

## Tools

### Introduction:

Lists Tools that an independent clockmaker may need. This was drawn up as part of the dissertation requirements for the West Dean Diploma.

### Caveats:

- *The list was drawn up to be useful to me* - research time was limited. It was not based on practical experience. It should not be considered exhaustive or definitive. *Use with caution.*  
... 2016 note. *After some experience building a workshop, I would say that whilst the advice is generally solid, it could do with some updating. In particular there is a tendency to over recommend. e.g. I have a small bench top lathe (Emco). Whilst I can see how useful a large lathe could be, I have yet to find something I absolutely need one for.*

### Structure

- *Item* - name, in alphabetical order. This is spread over two columns to allow sub-classification and elimination of repetition.
- *Priority* - when items should be purchased.
  - *Base* - Basics. Items needed frequently and to hand, generally these need to be available before setting up in business.
  - *JIT* - Just In Time. A specific tool for a specific job. Rarely used, but if needed payback is likely to be within a single job (which may not be possible without it). Buy when required, then keep for repeat use.
  - *Lux* - Luxury. You can get away with out having these, but when they are the right tool for the job, they will speed things up. Payback for the money invested is likely to take decades. Buy only when spare money is available.
  - *CCprefix* - Items only required for carriage clocks. The purchase prioritisation is as above.
- *Tbx/Wkshp* - identifies where the consumables are likely to be needed:
  - *Tbx* - Toolbox items. Ideally these should be packed for client visits, especially those where an element of on-site maintenance is likely.
  - *Wkshp* - Workshop items, may be packed in the toolbox when it is known that there is going to be a need.
- *Notes* - contains basic information about the item. Such as: a very brief description, the way it tends to be used, what makes for a good (or bad) example, etc.
- *Budget* - if an item needs to be bought, roughly what will need to be spent.
- *Purchasing advice* - information as to where an item can be bought, which brands are appropriate, and any other specific information.

| Item                                 | Priority | Where | Notes   | Budget | Purchasing advice   |
|--------------------------------------|----------|-------|---|--------|---|
| <b>Adjustable spanners</b>           | ↓        | ↓     | Needed because clocks do not use standard sized nuts. Jaw should be removable, so it can be filed flat.   | ↓      | Buy only good quality, as cheap ones WILL slip and round the nut off as well as taking the skin off your knuckles. Bahco for instance<br>Avoid chrome-plating as it can be used to mask cheap materials |
| <i>Large</i>                         | Base     | Wkshp | 12 inch for case-hook nuts etc.   | £10    | Second hand, dress the jaws if necessary. New from around £20   |
| <i>Medium</i>                        | JIT      | Wkshp | 8 inch.   | £10    | Second hand is fine.  |
| <i>Small</i>                         | Base     | Tbx   | 4 inch for that otherwise impossible to move bolt in a long-case clock.   | £15    | As above  |
| <b>Allen keys</b>                    | ↓        | ↓     | For the lathe, best if long, with a ball end. You only need a set that is appropriate to the lathe(s) you are using.<br>Get some in a case or holder so that you can see when they are missing (those on a wire 'keyring' are awkward to use and end up getting separated/lost)   | ↓      | Get good quality, a known brand, e.g. Allen or Bondhus. Worth buying new as second hand ones may have the corners burred.   |
| <i>Metric</i>                        | Base     | Wkshp | For continental lathes.   | £25    | Any good tool shop, or internet.  |
| <i>Imperial</i>                      |          | Wkshp | UK or US lathe.   | £25    | As above.   |
| <b>Abrasive Stones</b>               | ↓        | ↓     | ↓   | ↓      | ↓   |
| <i>White Spyderco slip stone</i>     | Base     | Wkshp | Teardrop section. small, fine aluminium oxide for polishing pivots, longcase pallets etc. Can be ground/shaped/cleaned on the diamond wheel.  | £15    | Search for Spyderco ceramic file slip stone 400F1SP. Available in the UK from <a href="http://www.mindyourfingers.co.uk">www.mindyourfingers.co.uk</a> .  |
| <i>Arkansas</i>                      | Lux      | Wkshp | Slip stones, a fine hard abrasive stone. Used for stoning the pallet edges when refacing pallets and taking burrs off suspension spring material when you've punched a hole in it.  | £10    | Go for the one that is a 10-12 mm square section buy one new and look after it (it's brittle). Alternative is to go for ceramic slip stone from David Messon.   |
| <i>Degussit</i>                      | Lux      | Wkshp | Hardest of the stones, used for finishing hardened steel and cleaning the other stones.   | £12    | Just need a 6-10mm rectangular square section stick, buy new, or search out second hand from horological auctions etc.  |
| <i>Water of Ayre aka Tamoshanter</i> | Lux      | Wkshp | Fine abrasive stone, softer than arkansas. Not for use on steel, used for finishing brass. Some say that sometimes a piece of slate will have a similar quality - pick up a variety when visiting slate areas.  | £10    | Problem is they don't mine/retail this any more, so an ebay thing. Need c6mm section.   |
| <b>Apron</b>                         | Lux      | Wkshp | Plastic or cotton apron to protect clothes whilst cleaning.   | £10    | Almost anywhere. Cromwell tools for disposable plastic ones.  |
| <b>Archimedean Drill</b>             | Lux      | Tbx   | Look like a tiny 'yankee' screwdriver. Used for drilling small holes on site, really useful.<br>Trouble is you only tend to see watch-makers versions (modern ones tend to be really really nasty) these only take very tiny drills.  | £15    | Buy second hand (beware of reverse actions, they are around). Cousins sell one at £3.   |
| <b>Bench Anvil</b>                   | JIT      | Wkshp | Small bench anvil for work hardening wheels etc. Needs a flat top, which can be flattened further by scraping.<br>C 6 inches log will do.   | £10    | Available from many suppliers, e.g. Walshes, Cousins, Proops Bros.  |
| <b>Bench Micrometer</b>              | Lux      | Wkshp | Digital caliper on stand, for accurate measurement of all sorts, pivots on carriage clocks, jewels etc.   | £100   | Moore and Wright, or JKA Feintaster, buy second hand.   |
| <b>Benzine jar</b>                   | CCLux    | Wkshp | Flat glass jar with ground glass top for holding small amounts of solvents c80mm dia. Use at bench when cleaning items - you work in the jar. Tupperware or small jam-jar can substitute.<br>Only really of use if you are working on carriage clocks and/or watches.   | £30    | HS Walsh, Proops Bros. etc.   |
| <b>Bench Light</b>                   | Base     | Wkshp | Good workplace lighting is essential. Look for<br>- <i>Flexibility</i> - that the light can be easily moved to any point, and can be moved out of the way.<br>- <i>Quality of light</i> - light temperature is important, it should be as close to daylight as possible to allow for colour matching.<br>- <i>Unobtrusiveness</i> - a long reach, or compact light that does not get in the way on the bench. | £30    | Does not have to be an industrial quality light, high street shops that offer a good range of lights (e.g. Ikea, John Lewis, BHS) may offer cheaper options.  |
| <b>Binocular Microscope</b>          | CCBase   | Wkshp | If you want to work on carriage clocks, more or less a 'must'. Magnification between 15 and 20 times, a long-armed one for preference.  | £250   | e.g. Brunel ( <a href="http://www.brunelmicroscopes.co.uk">www.brunelmicroscopes.co.uk</a> )  |

| Item   | Priority | Where | Notes  | Budget | Purchasing advice  |
|--|----------|-------|--|--------|--|
| <b>Bolt Tool</b>                                     | JIT      | Wkshp | Small clamp with adjusters for holding an item at a particular angle to a stone. e.g. For polishing out the wear in deadbeat pallets.  | £0     | Can be made yourself. Also they come up at auctions, and people don't know what they are, so nice ones can be cheap.   |
| <b>Boxes (Plastic)</b>                               | Base     | Tbx   | For transporting clocks, important to give the correct impression for clients.<br>Need:<br>1) Large box c 55 litres for the clock itself.<br>2) Smaller one for the weights c 1 ft x 6 inches.   | £50    | Allibert Brand storage boxes available from a number of sites on the internet. e.g. tradesystems.co.uk   |
| <b>Boxwood Block</b>                                 | Base     | Tbx   | c 3/4 "x 3/4 " x 4" - for general filing and use as a drift if necessary.  | £0     | From internet, the people who do with ornamental turning. Also old chisels and mallets are often made out of boxwood and can be picked up very cheaply.  |
| <b>Brass Filings</b>                                 | Base     | Wkshp | To act as a heat sink when heating small items.  | £0     | Can be obtained from filing in the normal course of work, or fine turnings if sieved. Care should be taken not to mix iron filings in with the brass as they can be highly inflammable.  |
| <b>Broaches</b>                                      | Base     | Tbx   | For bushing making, colleting, make an undersized hole, then broach out.<br>Need a continuous range of cutting broaches (not smoothing broaches). All the sizes from 0.6mm to 10mm and put handles in them, keep the small ones in the tool box.<br>Make handles out of beechwood dowel, which can be bought in metre lengths.     | £211   | Only ones worth having are the Bergeon ones for the small sizes, up to 6mm £25 per set for small sizes, £43 for the larger set. - the cheap ones get thinner at the handle end and slip.<br>For sizes above 6 mm they have to be bought individually, 8 or so averaging £15 plus VAT.<br>Available from clockmakers suppliers, e.g. Cousins. |
| <b>Broom</b>   | Base     | Wkshp | A standard floor broom copes better with swarf than a vacuum cleaner, and is faster too. Traditional bristles are preferable as they absorb rather than spread oil.<br>Do not use the bench brush for the floor as it will spread oily deposits.   | £15    | Ironmongers or supermarket - this is a household item.   |
| <b>Brushes</b>                                       | ↓        | ↓     | ↓  | ↓      | ↓  |
| <i>Artists</i>                                       | JIT      | Tbx   | When vacuuming things, cleaning out corners etc. Size, #18.  | £10    | Major brushes - craft stores or internet.  |
| <i>Bench</i>   | Base     | Wkshp | Black Bristle (pure) bench brush - the plastic ones don't work properly as they pick up and retain oil and dirt.   | £6     | Jewellery suppliers e.g. Cookson.  |
| <i>Brass (Wire)</i>                                  | Base     | Wkshp | Soft Brass brush, for cleaning rusted steel items. Look for dense, fine wires, so as not to scratch with a wooden handle which is more comfortable to grip than plastic when wet.  | £7     | Internet, local diy store.   |
| <i>Chestnut</i>                                      | Lux      | Wkshp | (Small brush shaped a bit like a shaving brush).Cleaning plates etc cut bristles in half as they generally come too long.  | £10    | Axminster Tools.   |
| <i>Glasgow #2<br/>(aka watch or clockmakers brus</i> | Base     | Tbx   | Natural white bristle brushes, come in 4 grades. Hundreds of uses, applying chalk, removing gunk/dust etc. Useful all round tool.<br>1 is the stiffest, 4 is the finest - 2 is a good general purpose one.<br>Can be reused, wash out in washing up liquid & hot water, then once dry, in IMS and they'll last for 30 years or so. | £6     | If there is a discount for volume, then go for it, you will get through these brushes.<br>Second hand ones are brilliant as they've been 'run in'.<br>Brands: buy from Cousins or HS Walsh.  |
| <i>Glasgow #4<br/>Fibreglass<br/>Paint 1/2"</i>      | CCJIT    | Wkshp | As above, but finest will be needed for carriage clocks.   | £6     | Cousins or HS Walsh.   |
|  | Base     | Wkshp | For cleaning corrosion off objects.  | £2     | e.g. Cousins.  |
|  | Lux      | Tbx   | Round, varnish brush. cover the ferrule with masking tape so that it does not scratch objects when in use.<br>Long, well attached pure bristles, on a wooden, rather than plastic, handle is less likely to spread oil around the bench.   | £10    | Hamilton Perfection brand (from Axminster Tools, who do a set for £30.) Also available from many decorator's stores.   |
| <i>Paint 1"</i>                                      | Base     | Tbx   | As above.  | £10    | Hamilton Perfection brand or similar.  |
| <i>Washing out</i>                                   | Lux      | Tbx   | Similar in shape to small glasgow brush stiffer bristles and water resistant handle (e.g. bone).   | £10    | 2nd hand - ones with worn in bristles are lovely   |
| <b>Buff Sticks</b>                                   | Base     | Wkshp | For cleaning off steel items after hardening and/or tempering ( <u>not</u> as a file substitute).  | £0     | Make up by spray-mounting wet and dry paper onto thin strip of wood.   |
| <b>Burr</b>  | Base     | Wkshp | For removing the burrs from holes that are larger than a roller-sinker (see below). A ball ended tungsten carbide one, between 7 and 10mm diameter is ideal. Mount it in a file handle for use.  | £7     | Internet or market tool shop.  |
| <b>Burnisher</b>                                     | Lux      | Wkshp | A polished up piece of steel, can use it to roll metal back into place, useful as a luxury, but not something to go out and buy.   | £0     | Can be made use oval piece of silver steel, or needle in piece of wood.  |

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| <b>Bushing Tool</b>                  | Lux      | Wkshp | Comes into its own for 20th century clocks, can finish the bushes very quickly. Has a range of other uses, but is very expensive for this.  | £725   | Bergeon 6200. Complete set from Cousins, who also supply accessories/spares.   |
| <b>Calculator</b>                    | Base     | Tbx   | General calculations (if you don't have a tablet or smart phone).   | £1     | Pound shop.  |
| <b>Camera</b>                        | Base     | Tbx   | Reasonable digital camera, can be a compact rather than SLR shape. It doesn't need a lot of zoom, (c100mm is fine) and it only needs a medium pixel count. Priorities are, (by star rating) :<br>*** Large lens, ideally f1.8 to take advantage of available light.<br>*** Small f-stop, ideally f16 to provide depth of field.<br>*** Self-timer or remote trigger for stable shooting.<br>*** Aperture priority mode.<br>*** Macro mode.<br>** Take a filter e.g. Polariser to reduce reflections.<br>** Manual Focus, for fine control.<br>** Easy control of exposure, ideally offering bracketing.<br>** Have reasonable heft, for stability.<br>* Hotshoe, for flash options. | £200   | Depends on what you go for, £200 and a bit of patience will buy a second hand last-generation high-end compact camera, that meets the criteria e.g. Panasonic Lumix sourced from the internet.   |
| <b>Card</b>                          | JIT      | Tbx   | Thick card cut in c40mm strips for levelling clocks, putting under seatboards etc.  | £0     | Get from rubbish bins.   |
| <b>Centre Punch</b>                  | Base     | Tbx   | Can be made from silver steel. Avoid standard engineer's ones with knurled handles as the patterns tend to hold dirt and grease.  | £5     | Make yourself, or buy second hand if the opportunity arises.   |
| <b>Chalk Block</b>                   | Base     | Tbx   | For chalk brushing clocks once they've been cleaned, very mildly abrasive, it burnishes all the surfaces, has a slight lubricating quality, also helps prevent further tarnishing.  | £10    | If you can find suitably soft chalk, pick it up out of a field. Give it a good scrub etc. If you want to buy a block, you will get finer grading though a search for Gym Chalk on the internet should provide results.   |
| <b>Chisel (1/2")</b>                 | JIT      | Tbx   | For cutting and parring wood for wedges etc.  | £4     | 2nd hand, English made should provide good steel. Look in markets, auctions, internet etc.   |
| <b>Clip-Board</b>                    | Lux      | Tbx   | Taking notes, allows you to work off prompt-sheets, also useful for hanging up rating sheets near a clock being tested. A4 sized, not plastic covered as they pick up dirt.   | £5     | eg. Rapesco Masenite (or plywood and a bulldog clip). Buy from stationers.   |
| <b>Cloches</b>                       | CCBase   | Wkshp | To cover clock movements whilst they are being worked on.   | £8     | Look for special offers in supermarkets and garden centres.  |
| <b>Cutters</b>                       | ↓        | ↓     | Will not cut blue pivot steel - don't try. . One that will do so are 'Nippex' cutters. Can be sharpened, too a degree, as there is limited travel on the box-joint.   | ↓      | Get an old pair of Lindstrom cutters, there are no substitutes! (can be stoned if they are damaged, or filed very very slowly).<br>Alternatively buy cheap ones for market stalls and see them as consumables.   |
| <i>End</i>                           | Base     | Tbx   | Look for cutters with a bevel, the flush ones are too weak.   | £10    | See above.   |
| <i>Side, Small</i>                   | Lux      | Tbx   | Small c 100mm long.   | £10    | See above.   |
| <i>Side, Large</i>                   | Base     | Wkshp | c 200 mm for cutting wire, pins etc if the blade is ground and stoned to sharpen.   | £10    | Nippex brand recommended.  |
| <b>Diamond Disk, or Cup, Grinder</b> | Base     | Wkshp | For shaping and sharpening carbide and other very hard materials. Look for 1000 grit or finer.  | £30    | Wheels can be obtained off the internet e.g. arceurotrade.   |
| <b>Diamond Stones</b>                | Base     | Wkshp | Use for fine shaping of tools and hardened steel items. Not advisable for use on a lathe as there is a danger of diamond dust getting into the bearings.  | £20    | Purchase one of each coarse, medium, fine. No particular requirement for the better brands, so internet or local toolshop. e.g. Amtech at c6 per stone.  |
| <b>Dividers</b>                      | ↓        | ↓     | Spring dividers, with a knurled handle on top. Do not want them to be too heavy as the 19th century ones often are.   | ↓      | ↓  |
| 3"                                   | Lux      | Wkshp |   | £5     | Good: Moore & Wright. Starretts.   |
| 4"                                   | Base     | Tbx   | Nice to have is a quick release mechanism.  | £5     | Second hand ones should be cheap (c£5) and easily available (e.g. eBay).   |
| 6"                                   | Lux      | Wkshp |   | £5     |  |
| <i>Odd Legs</i>                      | Lux      | Wkshp |   | £5     |  |
| <b>Depthing Tool</b>                 | Base     | Wkshp | Workshop essential, the bigger the better. Used to find the optimum distance between two gears.<br>Ones where the runners are drilled through the casting rather than held by a clamp are much less likely to cause difficulties.   | £400   | JMW (Malcolm Wild, c£400) Cheap ones with flat clamps may be difficult to maintain accuracy.. As long as it is accurate end to end you learn to work with it. American ones may be good also e.g. Mount Vernan, Webster clock company.<br>If buying second hand, check from end to end to make sure they haven't been dropped. Hold vertically, and scribe a circle with the two points. Turn up the other way and scribe a second circle using the same centre point. The circles should be accurate to within a 20th of a mm. Any discernible difference with the eye and they are too far out. This can be corrected, but this is tricky. |

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|-------------------------------|----------|-------|---|--------|---|
| <b>Demagnetiser</b>           | JIT      | Wkshp | Inevitably tools get magnetised, and if you get involved in carriage clocks a demagnetiser is pretty much essential for tweezers or screwdrivers.   | £7     | Needs to work. Buy second hand, if you know it works, otherwise pocket sized ones are cheap off the internet.   |
| <b>Domed Stake</b>            | Lux      | Tbx   | Small mushroom shaped stake used for hardening brass, rivets and so forth.  | £0     | Can be made yourself, or use the back end of a hammer. Commercial ones available from clock suppliers e.g. HS Walsh.  |
| <b>Drawing Set</b>            | Base     | Tbx   | Ideally: Pair of spring dividers small, spring compass small, dividers large. (But really all you need are the compasses). These allow you to use the lead for drawing, as well as scribing smaller circles than the engineering dividers.  | £15    | Buy second hand (eg. ebay) Reifler, Rotring, Staedler. The internet should provide a good source.   |
| <b>Drills</b>                 | ↓        | ↓     | Drills should be ground, not rolled - gives greater precision.<br>Buy 2 sets of steel drills, and then modify one back for brass - much cheaper than buying the 'slow helix' version.   | ↓      | Go for a good brand of ground drills, e.g. Goering or Dormer - not Presto (the accuracy is not always there).   |
| <i>Imperial</i>               | Lux      | Wkshp | Up in 1/64" divisions to 1/2" - c 30 drills.  | £100   | See above.  |
| <i>Metric (for Steel)</i>     | Base     | Wkshp | 0.1mm division to 6 mm, .5 divisions to 12 mm.  | £100   | See above.  |
| <i>Metric (for Brass)</i>     | Base     | Wkshp | Most holes in horology have to be made in brass so these tend to be the most used set of drills.<br>These have a slow helix on them. Steel drills can be 'backed off' to make them more suitable for drilling brass.  | £200   | Probably better to go for 'backed off' steel drills - mark them clearly so they do not get confused.  |
| <i>Stands</i>                 | Lux      | Wkshp | In metal, allows both rapid access to the right size of drill and identification of missing drills.   | £40    | 2nd hand, ebay, market stalls etc. It is possible to make up a block out of plastic, wood or metal, but time-consuming.   |
| <i>Tungsten Carbide</i>       | JIT      | Wkshp | Set. 0.6mm to 1.2mm in .1mm separations.<br>Harder than HSS, so can get you out of trouble. On the other hand they are much more brittle, so inclined to snap and create difficulties.<br>For example use these when re-pivoting and a spade drill has work-hardened the end of the hole.   | £12    | Ex pcb drills are available on the internet. Alternatively Eternal Tools offer spade drills that are a lot stronger.  |
| <b>Drill Press</b>            | ↓        | ↓     | ↓   | ↓      | ↓   |
| <i>Large</i>                  | Base     | Wkshp | Must be substantial, large diameter column, and the chuck needs to go down to as near zero as possible.   | £150   | Buy 2nd hand, but be prepared to replace the chuck. Not Emco, Chinese or B&Q type ones. Fobco star or Meddings, Don't be afraid of getting them 20-30 years old.  |
| <i>Small</i>                  | Lux      | Wkshp | Can be useful to have a small, accurate, high speed drill for smaller holes. This saves re-setting the large one.   | £150   | As above.   |
| <b>Engineer's clamps</b>      | JIT      | Wkshp | Parallel sided clamps. Pair of each of the 4 sizes, for general work-holding and clamping. Very useful in a workshop.   | £80    | e.g. Eclipse 410, 411, 412, 413. Can buy these second hand, the internet being a good source.   |
| <b>Engineer's steel block</b> | Lux      | Wkshp | For light riveting and flattening - a 3"x3"x1" block of steel, ground square, and tempered.<br>(A 321 block may substitute (used for setting up milling machines).  | £20    | Second hand is fine, or can be bought from many jewellers suppliers (e.g. Proops). On the other hand, the back of a vice, or hammer will substitute.  |
| <b>Engineer's Square</b>      | ↓        | ↓     | ↓   | ↓      | ↓   |
| <i>4" Square</i>              | Base     | Wkshp | Basic marking out.  | £8     | Try Starretts, Mitutoyo, Moore & Wright, can get away with a second hand one  |
| <i>6" Square</i>              | JIT      | Wkshp | Marking out larger items.   | £8     | As above.   |
| <b>Eye Glasses</b>            | Base     | Tbx   | Very much a personal thing, some thoughts for clockmaking:<br><ul style="list-style-type: none"> <li>Buy low-power, need around 6 as they get lost. Aluminium ones, the plastic ones don't break - glass lenses - good idea to cut out a hole, they do not steam up, and you don't have to take them out and can see through the hole.</li> <li>For carriage clocks, consider a 15 and a 4 - need a) decent focal length and b) decent depth of field.</li> </ul> | £3     | Consider HS Walsh's Pioneer ones.   |
| <b>Files</b>                  | ↓        | ↓     | Good files, well treated, and used only on brass should last a lifetime. But this needs discipline.<br>Get a range of files, and then some cheap ones for use on steel - MARK THEM so they do not get mixed up.<br>Files will need attention when bought. Stone the edges so that they do not cut out at the corners.   | ↓      | File handles should be Python brand: Size 0 for 4", Size 1 for 6". These have a solid ferrule.<br>Good files: Valorbe, Grobet, or (slightly less so) Baita. Expect to pay c£25 per file.<br>Cheaper/disposable files: Tilger (or similar) from HS Walsh jewellery supplies or similar from Axminster tools.<br>Avoid the very cheap grey-painted files, they usually have uneven teeth. |
| <i>4" Hand File, cut zero</i> | JIT      | Wkshp | First quality.  | £25    |   |

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| 4" Hand File, cut two     | JIT      | Wkshp | First quality.  | £25    |  |
| 4" Hand File, cut four    | JIT      | Wkshp | A luxury, a worn out file can also work for this.   | £25    |  |
| 6" Hand File, cut zero    | JIT      | Wkshp | First quality.  | £25    |  |
| 6" Hand File, cut two     | Base     | Tbx   | First quality.  | £25    |  |
| 6" Hand File, cut four    | JIT      | Wkshp | A luxury, a worn out file can substitute.   | £25    |  |
| 6" Coarse Hand File       | JIT      | Wkshp | Second quality, rectangular cross section, one safe edge minimum of one.  | £25    |  |
| 6" Barette                | JIT      | Wkshp | First quality. Useful because it has a slight flex in it, which is useful for flattening bushes. (Wrap small piece of masking tape around end so it slides on the plate, apply pressure so slight curve contacts the bush: Bush can be filed flat without damaging the plate).  | £25    |  |
| 6" Crossing               | JIT      | Wkshp | First quality, needed when making new wheels.   | £25    |  |
| 8" Coarse Hand File       | JIT      | Wkshp | Second quality, rectangular cross section, one safe edge minimum of one   | £25    |  |
| 12" Bastard (Very Coarse) | JIT      | Wkshp | Minimum is one 12" second level quality "english engineers files" - it's bound to get ruined, chuck away and get another.   | £25    |  |
| 4" Half Round             | Lux      | Wkshp | First quality.  | £25    |  |
| 4" Crossing               | Lux      | Wkshp | First quality.  | £25    |  |
| 4" Barette                | Lux      | Wkshp | First quality.  | £25    |  |
| 6" Half Round             | Lux      | Wkshp | First quality.  | £25    |  |
| <b>Files - miniature</b>  | -        | -     |   |        |  |
| Needle                    | Base     | Tbx   | So many shapes and sizes, buy on ebay as pot luck and build a collection, you cannot predict what is the next one you want. It can also be useful to re-shape or adapt needle files for specialist jobs, use a diamond wheel for this.  | £10    | An assorted set, would be nice, otherwise buy second hand and build up a drawer.   |
| Escapement, Square        | JIT      | Wkshp | These are finer cut and smaller than needle files, used for finishing and tweaking collets, gathering pallets, 2nds hands etc.  | £12    | Buy new, unlikely to be able to find decent second hand examples. Brands as above.   |
| Escapement, Round         | JIT      | Wkshp | See above.  | £12    |  |
| Escapement, Flat          | JIT      | Wkshp | See above.  | £12    |  |
| Escapement, Barrett       | JIT      | Wkshp | File the end off and grind the edges off this.  | £12    |  |
| Escapement, Set           | Lux      | Wkshp | Standard set of 12.   | £100   | Walsh's Cousins, Nathaniel Shesto.   |
| Pivot                     | Base     | Tbx   | For polishing or cleaning brass stains off pivots.  | £25    | Can buy this second hand at BHI Auctions and the like.   |
| <b>File Cleaner</b>       | Base     | Tbx   | Can use an old piece of brass.  | £0     | N/A.   |
| <b>Fire Bricks</b>        | Base     | Wkshp | Sheet of fire resistant material (asbestos free) e.g Supablox or Millboard which comes in 300 mm square. Buy what you need once you've designed the hearth area in the workshop.<br><br>WARNING classic refractory firebrick can be hydroscopic which can be dangerous in a hearth when fierce heat is rapidly applied (explode). | £50    | Budget based on a small selection of Supablox and Millboard from HS Walsh's web site.  |
| <b>Forceps</b>            | Base     | Wkshp | For holding small hot items whilst heating, hardening and tempering.<br><br>Alternatively use self-locking tweezers   | £5     | Internet (e.g. Proops) or local toolshop or market stall. If they are particularly cheap, buy several pairs as they have a limited life-expectancy. Cousins sell a 'soldering tweezer Set' as an alternative to forceps. |
| <b>Glass</b>              | JIT      | Wkshp | Minimum 300mm square, plate glass 1/2" Use to glue a piece of paper to it to polish it absolutely flat. Fine papers can be 'floated' on a glass sheet using a thin skim of oil on the surface and 'sticking' the paper to it using surface tension.   | £12    | Glass merchant should be able to do an off-cut.  |
| <b>Gravers</b>            | ↓        | ↓     | Put a lightweight handle on them e.g. hardwood made out of drum sticks, aluminium off-cuts or old bios. The important thing is to have a solid button at the bottom so that were the graver to catch when turning it does not spear your wrist.   | ↓      | ↓  |
| Lozenge                   | Base     | Tbx   | Start with the largest lozenge shaped graver you can get c c4mm x 5mm, go for chunky.   | £10    | HS Walsh, or other clockmaker's supplies.  |
| Square                    | Lux      | Wkshp | Not as useful as lozenge, but nice to have.   | £10    | As above.  |
| Tungsten Carbide          | Lux      | Wkshp | Useful for fine work on hard materials e.g. when re-pivoting, but chip easily.  | -      | Can be made out of old carbide drills using a diamond grinder. Alternatively Eternal Tools or Gloster tools.   |

| Item                               | Priority | Where | Notes  | Budget | Purchasing advice  |
|------------------------------------|----------|-------|--|--------|--|
| <b>Grinder</b>                     | Base     | Wkshp | For sharpening HSS tools, e.g. lathe tools. Should have a substantial rest set to 15° to facilitate sharpening lathe tools.<br><br>Ideally should have a vacuum to catch the sparks, but this is a luxury. In any case, should not be used in the 'clean' workshop, as it will throw off abrasive, and they will get into pivots.      | £25    | Go for cheap - you may need to replace the wheels, and possibly upgrade the rests. e.g. Screwfix.  |
| <b>Hammer</b>                      | ↓        | ↓     | Hammers may need polishing once purchased - any marks in the head will replicate into the surface being hammered.<br><br>Should be radiused - take the edge off the head so that if you miss hammer you don't get a clear mark.  | ↓      | Try: Whitehouse, or AF<br>All can be bought second hand.   |
| <i>Ball Pein 1/4 lb</i>            | Base     | Tbx   | A small one, for general purpose work.   | £8     | See above.   |
| <i>Ball Pein 1/2 lb</i>            | Lux      | Wkshp | Useful general purpose tool.   | £10    | See above.   |
| <i>Brass</i>                       | Base     | Tbx   | A slightly more dead blow than a steel hammer and grips when you hit with it, use it for things like driving pins. (Do not bother to polish).  | £0     | Can be made from a piece of scrap brass.   |
| <i>Copper hammer</i>               | Lux      | Wkshp | Smallest that people make, softer than brass so provides a 'dead' strike.  | £10    | Tool stores, or internet   |
| <i>Nylon Mallet</i>                | Lux      | Wkshp | Gets a lot of use, smallest you can get is what is needed.   | £10    | As above.  |
| <i>White Rubber Mallet</i>         | Lux      | Wkshp | NOT black one, they leave a mark.  | £10    | As above.  |
| <i>Watchmakers's hammer</i>        | Lux      | Tbx   | Small cross-pein for tiny riveting operations, gives delicacy of weight, aim for about a 2 ounce one.  | £8     | As above.  |
| <b>Hand Drill</b>                  | Base     | Tbx   | For minor works, and for fixing cases to walls.<br><br>No problems with flat batteries. Need good quality with double bevel gear, look for small one.  | £20    | 2nd hand.  |
| <b>Hazardous Substance Cabinet</b> | Base     | Wkshp | To keep inflammable liquids in without invalidating insurance.   | £200   | Budget based on small (915x457mm) cabinet from Screwfix, but there are plenty of alternative sources.  |
| <b>Hearth</b>                      | Base     | Wkshp | 1/32 mild steel sheet bent up (ideally with apron) Minimum dimensions 600mm deep x 600mm wide (ideally 800) 120 mm high. Filled with firebricks. Keeps mess contained.   | £0     | Can make from scrap See Firebricks above for fitting it out. Budget assumes you have access to the carcasses of an old washing machine or other white goods available.   |
| <b>Jewelling Set</b>               | CCBase   | Wkshp | Essential for carriage clocks, not generally needed for ordinary clocks - primary differences between this and a staking set are that the scale is smaller, and there is micrometer control over the depth.  | £200   | 2nd hand, aim to pay £80-200 go for Sitz. New, Sitz or Horia but expect to pay c£600.  |
| <b>Lab Coat</b>                    | Lux      | Tbx   | A matter of sartorial taste! Generally a white one is most acceptable. Brown and blue send the wrong message to collectors.  | £25    | Try online - prices range from £10 to 50. Available from John Lewis for c£25.  |
| <b>Lathe - Large</b>               | Base     | Wkshp | For general purpose turning. Needs drilling tailstock and a screw-cutting facility (change wheels or gear box.) Whilst metric is nice, difficult to find in older machines and not essential.  | £3,000 | A well looked after second hand model is ideal. Check the bed for scarring - walk away from battered beds. Remove the tailstock and move the saddle along the full extent of the bed. If it is noticeably tighter at the tailstock than the headstock, then walk away. |
| <i>Collets</i>                     | Base     | Wkshp | Ideally to fit lathe type, alternatively a set of the largest ER series that will fit the lathe, along with a Collet holder.   | £150   | Good source for buying second hand are the adverts at Lathes.co.uk.  |
| <i>Centre, fixed</i>               | Base     | Wkshp | Male one most useful, ideally also a female one.   | £25    | Models to look for:  |
| <i>Centre, Rotating</i>            | Base     | Wkshp | To fit tailstock.  | £30    |  |
| <i>Chuck, 3 jaw</i>                | Base     | Wkshp | Needs internal/external jaws.  | £75    | • Myford Super 7, parts and accessories are easy to get, although it is unusual to find a metric one. Although they were originally supposed to be light duty many have survived very well, and they are common.   |
| <i>Chuck, 4-jaw</i>                | JIT      | Wkshp | Reversible independent jaws for holding odd-shaped work-pieces.  | £75    |  |
| <i>Dividing Plates</i>             | JIT      | Wkshp | Will also need a method to attach these to the headstock. It is reasonably easy to make an arbor for most lathes.  | £200   | • Boxford or Colchester, are both solid models, but parts are difficult to find, so the original purchase must be fully equipped.  |
| <i>Drill-Chuck</i>                 | Base     | Wkshp | To fit tailstock.  | £40    |  |
| <i>Driving Plate and dogs</i>      | Lux      | Wkshp | For turning between centres.   | £150   | A well looked after second hand model is ideal. Check the bed for scarring - walk away from battered beds. Remove the tailstock and move the saddle along the full extent of the bed. If it is noticeably tighter at the tailstock than the headstock, then walk away. |
| <i>Face Plate</i>                  | JIT      | Wkshp | For holding wood, which in turn can be cut to hold large or unusual items.   | £30    |  |
| <i>Gear Cutting wheels</i>         | JIT      | Wkshp | Buy cutters as and when you need them and gradually build up a collection.<br><br>Be careful that the cutters you buy have the correct cycloidal profile for clocks, most will be involute.<br><br>Often is possible to use fly-cutters to cut wheels, but achieving the correct profile takes time, practice, and considerable skill. | £1,000 | Thornton's is the brand to get, but c £80 per cutter.<br>Bergeon are reputed to be good, but more complex to use.  |

| Item                            | Priority | Where | Notes   | Budget | Purchasing advice   |
|---------------------------------|----------|-------|---|--------|---|
| Lantern Runner                  | JIT      | Wkshp | For turning and polishing pivots  | £180   | Can be made, although at least a couple of day's work. Do occasionally come up on ebay.   |
| Light                           | Base     | Wkshp | A good light on the lathe makes a significant difference to both safety and the experience.<br><b>DO NOT USE FLUORESCENT BULBS</b> , including many 'eco bulbs'. <b>They can be dangerous around machine tools.</b> A 'strobe' effect can develop whereby a fast turning machine appears to be stationary.  | £40    | Does not have to be a purpose made lathe light. A clip-on or floor-standing spotlight from one of the high street furniture shops (e.g. John Lewis, Ikea, BHS) may work as well for significantly less cost.  |
| T-Rest                          | JIT      | Wkshp | Useful for turning pieces for holding materials and occasional use of large graver.   | £100   |   |
| Tool, Boring (holder)           | Lux      | Wkshp | For all sorts of internal cutting.  | £40    | A piece of brass drilled out then slotted along the side allows boring tools to be used in a standard holder.   |
| Tool, parting off holder        | Base     | Wkshp | With tool-holder to fit the tool post/quick change post.  | £40    | Need 2 sets of blades one shaped for steel, one for brass.  |
| Tool-steel                      | Base     | Wkshp | To fit, ground to various cutting shapes.   | £30    | Chronos, RDG Tools and other internet suppliers.  |
| Quick-change post               | Base     | Wkshp | Makes a real difference to efficiency when using the lathe.   | £70    | Most model engineering suppliers, e.g. Chronos, RDG Tools etc.  |
| <b>Lathe - Watch\Clockmaker</b> | Base     | Wkshp | Used for Pivoting and straightening pivots. 8mm collet size watchmaker's lathe, standard swiss pattern, 20mm diameter D bed with tail-stock. Mount this on small board cA3 size with lip around to increase flexibility.  | £1,000 | 6mm ones no more precision, but you can't put 8mm stock in a 6mm lathe but you can do the other way round, but if you have one, it is not worth swapping.<br>At a push a good small model engineering lathe can also be used, e.g. Austrian manufactured of Emco 3. |
| Collets                         | Base     | Wkshp | Full set 0.1-5mm in .1 steps is ideal. Can get away with a smaller set by having larger gaps between the larger collets.  | £200   | Ebay or horological auctions.   |
| Hand-wheel                      | Lux      | Wkshp | Although marked as Lux, some people would classify this as a Base. Allows complete control of fine turning for pivoting etc.  | £150   | Second hand from ebay, or horological auctions.   |
| 3-Jaw Chuck                     | Lux      | Wkshp | Seldom needed on a watchmaker's lathe.  | £150   | Second hand.  |
| 6-Jaw Chuck                     | Lux      | Wkshp | Boxwood can be used as a substitute   | £700   | Second hand   |
| T-Rest                          | Base     | Wkshp | Requirement for use with graver.  | £100   | If bought new, but usually comes as a part of the original purchase.  |
| Rotating Centre                 | Lux      | Wkshp | Supports work when turning between centres.   | £40    | Chronos, or RDG Tools.  |
| Lantern Runner                  | JIT      | Wkshp | For polishing and finishing pivots.   | £180   | Fetch quite a price on ebay, try BHI or other horological meetings, or make it yourself   |
| Fixed Centre                    | Base     | Wkshp | Supporting work & turning between centres.  | £0     | Can be turned up from a piece of silver steel.  |
| <b>Let down tool</b>            | Base     | Tbx   | For the safe let down of main springs, comes with all 12 key sizes, and a smooth handle.  | £12    | Buy on ebay - the English ones are better than German.  |
| <b>Lifters</b>                  | CCBase   | Wkshp | Hands lifters to remove hands from small clocks without damaging them are a must.   | £50    | Can be made from silver steel, otherwise HS Walsh or Cousins.   |
| <b>Microset Timer</b>           | Lux      | Wkshp | Electronic frequency analyser with specific software for clocks. Listens for either sound or uses photocell to time clocks. Gives precision on the rate.<br>A luxury, can be used as a fault-finding tool.<br>There are other timers available on the market, e.g. Wyttschi, or Greiner, but these are watch-timers and struggle for pendulum based clocks. | £300   | New Mumford Technologies California. (There are apps and computer software for this).   |
| <b>Mitutoyo</b>                 | Base     | Tbx   | Digital calliper, a basic tool for all sorts of measurement   | £65    | Accept no other brand. Can be bought 2nd hand, but be prepared to stone the jaws if they've been dropped.   |
| <b>Oil Can</b>                  | Base     | Wkshp | Use for applying oil to lathe and as a cutting fluid when drilling or turning for a fine finish.<br>A plastic bottle with a fine nozzle can be used as an alternative.  |        | Internet or local/market stall toolshop. Look for one that has a reasonably fine nozzle, but most importantly has good control over flow. (i.e. does not flood the work item).  |
| <b>Oilers</b>                   | Base     | Tbx   | For application of oil to pivots and other moving parts.<br>You can make your own out of a bit of hard brass wire (and as they get lost frequently, this may be a good idea.)<br>Hammer one end flat, file it into a point. Bending a loop in the other end helps to make sure you pick it up the correct way round.  | £0     | N/A.  |
| <b>Oil Pots</b>                 | Base     | Tbx   | Small pot (lidded) for oil, so as not to contaminate your main supply. Will need 3.   | £5     | Ebay or HS Walsh.   |

| Item                       | Priority | Where | Notes   | Budget | Purchasing advice   |
|----------------------------|----------|-------|---|--------|---|
| <b>Oil Stand</b>           | Lux      | Tbx   | (Can use oil pots) Small stand that you put the oil in prior to oiling, so as not to contaminate your main supply - has 3 or 4 small pots for different quality oils, You will probably need a 3-pot version, need to be able to see how much oil is in them, and they need to be lidded so that they don't gather dust.  | £10    | Ebay - second hand are fine, just make sure the cups are there.<br>New, a range - Bergeon c £100-150, indian/chinese versions, c£20, the pressed plastic ones £4.                             |
| <b>Peg Wood Knife</b>      | Lux      | Tbx   | A small sharp knife is what a traditional clockmaker would have (a good quality penknife will do).  | £5     | Second hand shop.   |
| <b>Pendulum Splints</b>    | Base     | Tbx   | Pieces of plywood cut to be bound round pendulum rods to protect them in transport. a 1.4 metre long version can be used for smaller pendulums.   | £5     | Make them yourself.   |
| <b>Pencil Case</b>         | Lux      | Tbx   | (To keep your pencils together.)  | £3     | Any stationers  |
| <b>Photographic Trays</b>  | Base     | Wkshp | For putting components in when disassembling stuff, also for cleaning things.<br>Should be resistant to chemicals - Note: do not use garden seed trays! Think both of the image and the potential for breakage on a client site.<br>Need at least one of a fair size, big enough to be able to put a whole clock in, light enough to take with you.   | £50    | Preservation Equipment Limited is good supplier of this sort of stuff.<br>Or photographic trays from Patterson (come in a set of 3) from camera stores.                                       |
| <b>Photographic Scales</b> | Base     | Tbx   | Can be printed out on computer printer.   | £0     | Print.  |
| <b>Piercing Saw</b>        | ↓        | ↓     | ↓   | ↓      | ↓   |
| <i>Frame</i>               | Base     | Tbx   | (AKA Jeweller's Saw) Used for crossing out wheels and a thousand other things. Look for one with at least a 4" depth (blade to frame). Adjustable Frame ones nice to have as they allow the use of broken frames.   | £8     | Pioneer ones are all right. Historic ones ok. Grobet one has different blade holding mechanism which some prefer.   |
| <i>Blades</i>              | Base     | Tbx   | Look for ones with a rounded back. Use fine ones (00 or 0000) as they cut quicker and turn easier - down side is they break more easily.  | £3     | UMV Super Glardon (pricing is for 12 blades), or Bergeon from HS Walsh.   |
| <i>Table</i>               | Base     | Tbx   | Can be home made from scrap 1/2 inch ply c150 mm x 200 mm and a 150mm piece of 2 by 3 or similar bar. Cut a 'V' in one of the short ends of the ply, around 50mm deep. Screw the bar to the underside at the other end of the ply. This can then be clamped in a vice.  | £0     | Alternatively buy a fret saw table from the internet, around £5.  |
| <b>Pin Tongs</b>           | Lux      | Tbx   | Great for holding flat items, must be drilled through the handle for putting wire in.<br>Look for c1/2" wide, nice handle, nice weight, but most importantly need to be FLAT at the end.<br>Jaws don't really need to open up beyond parallel.  | £5     | Buy second hand, no particular branding needed.   |
| <b>Pin Vice Set</b>        | Base     | Tbx   | Set should contain 3 or 4 pin vices, come in a graduated set from zero on. A good pin vice will close down to zero, some of them don't<br>Steel collet on a brass handle are a good thing as they don't get totally stuck. On the other hand, if the collet is integral, then that can't get lost.<br>The type with a spare collet in the end have the drawback that you tend to lose it. Anything with multiple bits tend to get lost.<br>Double ended ones are not a good idea either as you'll end up having to take off the end for long wire, and then it gets lost. | £20    | Eclipse of Sheffield (although these are all steel), Starrett's, Bergeron, but make sure you buy a set, not individual items.<br>Buy second hand, they are about £50 for a set new.           |
| <b>Pliers</b>              | ↓        | ↓     | Should have a box joint, no springs (if they come with them, then remove them)<br>Close fitting jaws, no play, ideally no plastic on the handles.<br>Sometimes it is really useful to have cheap, disposable ones though so keep an eye out.  | ↓      | Best brand is Swedish, Lindstrom (c £50 per pair) tend to be smaller sizes. Elliot Lucas, or Wilkinsons are good subs - Walsh's sell a range of German pliers at c £20 are a good compromise. |
| <i>Brass lined</i>         | Base     | Tbx   | Inexpensive ones for dissembling clocks, day in day out, semi-disposable, can be modified to hold things that are not flat  | £8     | Go for a pair of cheap ones from model engineering shows/shops or somewhere like Proops.  |
| <i>Combination pliers</i>  | Base     | Wkshp | 'Standard' pliers with the cut-out in the nose and cutters on the sides. Will get occasional use.   | £5     | Get cheap ones, they only get used now and again. Proops or similar   |
| <i>Flat wide nosed</i>     | Base     | Tbx   | Should meet at the ends, not fit flat all the way along.  | £5     | Wilkinson's wide nosed, used to be issued to GPO en mass, get them from ebay  |
| <i>Half round</i>          | Base     | Wkshp | May need them.  | £5     | German ones from HJ Walsh   |
| <i>Needle Nosed</i>        | Base     | Wkshp | Might use these for bending round corners in wire.  | £5     | German ones from HJ Walsh   |

| Item                                | Priority | Where | Notes  | Budget | Purchasing advice   |
|-------------------------------------|----------|-------|--|--------|---|
| <i>Mainspring Pliers</i>            | Base     | Wkshp | Flat ended pliers radiused around the outside of the upper jaw and on the inside of the lower jaw to grip springs <u>without</u> creasing them. A cheap pair of pliers will do.  | £5     | Internet, market stalls or cheap tool shops.  |
| <b>Polishers</b>                    | JIT      | Wkshp | Made from scraps of tin, copper, or zinc. Used with diamantine for fine polishing. Use a piece around 100mm long and a few mm wide. File to an overall shape similar to a barrette file, and a trapezoid cross section. Use the broad side for polishing                             | £0     | Use scrap materials.  |
| <b>Puffer</b>                       | Base     | Tbx   | Used for blowing dust out of inaccessible places. Simply blowing is not recommended as it will distribute small saliva droplets on the mechanism. Over time these will corrode the brass and achieve a pock-marked effect. Go for photographic type, not the small watchmaker's one. | £8     | Cheaper from photographic suppliers as part of a lens cleaning kit.   |
| <b>Punch Set</b>                    | ↓        | ↓     | ↓  | ↓      | ↓   |
| <i>Letter</i>                       | JIT      | Tbx   | For stamping your own tools and things you make eg. new wheels, to identify in the future. Go for a 1/32nd set.  | £15    | e.g. Pryor punches, second hand ok, but check set is complete.  |
| <i>Number</i>                       | JIT      | Tbx   | As above, for dating a component.  | £15    | Ebay.   |
| <b>Protractor</b>                   | Base     | Tbx   | For marking out. Go for one that has half degrees marked.  | £2     | Stationers.   |
| <b>Protective Wear</b>              | ↓        | ↓     | ↓  | ↓      | ↓   |
| <i>Gauntlets</i>                    | Base     | Wkshp | When undertaking hot-metal operations, e.g. casting  | £5     | Trade supply stores. e.g. Screwfix  |
| <i>Ear Defenders</i>                | Base     | Wkshp | Advisable as small workshops can reflect and condense noise from operations like grinding.   | £7     | Screwfix  |
| <i>Face Shield</i>                  | Base     | Wkshp | There are some operations, e.g. fly cutting, when something more than just eye protection is advisable.  | £15    | Screwfix offer a range, including polycarbonate one for extra strength.   |
| <i>Leather Apron</i>                | JIT      | Wkshp | Purchase if contemplating any casting activities, lead, pewter or brass.   | £18    | Trade supply stores e.g. Cowhide leather welding apron from Screwfix.   |
| <i>Safety Boots</i>                 | JIT      | Wkshp | Solid leather, preferably steel toe-caps. Use for casting activities or those involving moving or lifting heavy weights.   | £40    | From specialist workwear shops or general suppliers e.g. Screwfix offer a range.  |
| <i>Safety Glasses</i>               | Base     | Wkshp | For wear in any operation that might generate flying metal or other debris, e.g. drilling, machining, grinding.  | £12    | Screwfix offer a range.   |
| <b>Relative Humidity (RH) Meter</b> | Base     | TbX   | For measuring the environmental conditions in which a clock is kept. If 70 (or near) there is a real danger of condensation and/or moulds forming. If too low (40's or below) the wood in the case is vulnerable to cracking.  | £50    | From Internet. Need to be sure the meter is responsive, (sampling rate should be stated) cheaper meters can take some time to register.         |
| <b>Roller Sinker</b>                | Base     | Tbx   | Come in a set of six, perfect tool for cutting oil-sinks after re-bushing, accept no alternatives.   | £80    | Always buy new. HS Walsh, supply Bergeon versions, but if you can find pattern copies they may do.  |
| <b>Rulers</b>                       | ↓        | ↓     | ↓  |        |   |
| <i>12"</i>                          | Base     | Tbx   | Steel ruler with deep (and accurate) engraving so that spring dividers will sit in them.   | £15    | Mitutoyo are good, As are some of the older makes, e.g. Chesterman Rabone 64r.  |
| <i>6"</i>                           | Base     | Tbx   | Need to have 1/2 mm divisions, and Imperial.   | £15    |   |
| <b>Safe</b>                         | CCBase   | Wkshp | To insurance specification to leave small valuable clocks in overnight.  | £300   | Budget is based on a number of fire/flood rated safes of c 20-30 litres from Screwfix.  |
| <b>Saw</b>                          | ↓        | ↓     | ↓  | ↓      | ↓   |
| <i>Back</i>                         | Base     | Tbx   | Fine toothed for cutting skirting boards etc. 6 to 8 inch blade.   | £7     | Second hand is fine.  |
| <i>Fret</i>                         | Lux      | Wkshp | Use one with piercing saw blades very occasionally for it's deep reach.  | £7     | Second hand.  |
| <b>Scissors</b>                     | Base     | Wkshp | For prototyping in paper/card, can also be used for thin brass.<br>Go for solid c 250mm.   | £5     | e.g. Fiskars kitchen scissors, can be bought second hand.   |
| <b>Scalpel</b>                      | Base     | Tbx   | For general scraping and delving, removing small areas of corrosion, cutting paper etc.  | £7     | Small Swann Morton #3 - look for older types that have the nickel handles - more modern ones rust more.<br>Buy handles second hand, blades new. |
| <b>Screwdrivers</b>                 | ↓        | ↓     | ↓  | ↓      | ↓   |
| <i>Clock</i>                        | Base     | Tbx   | Cabinet maker's screwdriver (3 inch) has a nice curvy wooden handle, (plastic gathers oil) and are easy to file.   | £5     | •Off ebay, should be able to get them for next to nothing.<br>•or from Axminster Tools for c £5   |
| <i>Watchmaker's (Large)</i>         | Base     | Tbx   | Need this as well as a set for the general run of clocks.  | £10    | Can be made yourself, but more realistically from ebay.   |

| Item                              | Priority | Where | Notes  | Budget | Purchasing advice  |
|-----------------------------------|----------|-------|--|--------|--|
| <i>Watchmaker's (Set)</i>         | Base     | Tbx   | Need a watchmaker's screwdriver set, for working on carriage clocks, watches etc. The beauty is in the box, which can be taken with you to site, as opposed to the bench set, which are difficult to transport.  | £35    | AF brand name (from France), or Bergeron if you are feeling flush. Avoid the cheap ones, the ends are not free rotating, and the chrome plating shells off.  |
| <b>Screw Plates</b>               | Lux      | Wkshp | For cutting threads - tap and die very rarely fit historic threads, and screws get lost more often than holes.   | £60    | Buy all you can afford £8 and £10 per plate. (although can be made if you have a screw-cutting lathe by making a tap then cut the hole, but laborious).  |
| <b>Scriber</b>                    | Base     | Tbx   | Can be made from silver steel quite simply.  | £0     | Make.  |
| <b>Seatboard blocks</b>           | Base     | Tbx   | Smart wooden blocks about 4' long, 2 or 3 inches square used to go under the seatboard of a clock that has been removed (should be in the toolbox when visiting a client's house, looks professional).   | £0     | Make.  |
| <b>Sharpening Stone</b>           | Base     | Tbx   | These should be ceramic, as oilstone gets clogged, aim for 1000 grade.<br>A large and small example should cope with most conditions - small stones can be shaped for particular applications.<br>Steer clear of diamond stones, any debris may find its way into bearings! (The aluminium oxide in ceramic ones will eventually break down, diamond won't).   | £60    | Good: Global Ceramic 1000 grade (Japan); Spyder Co, Degussit. Look also at kitchen and 'outward bound' suppliers, they may be cheaper than horological ones.   |
| <b>Sieve</b>                      | Base     | Wkshp | Cheap plastic sieve for drying off components in grit-o-cobs - not metal, it will scratch components.  | £1     | Pound store.   |
| <b>Site Lamp</b>                  | JIT      | TBX   | Sturdy workplace lamp for when working on-site in large houses. Needs to be lightweight, robust, ideally IP54, low heat, and constructed so as not to damage anything it knocks against (not metal).   | £30    | The Thorsman Goliath seems to be the standard one used by institutions such as the National Trust.<br>Available all over the Internet.   |
| <b>Soldering Kit (Gas)</b>        | Base     | Wkshp | Well built, a range of burners, fits straight onto standard gas bottle, parts available. Avoid type that fit onto a canister.  | £150   | Sievert strongly advised - can buy these second hand, but that is possibly 'Brave'.<br>Also need to budget for a gas canister and regulator, included in the budget cost.  |
| <b>Spanners (Open ended/Ring)</b> | Base     | Wkshp | Mostly for use on the lathe. Metric and/or Imperial, dependant on the lathe.   | £20    | Anywhere, need reasonable quality to get accuracy.   |
| <b>Spirit Lamp</b>                | Base     | Tbx   | Use for soft soldering and sometimes for blueing, gives small controlled flame. With care it is possible to use a gas torch instead.<br>Note the tops have a much shorter life expectancy than the bottoms.  | £10    | Ebay, or HS Walsh.   |
| <b>Spirit Level (small)</b>       | Lux      | Tbx   | For setting up photographs, levelling both camera and objects.   | £5     | Market stall, or ebay.   |
| <b>Split Stake</b>                | Base     | Tbx   | (aka a row of holes) - used in a vice to hold any round item, screws, lantern pinions etc. Because it is brass it holds things without damaging them.  | £3     | Can be made yourself or bought for about £3 - Cousins, Walshes, Proops etc.  |
| <b>Stanley Knife</b>              | Base     | Tbx   | Those with a retractable blade tend to slip when they are worn.  | £5     | DIY store.   |
| <b>Spring Winder</b>              | Base     | Wkshp | Used for safely (for you and the clock) removing and refitting main springs. Don't be tempted to start trying to pull mainsprings out, you will both distort the spring and gouge out the end of the barrel.   | £175   | Get one of the relatively inexpensive american ones and modify it so that it does not use the barrel's own arbor. i.e So that it works like the English ones, then you don't risk damaging the arbors. (These are difficult to get and expensive though.) c £150 - £200  |
| <b>Staking Set</b>                | Base     | Wkshp | Invaluable, used for punching and riveting things, look for the small watchmaker's type. Very useful generally around a workshop. Ideally you should keep one for rough work, one for fine work, and keep them apart.<br>Some come with an 'inverto base' that can allows punching from underneath if you can find one it is nice to have.<br>Need at least to have the medium sized set (c 100 punches), including flat punches and the fine ones.<br>Note, the larger clock-maker's one is very much a luxury. | £50    | Buy second hand. All the French, Swiss or German ones are good, Japanese are also quite nice. Brand names to look for include 'Favorite'. ... keep an eye on whether the fine punches are broken or missing.<br>Occasionally small sets of stakes (without the stand/holder) come up, these are useful for the tool-box. |
| <b>Surface Plate</b>              | Lux      | Wkshp | Made in Cast Iron or Granite used as a flat surface reference edge.  | £50    | Ebay (but people are unlikely to post these).<br>An alternative is to purchase a piece of Granite from a kitchen worktop specialist - the piece cut out for the sink can often be obtained very cheaply.   |
| <b>Tap and Die Set</b>            | ↓        | ↓     | One of each, both plug and taper taps and dies must be the split sort.<br>Note quality counts - newer ones may not even be the right size - die holders should be cast steel not cast zinc.<br>If you can find taps with a centre hole in the back end, these are great for centring on a lathe.   | ↓      | Look for Lyndon or older British ones e.g Lahman Archer Lane. For most uses you can get away with plain carbon steel inexpensive items, e.g. Bott Brand.   |
| <i>BA</i>                         | JIT      | Tbx   | Down to at least 12 BA.  | £40    |  |

| Item                          | Priority | Where | Notes   | Budget | Purchasing advice  |
|-------------------------------|----------|-------|---|--------|--|
| <i>Metric</i>                 | JIT      | Tbx   | Small sizes typically M2, M2.5 plus standard M3 set.  | £40    |  |
| <i>Whitworth</i>              | JIT      | Tbx   | Standard sizes from 1/32 up to 1/2".  | £40    |  |
| <b>Tape Measure</b>           | Base     | Tbx   | Standard steel tape measure, must have imperial on them - don't need anything longer than 3 meters.<br>Avoid anything with a soft-grip type surface, soaks up oil and dirt.   | £5     | Old Stanley ones are good, but check they were of the era that were made in France as they are tougher.  |
| <b>Tinsnips</b>               | ↓        | ↓     | ↓   | ↓      | ↓  |
| <i>Aerosnips</i>              | JIT      | Wkshp | For roughing out sheet brass.   | £15    | Buy cheap ones, from market stalls, internet etc.  |
| <i>Jewellers snips</i>        | JIT      | Tbx   | c 200mm long.   | £20    | From second hand shops or Axminster's Gilbow jeweller's snips.   |
| <b>Toolbox</b>                | Base     | Tbx   | Engineer's toolbox to store tools safely and prevent damage.<br>Thought is needed as to the image you want to project. A traditional wooden one looks good, but is heavy, wastes a lot of space, and more importantly is unwieldy, so may bang into client's furniture and doors. A plastic one will not look as good, but does less damage. A metal one is for garages.  | £100   | Buy from ebay, but patience is needed if you want a wooden one, as some go for silly prices.   |
| <b>Torch (Flashlight)</b>     | Base     | Tbx   | For use in historic houses for peering into the movements, not tripping over cats etc. Reasonable size, bright beam, robust.  | £35    | Go for function over fashion (e.g. Ledlenser rather than Maglight).  |
| <b>Transit Blankets</b>       | Base     | Tbx   | Packing, handling, transportation - you will need at least a dozen of these. Caution, when new have a fire retardant on them, need to be washed as the fire retardant will off-gas and cause damage.  | £25    | Buy from the internet, buy in quantity. Should be c £25 for 10.  |
| <b>Tripod</b>                 | Base     | Tbx   | Required for on-the-fly photography, allows slow shutter speeds.<br>Solid item, ideally not with a ball adjustment as this is difficult to set up look for a tilt and pan head. Ideally a boom arm.   | £70    | Recommended were Manfrotto<br>Second hand is good budget range £50-80  |
| <b>Tweezers</b>               | ↓        | ↓     | ↓   | ↓      | ↓  |
| <i>Brass</i>                  | Base     | Tbx   | A pair of strong tweezers in brass have more grip than steel ones - the ends do get mutilated, over time you will file up the ends buy inexpensive ones.  | £3     | Craft shops sometimes sell quality tweezers at reasonable prices, alternatives are Walsh's, Cousin's etc   |
| <i>Steel</i>                  | Lux      | Tbx   | Worth buying a good pair, for carriage clocks etc.<br>Look at the ends, they should come together at the tips, and not move as the arms are squeezed.   | £25    | Dumont - nice and strong, or 'Fontax' (no longer made)   |
| <b>Ultrasonic Tank</b>        | JIT      | Wkshp | Cleaning larger items, taps, dies etc, collets etc. Takes space and use. Get one reasonably substantial, (2-3 litres) not a small jewellers' one. A large one can be used with small quantities of cleaner - Part fill the tank with water, fill a jar to about the same level with cleaner. Place the items in the jar, the jar in the ultrasonic, and turn on. There is no sensible way to use small tanks for large items. | £120   | Look for one with a substantial transducer as this tends to be the achilles heel of ultrasonic tanks. Source from horological auctions.  |
| <b>Vice</b>                   | ↓        | ↓     | ↓   | ↓      | ↓  |
| <i>Bench</i>                  | Base     | Wkshp | 3" vice for general filing and such like. Needs to have flat jaws.  | £70    | e.g Record #0 vice.  |
| <i>Portable</i>               | JIT      | Tbx   | Small, clamp (or sucker) attached vice 40mm jaws, plain/flat, not serrated. No particular requirement for accuracy otherwise, although backlash can be annoying.<br>May be useful to have it clamped to a piece of substantial plywood.<br>Advise against the sort that has a universal joint underneath it as it will slip and damage work.  | £75    | Bergeron make a really nice one, could buy a good model engineering one e.g Record, and/or second hand. Worth going for quality as this is a fundamental tool.   |
| <b>Watch-cleaning Machine</b> | CCBase   | Wkshp | For carriage clock components, watches etc. Pretty much indispensable once you get into carriage clocks   | £100   | Look for a traditional manual 3-jar cleaning machine, with heater, do not need automatic or Ultrasonic features, and they are the first bits to go wrong on second hand kit. Budget c£100 at a horological auctions. Brands to look for are Brenray or Elma. |

| Item                     | Priority | Where | Notes   | Budget  | Purchasing advice  |
|--------------------------|----------|-------|---|---------|--|
| <b>Work Bench</b>        | Base     | Wkshp | Needs to have:<br>Solidity - with substantial supports direct to the (ideally concrete) floor, to deal with direct hammering.<br>Flat & level - absolutely so, in both dimensions<br>Correct height - depends on you, but around hip height - circa 95 cm.<br>Reasonable size - enough to put a 3-chain fusee clock, disassembled - e.g. 60cm x 120cm.<br>Good surface - with slight give and of a colour that shows up clock components, but yet robust enough to stand up to wear. Lino recommended.<br>Edged - a wooden edging that can be used to rest components against for filing is very useful, as is a routed groove c 1/2 to 1 cm deep around the edge to catch small items before they roll off.<br>Well lit - with both overhead and side light. | £350    | Price assumes you can make this yourself, if not add in a carpenter's time.  |
| <b>Wood Strip</b>        | Base     | Tbx   | Some thin strips of double faced hardboard or thin MDF, for packing seatboards propping up clocks etc.  | £0      | Pick up from Ikea's 'take broken wood' spot, or a skip.  |
| <b>Vacuum Cleaner</b>    | Base     | Wkshp | Cleanliness in the workshop is important. Vacuum (and mop) the floors regularly and vacuum up fine particles from the machine tools immediately after use.<br>Vacuum cleaner should be powerful and capable of dealing with a workshop environment, whilst small enough not to get in the way. Generally this means a cylinder/bin type.  | £100    | e.g. Numatic 'Henry' type cleaner from internet suppliers  |
| <b>V block and clamp</b> | Lux      | Wkshp | Come in matched pairs, with clamps - it is important to have the clamps. Look for smaller ones.   | £5      | Eclipse, Moore and Wright (second hand is fine)  |
| <b>Vice Anvil</b>        | Lux      | Wkshp | Small mushroom shaped stake and/or a piece of cylindrical steel, inch dia, polished at the top. A hammer held in the vice can substitute.   | £0      | You can make this from scrap - needs to be harden-able.  |
| <b>Zeus Guide</b>        | Lux      | Wkshp | Information about taps, dies, drill speeds, surface speeds, cutting speeds etc. A lot of succinct information, even though much of this information is now fairly easily available on the internet.   | £10     | New, old, 21st century one if second hand. There was a point where they became anti-decimalisation and so a lot less useful. |
|                          |          |       |   | £15,368 |  |