "lost volts" = 0.02 × 145 = 2.9 V **or** V = 12.6 − 145 (0.02) [1]

Terminal p.d. = 12.6 − 2.9 = 9.7 (V) [1] [2]

11

10 (i) Total circuit resistance = 720 Ω [1]

hence current = (18/720 = 0.025 A) = 25 (mA)   [1]   [2]

(ii) Potential difference = 0.025 $\times$ 120 = 3 (V) (ecf)   [1]

(iii) PD between B & D = 9.0 V

PD between C & B = 1.5 V   [1]

hence PD between C and D = 10.5 (V)   [1]   [2]

(iv) Resistance between C & D becomes

420 $\times$ 210/630 = 140 Ω [1]

Total circuit resistance = 240 + 60 + 140 = 440 Ω [1]

Hence PD = 140 $\times$ 18/440 = 5.72 (V)   [1]   [3]

	AVAILABLE MARKS
	8
Total	**75**