# Forces

## Mark Scheme 5

| | |
|---|---|
| Level | IGCSE |
| Subject | Physics |
| ExamBoard | CIE |
| Topic | General Physics |
| Sub-Topic | Forces |
| Paper Type | (Extended) Theory Paper |
| Booklet | Mark Scheme 5 |

**Time Allowed:** 60 minutes

**Score:** /50

**Percentage:** /100

1  **(a**  any logical method e.g.
           extension is 2 cm for 8 N or 1 cm for 4 N                                                    C1
           final extension is 3 cm                                                                       C1
           need 12 N to extend to 6 cm                                                                   A1

   **(b)** **(i)**  shown on diagram:
                    distance from pivot to *F* OR value of weights OR dist from weights to pivot         B1

         **(ii)**  force/weight of load × distance from pivot to force
                   (accept symbols if clear)                                                              B1

                                                                                              **[Total: 5]**

2  any closed triangle or parallelogram                                                                  C1
   forces in correct directions relative to each other                                                   C1
   correct resultant indicated                                                                           C1
   resultant 7.7 N to 8.1 N                                                                       A1   **4**
   scale stated                                                                                          B1
   resultant vertically upwards                                                                   B1   **2**
                                                                                                       **[6]**

3  **(a**  limit of proportionality (allow elastic limit)                                         B1   [1]

   **(b)**  force is proportional to extension or in terms of doubling                             B1   [1]

   **(c)**  (up to Q extension proportional to force applied)
            Q to R extension/unit force more however expressed                                    B1   [1]

   **(d)**  k  = force/extension or 8/2 or other correct ratio                                     C1
               = 4.0 N/mm                                                                          A1   [2]

                                                                                              **[Total: 5]**

| 4 | (a) | in a straight line or (vector) has direction | B1 | 1 |
|---|---|---|---|---|
| | (b) | f = ma or f = 3.0 x 2.0<br>    = 6(.0) N | C1<br>A1 | 2 |
| | (c) | P = F/a or P = 120/0.05<br>    = 2400 N/m$^2$ (or Pa) | C1<br>A1 | 2<br>[5] |

| 5 | (a) | upwards force = downwards force or no resultant force<br>opposing moments equal or A.C.M. = C. M. | B1<br>B1 | [2] |
|---|---|---|---|---|
| | (b) | 30 x spring balance reading = 40 x 6.0 or equivalent<br>spring balance reading = 8.0 N | C1<br>A1 | [2] |
| | (c) | 0.5 N<br>downwards | B1<br>B1 | [2]<br>Total [6] |

[7]

| 6 | (a | (i) | Extension proportional to load however expressed | B1 | |
|---|---|---|---|---|---|
| | | (ii) | Any relevant arithmetic to show direct proportion (or straight line graph <u>with values</u>) | B1 | 2 |
| | (b) | (i) | Work done = force x distance / 400 x 0.210<br>84.0 J | C1<br>A1 | |
| | | (ii) | (total) work/time or (24 x) 84/60 (apply e.c.f from (i) )<br>33.6 W | C1<br>A1 | 4<br>[6] |

| | | | | | |
|---|---|---|---|---|---|
| 7 | **(a)** | **(i)** | force of gravity acts on masses/weight of masses | **B1** | |
| | | **(ii)** | vector has direction/force has direction | **B1** | **2** |
| | **(b)** | **(i)** | spring 1 (more difficult) | **M1** | |
| | | | any correct relevant pair of values | **A1** | |
| | | **(ii)** | P marked at extension 25 mm to 28 mm | **A1** | |
| | | | explanation in terms of end of proportionality | **B1** | |
| | | **(iii)** | each graph read at 15 N, approx. 25 mm, 19 mm | **C1** | |
| | | | difference correct, 6 mm +/- 1 mm | **A1** | **6** |
| | | | | | **[8]** |

| | | | | | |
|---|---|---|---|---|---|
| 8 | **(a)** | | attempt to use triangle or parallelogram of forces | **M1** | |
| | | | stated scale used | **A1** | |
| | | | 950 N and 1220 N in correct relative directions | **C1** | |
| | | | correct resultant drawn in | **C1** | |
| | | | weight = 1785 N [limits 1700 N to 1850 N] | **A1** | **5** |
| | **(b)** | **(i)** | work = force x distance or 1500 x 3.0 | **C1** | |
| | | | work = 4500 J | **A1** | |
| | | **(ii)** | power = work/time or 4500/2.5 | **C1** | |
| | | | power = 1800 W | **A1** | **4** |
| | | | | | **[9]** |