



Founded 1858

British Horological Institute

## Certificate in Clock and Watch Servicing, Unit 1 Technician Grade, Theory of Clock and Watch Servicing

24th May 2006

Time allowed: - 2½ HOURS

### **Important notes - please read carefully**

1. You will be known to your Examiners by your examination number only, please put this number at the top right hand corner of all sheets of paper you use, including Section E.
2. There are four sections, A, B, C, D where each question carries twenty marks. Section E, which is on two separate pages, contains twenty short answer questions, each of which carries one mark.
3. You should attempt questions as follows: -  
A total of four questions, one from each of Sections A, B, C and D.  
All questions from Section E should be attempted and, as only brief answers are expected, the answers should be written in the spaces provided on the question paper.  
  
At the end of the examination period the pages giving your written answers to Sections A, B, C and D together with Section E, should be numbered in sequence before being collected by the invigilator. All answers should be clearly numbered.
4. Good informative sketches or drawings, with the various components labelled, should accompany all descriptive answers, where appropriate, since they could attract a significant proportion of the total marks awarded.
5. All answers must be written in blue or black ink, using a pen or ball point. Pencil will not be accepted except where appropriate in sketches or drawings.
6. Any calculations required must be shown and laid out in a clear and logical manner. The use of non-programmable calculators is allowed.
7. You may use the following data, if required:  
 $\pi = 3.142$ ,  $g = 9.812 \text{ ms}^{-2}$ , length of seconds pendulum = 994.16mm.

8. Please make sure that the question paper accompanying these instructions is appropriate to your examination entry.

## Section A

### Clocks and Clock Servicing – answer one question from this section.

1.
  - a) Describe the type of pendulum suspension assembly found in
    - i. a long case clock
    - ii mass produced German clock. (6 marks)
  - b) Describe *in detail* how you would calculate whether a pendulum is of the correct length for a clock. (11 marks)
  - c) Explain the function of a clock escapement. (3 marks)
2.
  - a) What is the purpose of a locking plate in count wheel striking? (2 marks)
  - b) For this type of striking, with the aid of sketches, describe the action of the mechanism during warning and during striking. (10 marks)
  - c) Explain the variety of arrangements which can be found in clocks to allow removal of the barrel assembly without stripping down the whole of the movement. (8 marks)

## Section B

### Watches and Watch Servicing - answer one question from this section.

3.
  - a) Explain with the aid of a diagram one method by which the friction drive is achieved in watches. (8 marks)
  - b) Explain how adjustment can be made to the friction drive. (2 marks)
  - c) Explain how watch parts need to be identified when ordering spares. (4 marks)
  - d) Describe *briefly* the operational aspects of a mechanical watch movement which should be checked before opening the case. (6 marks)
4.
  - a) Draw a labelled diagram showing the barrel assembly, winding wheel and click work in a modern watch. (10 marks)
  - b) Describe five electrical tests which can be carried out on a quartz watch and the faults which can be identified from these tests. (10 marks)

## Section C

### Escapements - answer one question from this section.

5.
  - a) Draw a labelled diagram of a complete jewelled lever balance assembly, including the spring and without the cock. (9 marks)
  - b) Explain how the spring is attached at both ends. (5 marks)
  - c) Explain how the index serves to alter the rate of the watch. (6 marks)
6.
  - a) Draw a fully labelled and proportioned diagram of the wheel and pallets in an anchor escapement. (9 marks)
  - b) Describe the action over one complete half cycle, starting with the pendulum at the extremity of its swing. (7 marks)
  - c) List the advantages and disadvantages of the recoil escapement. (4 marks)

## Section D

### Workshop Processes - answer one question from this section.

7.

- a) Use notes and sketches to show the construction and use of the standard 8mm collet used in the watchmaker's lathe. (5 marks)
- b) Explain the problems that occur if the collet is too large or too small for the work being held. (2 marks)
- c) Describe the precautions to be taken to ensure that work runs true again if it has to be removed from the collet and refitted. (3 marks)
- d) Describe the steps involved in making a blued, cheese head screw, use collets and a watchmaker's lathe for turning. (*Description of hardening and tempering is required.*) (10 marks)

8.

- a) Describe the various steps you would take to care for and ensure that workshop files are safe, clean and fit for purpose. (8 marks)
- b) Draw a labelled diagram showing the construction of a 0 - 25 mm external micrometer. (6 marks)
- c) Describe a staking tool and list four different processes carried out with the tool. (6 marks)



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Section E

WRITE YOUR EXAMINATION NUMBER HERE

Write a brief answer in the space below each question; 1 mark is awarded for each question

1	What is a <b>wax chuck</b> ?
2	What is known as <b>circular error</b> ?
3	Calculate the following and give the answer to two decimal places. $(8.007 \times 17.9) + 2.78$
4	With the stem <b>out</b> , in modern keyless work in a watch, list <b>four components</b> that are caused to move when the stem is turned.
5	In a <b>lever escapement</b> what is the function of <b>draw</b> ?
6	Describe a <b>contrate wheel</b> .
7	Why is a <b>self centring chuck</b> so called?
8	Fill in the missing two words in the following sentence. Wheels are ..... to reduce their inertia.

<p><b>9</b> State whether the following statement is <b>true or false</b>. An <b>equivalent simple pendulum</b> is always longer than the <b>actual pendulum</b>.</p>
<p><b>10</b> What is the shape of the backs of the teeth in a <b>recoil escape wheel</b> ?</p>
<p><b>11</b> What usually forms the low friction top bearing in a <b>foliot</b> ?</p>
<p><b>12</b> Fill in the missing number in the following gear reduction pair in <b>motion work</b>.  <math display="block">\frac{40 \times ?}{10 \times 8}</math></p>
<p><b>13</b> Which of the following is slackened to remove the stem of a watch ? The <b>keyless cover screw</b>, the <b>setting lever screw</b> or the <b>return bar screw</b> ?</p>
<p><b>14</b> What is the purpose of <b>EOL</b> in a watch ?</p>
<p><b>15</b> If a 2.0 mm component has an <b>upper tolerance</b> of 0.15 mm, what does this mean ?</p>
<p><b>16</b> List three important requirements for a screwdriver blade to be effective in the slot in a screw head.</p>
<p><b>17</b> How much <b>drop</b> is necessary in an escapement ?</p>
<p><b>18</b> What is a <b>safe edge</b> on a file ?</p>
<p><b>19</b> Why should a <b>mainspring winder</b> be used when required ?</p>
<p><b>20</b> Is the following statement <b>true or false</b> - a small neat undercut at the shoulder of a pivot is a benefit ?</p>